BARRATT HOMES

HOGSHAW FARM

Land at Hogshaw, SK17 7HN

Addendum to Design and Access Statement 499-DAS01 Rev C

Full application HPK/2023/0192

Contents

- 1.00 Introduction
- 2.00 Unit Numbers & Distribution
- 3.00 Layout
- 4.00 Design Updates
- 5.00 Landscaping
- 6.00 Appearance
- 7.00 Access

1.00 Introduction

1.01 Planning application HPK/2023/0192 was submitted to the LPA on 15/05/2023. It comprised of a full application for 116 dwellings on land at Hogshaw Farm in Buxton. It presented detail material in relation to access and perimeter landscaping, with matter of layout, scale, appearance and internal landscaping for subsequent approval. A layout accompanied the application, as referenced to in the original Design & Access Statement (DAS)

1.02 The purpose of this DAS addendum is to discuss the changes within the design to accommodate comments that were received from the Local Planning Authority on our original scheme and application.

1.03 This revised proposal seeks full consent for 99 dwellings which represents a reduction of 17 units.

2.00 Unit Numbers and Distribution

2.01 This planning permission seeks consent for the development of 10.4 acres of land for 99 dwellings comprising:

- 11 – 2 bedroom houses
- 48 – 3 bedroom houses
- 40 – 4 bedroom houses

2.02 Due to the existing topography, the development will consist of a series of development platforms which work with the hillside location.

2.03 Public open space surrounds development which provides amenity as well as doubling up as a natural buffer to the wider area. A SUDS pond is located to the north west whilst a LAP is proposed to the south adjacent to the public right of way, as requested by the LPA.

3.00 Layout

3.01 The design concept for this scheme follows the original submission but incorporates the LPA's comments and recommendations into the layout.

3.02 The DAS described the context of the area, and local character of surrounding buildings and landscape. In summary, these are as follows:

- A mix of housing types featuring mews, semi detached and detached dwellings.
- A strong presence of design features to ensure the development reflects the existing vernacular.
- A materials palette to help the development blend into the local environment.
- Predominately Dwellings with front and rear gardens.
- Boundary treatments to street frontages to separate private and public areas.
- A well designed open space that both offers recreation for residents as well as enhancing sustainability.

3.03 The same principals have been followed as per the original submission, and are followed through as part of this addendum.

3.04 The amended design sits entirely within the footprint of the previous layout and incorporates the original POS allocation.

4.00 Development & Layout updates

4.01 The layout has been amended to retain a number of trees designated in Tree Preservation Order ref: 2023No311. The road design has been amended in the north eastern area of the site with dwellings fronting onto the boundary with the existing golf course. This allows the development to better respect the adjacent Conservation Area and to retain the existing trees on the boundary.

4.02 We have proposed additional landscaping to enhance the retained flora to the northern boundaries to reduce the impact of development on the adjacent Conservation Area. In addition, chimneys have been introduced to plots where the development impacts the Conservation Area and adjacent residential development.

4.03 Additional house types have been introduced to the scheme, as requested by the LPA, to reduce the amount of frontage parking and add impact to focal areas.

4.04 A play area (LAP) has been proposed which will add further recreational benefit to the residents.

5.00 Further Amendments

- Revised north-west corner of the site to avoid 30m badger offset.
- Repositioning of some plots to reduce the amount of frontage parking.
- Revised Suds design incorporated as per engineering comments and red edge updated to suit.
- Entrance statement added to gateway greenspace.
- Minor changes to road layout to address LPA comments.
- Changes to the street hierarchy and design including removal of footways from one side of the primary access road.
- Built form pulled back from site's north-eastern boundary to avoid protected trees.
- Addition of flat roof from door canopies to all house types to suit M4(2) requirements.
- All garages updated to pitched roof profiles.
- Multi-use footpath added near to the farm to pick up existing FP2.

Appendix B;

SECTION A-A



Scale 1:200

SECTION A-A CONTINUED



Scale 1:200

SECTION B-B



Scale 1:200

SECTION C-C



Scale 1:200



Scale 1:500

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Rev	Description	Date	Drawn	Chk'd

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Job: HOGSHAW FARM, BUXTON			
Title: PROPOSED STREET SCENES			
Design By: GB	Date: JULY 2024	Drawing Number: 499-P-SS02	Rev: -
Drawn By: GB	Scale @ A1: VARIOUS		

5.1 Proposed Layout

- Appendix A.

5.2 Proposed Street Scenes.

- Appendix B.

6.00 Landscaping

- The landscaping scheme is drawn from a selection of native species which reinforces the biodiversity of the development.
- The design has been updated to enhance the natural buffers to the northern and eastern boundaries by using a mixture of shrubs, trees and hedges.
- Soft landscaping has been used to break up hard surfaces in the street scene where possible.

7.00 Appearance

7.01 The chosen materials are as per the original submission and follows the same principals established in the original DAS.

7.02 All proposed units will be finished with white front doors and garage doors with black rainwater goods.

7.03 The arrangement of the boundary treatments follows the principals established in the original submission.

7.04 The arrangement of the hard landscaping follows the principals established in the original submission.

8.00 Access

8.01 No alterations to the main point of access are proposed as part of this DAS addendum.

9.00 Conclusion

The proposed development will provide 99 new homes in a range of types and sizes to meet the local area need.

Well informed design and material choice will give the development longevity, contribute to the townscape and raise aspirations of the area.

Accordingly, we hope that the planning permission will be granted for the proposed development.

BARRATT HOMES

Appendix A;

SCHEDULE OF ACCOMMODATION

Barratt Type	House Type	Sqft	No	Total Sqft
Private Units				
Rowan - End	2 Bed Terraced House	866	10	8660
Rowan - Mid	2 Bed Terraced House	866	1	866
Oakmoor - End	3 Bed Bed Semi / Mews House Duel Aspect End Unit	1049	1	1049
Birchmoor - End	3 Bed Terraced House	1025	3	3075
Rathlin	3 Bed Detached House	990	11	10890
Matlock - End	3 Bed Semi / Mews House	970	23	22310
Hopton	3 Bed Detached / Semi Detached Dual Aspect House	1017	9	9153
Hopton - End	3 Bed Detached / Semi Detached Dual Aspect House	1017	1	1017
Knightwood - End	4 Bed Townhouse	1122	18	20196
Ashtead	4 Bed Dual Aspect Detached House	1265	4	5060
Wallasea	4 Bedroom Int. Garage Detached House	1206	11	13266
Haweswater	4 Bedroom Int. Garage Detached House	1495	7	10465
Total number of units and square footage			**99**	**106007**
Gross Site Area in Acres				**10.39**
Open Space & Undevelopable Area in Acres				**3.18**
Net Site Area in Acres				**7.21**
Density (Units per Acre)				**14**
Density (Units per Hectare)				**34**
Square Foot / Acre				**14,703**

North

AGRICULTURAL LAND

PUMPING STATION

SUDS

LOCAL WILDLIFE AREA

GOLF COURSE

Nunsfield Farm

Fairfield Commc

Potential Future Link Road

ENTRANCE STATEMENT

SUBSTATION

TEMP SALES PARKING

PLAY AREA (LAP)
Refer to drawing 2402.41929

Buxton FP 2

Buxton FP 1

Buxton FP 77

B.O.A.T

ARM 4

ARM 3

RKS

Nestle Water

Existing connection to remain open

BARMS WAY

GLENMOOR ROAD

Sub Sta

The Devonshire Coach House

324.3m

Northlands

St Peter's Church

Links View

NORTH ROAD

Legend:

- Proposed dwelling and house type code.
- Proposed garage to be built.
- Grass, refer to detailed landscpaing plans for details.
- Wall (Refer to BTL01/BTD01&02 for details)
- Timber gates to be erected to rear gardens. (as indicated on site layout).
- Existing trees to be retained & protected during works.
- Trees to be removed, refer to 1795_ARB_AIA & 1795_ARB_AMS for details.
- Root Protection Zone
- Indicates a tree with a TPO.
- Water main easement, 5m wide as confirmed by Ward Hadaway.
- AS OPP — Dwelling handing - as / opposite see the construction dwg.
- Refuse collection area
- EV — Car charging point, refer to EVCP info pack for specs & positioning details.
- PROW.
- GRP Chimney
- Indicative Landscaping, refer to UG_1795_Lan_SI_01-05 for details.

HOGSHAW FARM BUXTON

Revision	Description	Date	Design By
03	Flipped plot 16, pulled 16&17 south 1m, revised multi use footpath position, various minor tweaks to suit ENG comments.	28/06/24	GB
02	Layout updated to various internal comments.	18/06/24	GB

Project: HOGSHAW FARM

Description: PLANNING LAYOUT

Design By:	Date:	Scale at A0:	Revision:
GB	11/06/2024	1:500	3

Project	Originator	Functional	Spatial	Form	Discipline	Number
H8797	- BAH -	XX	- XX -	DR -	UD -	203001

Do not scale from this drawing. Work to given dimensions only. Any discrepancies are to be reported to Originator.

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- Infrastructure Design
- Structural Engineering
- Development Planning
- Professional Advice
- Geotechnical & Environmental
- Surveying

jpp



Proposed Residential Development
Hogshaw Farm
Buxton
Derbyshire

Flood Risk Assessment and Drainage Strategy

Revision F: July 2024
R-FRA-11024R-01-F

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Proposed Residential Development
Hogshaw Farm
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Report Reference	R-FRA-11024R-01-F
Date	Revision F: July 2024

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Revision	Date	Description	Prepared	Reviewed
0	23rd January 2019	Initial Report	Ram Sarpal	Warren Allsopp
A	31st March 2023	DRAFT – revised to suit latest development proposals.	Izzy How	Katherine Rose
A	26th April 2023	Revised to suit latest development proposals.	Katherine Rose	Katherine Rose
B	24th May 2023	Revised following client comments	Katherine Rose	Katherine Rose
C	6th June 2023	Appendices updated	Katherine Rose	Katherine Rose
D	16th February 2024	Revised following consultation comments, and to include latest drainage strategy information and JBA modelling data.	Josh Beverly	Katherine Rose
E	23rd February 2024	Revised following client comments.	Josh Beverly	Katherine Rose
F	12th July 2024	Revised to suit latest site layout.	Josh Beverly	Katherine Rose

Contents

1.0 Introduction 1

1.1 Background 1
1.2 Objectives 1
1.3 Reference documents 2
1.4 Report history 2

2.0 Description and history of the site and development proposals 3

2.1 Location and description of the site 3
2.2 History of the site 3
2.3 Proposed development 3
2.4 Site topography 4
2.5 Existing drainage infrastructure 4
2.6 Geology of the site and ground investigation data 4
2.7 Development proposals and flood risk vulnerability 5

3.0 Flood risk 6

3.1 Fluvial / Tidal flooding 6
3.2 Flooding from surface water 8
3.3 Flooding from groundwater 9
3.4 Flooding from sewers 9
3.5 Flooding from reservoirs, canals and other artificial sources 9
3.6 Historic flooding 10
3.7 Flood risk vulnerability and flood zone compatibility 11
3.8 Flood compensation 11
3.9 Access and egress 11

4.0 Additional flood modelling 12

4.1 Introduction 12
4.2 Baseline modelling 12
4.3 On-site surface water discharge hydraulic modelling 12
4.4 Mitigation 13

5.0 Management of surface water 14

5.1 Current conditions 14
5.2 Surface water drainage outfalls 14
5.3 Surface water drainage strategy 15
5.4 SUDS assessment 16
5.5 Water quality 17
5.6 Surface water drainage design and management 18
5.7 Existing run-off rates 18
5.8 Attenuation requirements 19
5.9 Overland flows 20

6.0 Foul water drainage strategy 21

7.0 Maintenance 22
7.1 Surface water drainage maintenance 22
7.2 Foul water drainage maintenance 24
8.0 Summary and conclusions 25

Appendices

Appendix A ..... A
Planning Layout ..... A
Barratt Homes drawing no. H8797-BAH-XX-XX-DR-UD-203001-P03 ..... A
Appendix B ..... B
Topographical Land Survey ..... B
Survey Eng Ltd drawing no BH.TS.12-C ..... B
Appendix C C
Severn Trent Water Asset Plan C
Appendix D ..... D
Environment Agency Product 4 Data ..... D
Appendix E ..... E
Extract of Ground Investigation ..... E
Soiltechnics report ref. STQ4642M-G01 ..... E
Appendix F ..... F
Areas Susceptible to Groundwater Flooding (High Peak Borough) ..... F
DCC Level 1 SFRA: Map 5.6 ..... F
Appendix G ..... G
Historic Flood Incidence by Source and Floodzones (High Peak Borough) ..... G
DCC Level 1 SFRA: Map 3.6 ..... G
Appendix H ..... H
Preliminary Drainage Layout ..... H
Barratt Homes drawing no. H8797-BAH-XX-XX-DR-CE-300001-P07 ..... H
Appendix I I
Greenfield Calculations I
Appendix J ..... J
Drained Area Plan ..... J
JPP Consulting drawing no. 11024-FRA05B ..... J
Appendix K ..... K
Attenuation Calculations ..... K

Appendix L ..... **L**
Overland Flows L
JPP Consulting drawing no. 11024-FRA06B L
Appendix M ..... **M**
Severn Trent Water Pre-Development Enquiry ..... M
Appendix N ..... **N**
Hydraulic Modelling Report ..... N
JBA Technical Note 2023s1142 ..... N

Figures

Figure 1.1 Site Location Plan 1
Figure 2.1 Aerial imagery dated 1999 3
Figure 3.1 Flood Map for Planning (Rivers and Sea) 6
Figure 3.2 Risk of Flooding from Surface Water 8
Figure 3.3 Risk of Flooding from Reservoirs 10

Tables

Table 2.1 Flood Risk Vulnerability Classification 5
Table 3.1 Flood Zone Definitions 7
Table 3.2 Flood Risk Vulnerability and Flood Zone Compatibility 11
Table 5.1 SUDS Assessment 16
Table 5.2 Pollution Hazard Indices for Different Land Use Classifications 17
Table 5.3 Indicative SuDS Mitigation Indices for Discharges to Surface Waters 17
Table 5.4 Peak Rainfall Allowance: Derwent Derbyshire Management Catchment 18
Table 5.5 Greenfield Run-off Rates 19
Table 7.1 Maintenance Areas – Surface Water 22
Table 7.2 Operation and Maintenance: Detention Basins 23
Table 7.3 Maintenance Areas – Foul Water 24

1.0 Introduction

1.1 Background

1.1.1 This report is a Flood Risk Assessment and Drainage Strategy which has been prepared by JPP Consulting Limited on behalf of Barratt Homes for a proposed residential development. The benefit of this report is to our instructing Client.

1.1.2 The proposed Residential development is located at Hogshaw Farm off Nunsfield Road, Buxton, as shown in Figure 1.1 below. Buxton is located to the south-west of Sheffield and east of Macclesfield. The National Grid Reference for the site is E406520 N374340. The proposed development has a total development area of 5.605ha (56,050m^2).



Figure 1.1 Site Location Plan
Source: Open Street Maps, obtained 29th March 2023

1.2 Objectives

1.2.1 The objective of this report is to advise interested parties regarding the potential risk of flooding and the management of surface water run-off arising from the proposals.

1.2.2 This report has been prepared to support a reserved matters planning application.

1.3 Reference documents

1.3.1 This report has been prepared with reference to the following publications:-

- Ministry of Housing, Communities and Local Government (March 2012, updated December 2023), National Planning Policy Framework
- Ministry of Housing, Communities and Local Government (March 2014, updated August 2022), Planning Practice Guidance 'Flood Risk and Coastal Change'
- Department for Environment, Food and Rural Affairs (March 2015), Non-statutory technical standards for sustainable drainage systems
- Environment Agency (September 2013), Climate Change Allowances for Planners: Guidance to support the National Planning Policy Framework
- Environment Agency (October 2013), Delivering benefits through evidence: Rainfall runoff management for developments
- HM Government (2010), The Building Regulations (2010), Drainage and Waste Disposal, Approved Document H, The NBS, Newcastle Upon Tyne
- Wilson, Bray, Cooper (2004), Sustainable drainage systems: Hydraulic, structural and water quality advise, C609, CIRIA, London
- Woods-Ballard et al (2015), The SUDS Manual, C753, CIRIA, London
- CIRIA Report C624 Development and flood risk
- National SUDS Working Group (2004), Interim Code of Practice for Sustainable Drainage Systems,
- Institute of Hydrology (1999), Flood Estimation Handbook, Institute of Hydrology, Wallingford
- BS EN 752:2008 Drain and sewer systems outside buildings. Hydraulic design and environmental considerations
- BS 8533:2011 Assessing and managing flood risk in development – Code of Practice
- CIRIA Report C635 Designing for exceedance in urban drainage – good practice
- Derbyshire County Council & Derby City Council Strategic Flood Risk Assessment Level 1: For Minerals and Waste Local Development Framework (August 2012)

1.4 Report history

1.4.1 This report had previously been revised (Revision E) further to the receipt of further client comments based on prior drainage strategy proposals as provided by Barratt Homes, and the inclusion of details of the fluvial hydraulic modelling study undertaken by JBA Consulting Ltd.

1.4.2 This report has been revised (Revision F) following the receipt of a new site layout and drainage strategy as provided by Barratt Homes.

1.4.3 Changes to the report associated with Revision F are marked by a vertical line in the right-hand column.

2.0 Description and history of the site and development proposals

2.1 Location and description of the site

2.1.1 The proposed residential development is located at Hogshaw Farm, off Nunsfield Road, Buxton, as shown in Figure 1.1 above. The site is bound by agricultural land to the north, a golf course and the A6 to the east, dwellings to the south, and woodland, Nun Brook and a railway line to the west.

2.2 History of the site

2.2.1 The site currently comprises an area of open land associated with Hogshaw Farm, as shown on the topographical survey enclosed in **Appendix B**. There is an area of woodland along the site's western boundary.

2.2.2 Aerial imagery dating back to 1999 shows that the site was comparable to the present day during this time, see Figure 2.1 below.



Figure 2.1 Aerial imagery dated 1999
Obtained: Google Earth Pro 29th March 2023

2.3 Proposed development

2.3.1 The proposed development will comprise 99 residential dwellings. The proposed development layout is shown on the plan enclosed in **Appendix A.**

2.4 Site topography

2.4.1 The topographical survey indicates that site levels fall from east (at approximately 323.0m) towards west (lowest point of approximately 296.0m). The topographical survey is shown on the plan enclosed in **Appendix B**.

2.5 Existing drainage infrastructure

2.5.1 Severn Trent Water's asset plan is enclosed in **Appendix C.** The asset plan identifies a surface water sewer and a foul water sewer, both located in Barms Way to the south. Both sewers then flow south along Nunsfield Road, with the foul sewer transitioning to a combined water sewer. The surface water and foul water sewers are both 150mm diameter, and the combined water sewer is a 225mm diameter pipe.

2.5.2 The topographical survey, as enclosed in **Appendix B**, identifies a number of inspection covers within the southern part of the site.

2.5.3 Nun Brook is located to the west of the site. As shown on the dataset provided by the Environment Agency (see **Appendix D**), a section of this watercourse is culverted.

2.6 Geology of the site and ground investigation data

2.6.1 Inspection of the geological maps show that there are no records of superficial deposits at the site. A narrow band on Alluvium (comprising clay, silt, sand and gravel) is shown along Nun Brook to the west of the site.

2.6.2 The bedrock geology which underlies the majority of the site is Eyam Limestone Formation. A small area along the western part of the site is underlain by Bowland Shale Formation, comprising Mudstone, Siltstone and Sandstone.

2.6.3 A Ground Investigation has been undertaken by Soiltechnics, see report extract enclosed in **Appendix E**. The GI included site visits in January and February 2019, which included:

- Twenty exploratory trials pits (TP01-TP20)
- Twenty-eight exploratory boreholes (DTS01-DTS13 and DTS15-DTS29)
- Infiltration testing in three borehole locations (DTS06, 13 and 19)

2.6.4 The proposed residential development is covered by Zone 3 of the GI, whilst the proposed access route falls within Zone 4 and the open space in the north-western corner within Zone 1. Zone 2 of the GI falls beyond the current site boundary. The encountered ground conditions are briefly summarised as follows:

- Topsoil: Zones 3 and 4
- Made Ground: Zone 1, 2 and 4
- Weathered Bee Low Limestone Formation: Zone 4
- Weathered Eyam Limestone Formation: Zone 3
- Weathered Bowland Shale Formation: Zone 2 and 3
- Bowland Shale Formation Bedrock: Zone 3

2.6.5 Groundwater inflows were encountered in many of the exploratory excavations, as set out in Table 6.4.1 of the Ground Investigation report (see extract in **Appendix E**). In short, groundwater was encountered at depths between 1.3m and 4.2m bgl.

2.6.6 Infiltration test results are summarised as follows:

- Weathered Bee Low Limestone (DTS06, Zone 4, access): 3.81 x 10^{-6} m/s
- Weathered Eyam Limestone (DTS13, Zone 3, residential): between 2.67 x 10^{-4} and 4.72 x 10^{-5} m/s
- Weathered Bowland Shale (DTS19, Zone 3, residential): between 2.94 x 10^{-6} and 3.12 x 10^{-6} m/s

2.6.7 The GI report states:

> *"Testing completed to date should be considered preliminary only and we recommend further, more intensive, on site testing is carried out targeting the part of the investigation allowing detailed design of infiltration systems to be progressed if such systems are to be adopted".*

2.6.8 Additional investigations are being undertaken in the north-western area of the site, to allow an assessment of risks associated with ground conditions.

2.7 Development proposals and flood risk vulnerability

2.7.1 With reference to Table 2 of the Flood Risk and Coastal Change Planning Practice Guidance (PPG) to the National Planning Policy Framework (NPPF), the proposed residential development would be classed as More Vulnerable development.

2.7.2 An extract from Table 2 of the PPG for Flood Risk and Coastal Change is replicated below in Table 2.1 with the proposed development type highlighted.

Flood Risk Vulnerability Classification	
Vulnerability	**Development Types**
More Vulnerable	Hospitals.
	Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.
	Buildings used for **dwelling houses**, student halls of residence, drinking establishments, nightclubs and hotels.
	Non-residential uses for health services, nurseries and educational establishments.
	Landfill and site used for waste management facilities for hazardous waste.
	Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Source: Planning Practice Guidance - 2014	

Table 2.1 Flood Risk Vulnerability Classification

3.0 Flood risk

3.1 Fluvial / Tidal flooding

3.1.1 An extract of the Environment Agency's Flood Map for Planning (Rivers and Sea) is provided below in Figure 3.1. The flood map was extracted from the GOV.UK website on 29th March 2023. The approximate application site boundary is shown in red. The map indicates that the majority of the development site is located within Flood Zone 1 (Low Probability).



Figure 3.1 Flood Map for Planning (Rivers and Sea)
Source: GOV.UK website – March 2023

3.1.2 We note that there are areas of Flood Zone 2 (Medium Probability) and Flood Zone 3 (High Probability) to the north-west and south-west of the site. These areas encroach into the site boundary in the north-western corner of the site. These areas are associated with Nun Brook. The topographical survey confirms that ground levels in this area are lower than those of the developable area of the site.

3.1.3 Product 4 flood level data has been obtained from the Environment Agency, as enclosed in **Appendix D**. This identified that the site is located within Flood Zone 1 and at a low risk of fluvial flooding.

3.1.4 Additional flood risk information is set out in Chapter 4.0, following a fluvial hydraulic modelling study undertaken by JBA Consulting Ltd.

3.1.5 Table 3.1 below is a copy of Table 1 from Planning Practice Guidance for *'Flood Risk and Coastal Change'* to the National Planning Policy Framework which defines Flood Zones. The proposed development, which is located within Flood Zone 1, is defined as having a less than 1 in 1,000 annual probability of river or sea flooding in any year.

Flood Zone Definitions	
Flood Zone	**Definition**
Zone 1: Low Probability	**Land having a less than 1 in 1,000 annual probability of river or sea flooding.**
Zone 2: Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.
Zone 3a: High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding.
Zone 3b: The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency.
Source: Planning Practice Guidance - 2014	

Table 3.1 Flood Zone Definitions

3.2 Flooding from surface water

3.2.1 An extract of the Environment Agency map 'Risk of Flooding from Surface Water' is provided below in Figure 3.2. The approximate application site boundary is shown in red. The site is shown to be located in an area of very low (less than 1 in 1000) risk of surface water flooding in a given year.

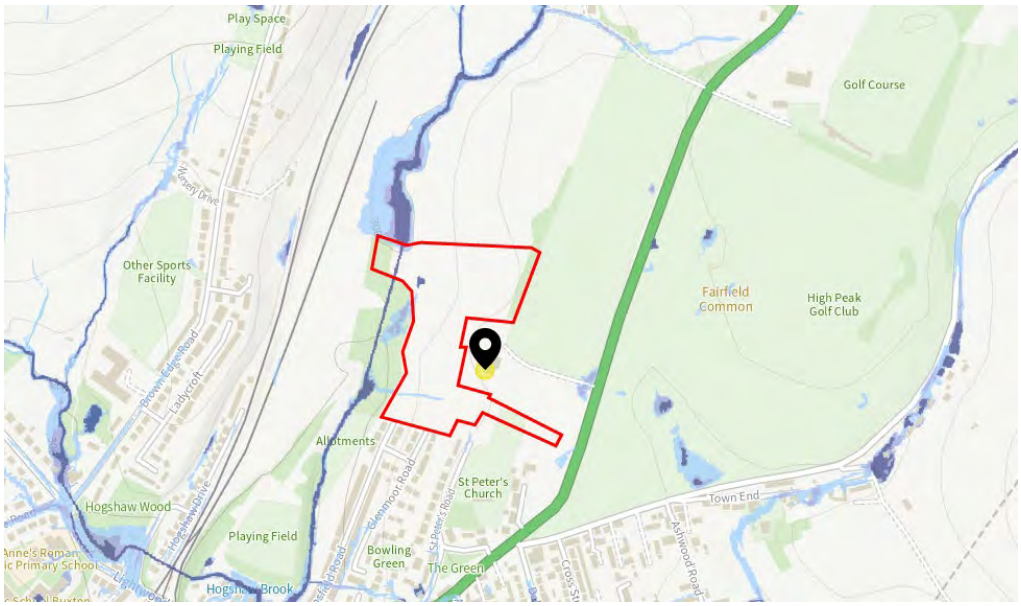


Figure 3.2 Risk of Flooding from Surface Water
Source: GOV.UK website – March 2023

3.2.2 We note that there are areas of medium and high surface water flood risk to the west of the site, associated with Nun Brook. The topographical survey confirms that ground levels in this area are lower than those of the developable area of the site.

3.2.3 It should be noted that this map is generated using a broad methodology applied at the national scale. The model utilises generalised information on infiltration, sewerage infrastructure, rainfall events and catchment topography to route rainfall over a ground surface model. As such, the analysis does not take account of site-scale factors / characteristics that may exert an influence upon surface water flood depths and extents. The map therefore only provides a guide regarding the areas that may be vulnerable to this source of flooding.

3.3 Flooding from groundwater

3.3.1 Information from the Derbyshire County Council (DCC) Level 1 Strategic Flood Risk Assessment (SFRA) has been reviewed with regards to groundwater flooding. The Areas Susceptible to Ground Water Flooding Map for the High Peak Borough is enclosed within **Appendix F**. This is a *"strategic scale map showing groundwater flood areas in a 1 kilometre square grid. It identifies at a broad scale areas susceptible to flooding from groundwater on the basis of geological and hydrogeological conditions. It does not show the likelihood of groundwater flooding occurring and therefore is a hazard not risk based dataset. It does not take account of areas where groundwater is likely to pond or flow, but simply considers where groundwater might emerge".*

3.3.2 The map shows that the 1Km grid square where the site is located is within the '<25%' category.

3.3.3 As part of the Ground Investigation, groundwater inflows were encountered in many of the exploratory excavations, as set out in Table 6.4.1 of the Ground Investigation report (see extract in **Appendix E**). In short, groundwater was encountered at depths between 1.3m and 4.2m bgl.

3.3.4 The information available at the time of preparing this report suggests that groundwater emergence at the surface is unlikely, and therefore the risk of flooding is considered to be low.

3.4 Flooding from sewers

3.4.1 Severn Trent Water's asset plans identify that there are no adopted sewers within the site boundary, as shown on the plan enclosed in **Appendix C.**

3.4.2 The DCC Level 1 SFRA has been reviewed with regards sewer flooding. The Historic Flood Incidence by Source and Floodzones map for the High Peak Borough is enclosed within **Appendix G**. No sewer flooding are incidents are shown within the site boundary. A single sewer flooding incident is identified within Buxton, south-east from the site. The scale of the mapping is not sufficient to refine the location of this incident.

3.4.3 We do not have any records of sewer flooding within the vicinity of the proposed development.

3.4.4 We therefore do not consider the risk of flooding from sewers to be a significant risk to the proposed development.

3.5 Flooding from reservoirs, canals and other artificial sources

3.5.1 We are not aware of any canals or artificial water sources that may result in flooding of this site.

3.5.2 The EA provides maps (https://flood-warning-information.service.gov.uk/long-term-flood-risk/) showing the area that may be affected by flooding as a result of a breach of a large, raised reservoir (i.e. capable of storing over 25,000 cubic metres of water above the natural level of any part of the surrounding land).

3.5.3 An extract of the Environment Agency map 'Risk of Flooding from Reservoirs' is provided below in Figure 3.3. It can be seen that the proposed development site, shown in red, is not at a risk of flooding from reservoirs.



Figure 3.3 Risk of Flooding from Reservoirs
Source: GOV.UK website – 29th March 2023

3.5.4 It can therefore be concluded that the risk of flooding from reservoirs and other artificial sources is low.

3.6 Historic flooding

3.6.1 The DCC Level 1 SFRA has been reviewed with regards to historical flooding. The Historic Flood Incidence by Source and Floodzones map for the High Peak Borough is enclosed within **Appendix G**. This map includes details of historic flooding from the following sources:

- Artificial
- Fluvial
- Groundwater
- Multiple
- Other
- Sewers
- Surface Water
- Unknown

3.6.2 No flood events from the above sources are shown within the site boundary.

3.6.3 The Environment Agency are not aware of any historic flood incidents at the site, as set out within **Appendix D**.

3.7 Flood risk vulnerability and flood zone compatibility

3.7.1 Based on the above assessment of the site being located within Flood Zone 1 and classified as a More Vulnerable development, and with reference to Table 3.2 below (Planning Practice Guidance for 'Flood Risk and Coastal Change' to the National Planning Policy Framework, Table 3), the proposed development of this site would be considered "appropriate". A copy of Table 3 is presented below highlighting the above. Neither a Sequential Test nor an Exception Test will be required.

Table 3 – Flood Risk Vulnerability and Flood Zone Compatibility

Flood Risk Vulnerability Classification	Essential Infrastructure	Water Compatibility	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception test required	✓	✓
Zone 3a	Exception test required	✓	X	Exception test required	✓
Zone 3b	Exception test required	✓	X	X	X
✓ = Development is appropriate			X = Development should not be permitted		

Source: Planning Practice Guidance - 2014

Table 3.2 Flood Risk Vulnerability and Flood Zone Compatibility

3.8 Flood compensation

3.8.1 Flood compensation measures will not be required for this site as it is located within Flood Zone 1.

3.8.2 The results of the fluvial hydraulic modelling study, discussed further in Chapter 4.0 below, identify the flood extents upstream of the culvert, to the north-west of the site. Based on these results, the proposed detention basin is considered to be outside of the modelled flood extent, such that flood compensation requirements are not triggered as a result of the detention basin location.

3.9 Access and egress

3.9.1 Access and egress to and from this site in the event of flooding will be via the proposed development's access road, which will allow residents of the development to move to higher ground.

4.0 Additional flood modelling

4.1 Introduction

4.1.1 As set out in Section 3.1 above, the flood maps available online identify the site to be located in Flood Zone 1. However, areas of Flood Zone 2 and 3 are identified to the north-west and south-west of the site, associated with the watercourse in this location. As such, a fluvial hydraulic modelling study has been undertaken. This has been undertaken by JBA Consulting, full details of which are set out in their report enclosed in **Appendix N**.

4.2 Baseline modelling

4.2.1 Baseline modelling has been undertaken for the following scenarios:

- 1 in 30 year
- 1 in 100 year
- 1 in 100 year + 29% climate change
- 1 in 1000 year

4.2.2 For the four scenarios set out above, the modelled flood extents are shown in to the north-western area of the site.

4.2.3 The modelled flood depths associated with the baseline 1 in 100 year plus 29% climate change scenario are shown to be deepest immediately upstream of the culverted watercourse. The maximum flood depth is identified to be 4.02m, within the area of low elevation surrounding the channel.

4.2.4 Blockage analysis has been undertaken for a worst-case scenario of a 100% blockage of the culvert during the 1 in 100 year plus 29% climate change event. This blockage results in a 1.88m increase in peak water level to the north-west, and Figure 2-7 of the JBA report identifies the route of water across the site.

4.3 On-site surface water discharge hydraulic modelling

4.3.1 The baseline model was updated to account for the calculated existing greenfield run-off rates from the site, which were then increased by 40% as an allowance for climate change.

4.3.2 The surface water drainage strategy proposes a flow restriction of 45.2 l/s, based on the existing Q_{bar} run-off rate from the site, see additional details in Section 5.7 below. This rate of 45.2 l/s has been used as a static value within the hydraulic modelling, based on the maximum run-off rate from the site. The 45.2 l/s flow restriction offers an overestimation of post-development flows, as smaller storm events will result in lower run-off rates from the site. The modelling results therefore present a worst-case scenario.

4.3.3 The results from the revised baseline modelling and post-development modelling were compared to understand the impact of the proposed development. With the proposed surface water drainage strategy in place, there is a slight reduction identified in the flood extent downstream of the site, in the proximity of the Lightwood Road area. There is also a reduction in flood depth identified here too. This betterment downstream is due to a greater proportion of the flow being held upstream of the 1.22m culvert. As a result, there is an increase in flood depths upstream of the site of up to 0.05m, however, the extent is unchanged.

4.3.4 As noted within the JBA report, *"the majority of the pre-development greenfield surface water discharge would enter Nun Brook downstream of the 1.22m diameter culvert"*. Therefore, the post-development scenario not only reduces greenfield discharge rates from the site, but also moves the surface water discharge point upstream of the culvert. This therefore allows the discharge from the site to be controlled, and, in turn, provides a betterment of alleviating downstream flooding.

4.4 Mitigation

4.4.1 The fluvial hydraulic modelling study undertaken by JBA Consulting Ltd identifies a slight reduction in the existing flood extent identified downstream of the site, and also a reduction in these flood depths. As the proposals are shown to offer flood alleviation downstream of the site, no mitigation strategy is considered to be required.

4.4.2 We would note that the positive results of the proposed drainage strategy are intentional, and developed in order to reduce an existing flooding issue identified within the vicinity of the site.

5.0 Management of surface water

5.1 Current conditions

5.1.1 The site is currently open with no existing development, and is therefore considered a greenfield site with no existing drainage. Therefore, greenfield run-off calculations shall be used to derive the allowable run off rate from the site.

5.2 Surface water drainage outfalls

5.2.1 It is a requirement of The Building Regulations (2010), Drainage and Waste Disposal, Approved Document H, to dispose of surface water collected by a development in accordance with the following, listed in order of priority:-

1. Infiltration systems where ground condition permit
2. To watercourses
3. To sewers

5.2.2 Each of these is considered separately below:

5.2.3 Infiltration systems

5.2.3.1 The geology of the site is described in Section 2.6 above. For a worst-case assessment, it is assumed that infiltration techniques are not viable for the management of surface water at the site.

5.2.3.2 We acknowledge the presence of Made Ground at the site, and the risk that infiltration techniques would pose with regards to the mobilisation of leachates. As such, infiltration techniques will not be considered further due to the risk associated with mobilising leachates to the watercourse.

5.2.3.3 On the basis that infiltration techniques are not viable at the site, the proposed detention basin will be designed accordingly, such as with a clay liner.

5.2.4 Watercourses / Main River

5.2.4.1 Nun Brook is located along the site's western boundary. Surface water from the proposed development will drain to this watercourse.

5.2.5 Sewers

5.2.5.1 Draining the site to an existing watercourse is a viable option, therefore the use of surface water sewers will not be considered further.

5.3 Surface water drainage strategy

5.3.1 Surface water discharge rates will be restricted to greenfield equivalent run-off rates to ensure that the rate of surface water run-off from the site does not increase as a result of the proposed development.

5.3.2 The proposed drainage strategy will comprise a piped network with attenuation provided in an online detention basin. Due to the risk of mobilising contaminants to the watercourse, the proposed basin will be lined accordingly, such as with clay.

5.3.3 The location of the proposed detention basin is considered appropriate. It is located in the lowest area of the site and in close proximity to the proposed outfall location upstream of the culvert. With the steeply sloping nature of the site in general, the flatter ground levels in this north-western area help minimise the earthworks required to achieve the detention basin.

5.3.4 The culverted Nun Brook is circa 8m below the ground level to which it runs through. The ground above the Nun Brook culvert is a former landfill site, that is covered by dense bushes and trees. The proposed location of the attenuation basin has been chosen to minimise the impact on existing trees, vegetation and biodiversity. The topographical survey, as enclosed in **Appendix B**, shows that other locations within this land are more severely impacted by trees and vegetation. The proposed location of the basin will offer ease of access and maintenance, as the surrounding dense vegetation will be cleared during the works. This includes the reduction in ground level from circa 8m to circa 6m, and thus improving access for possible future dig-downs.

5.3.5 The proposed flow control, to facilitate surface water being attenuated within the attenuation basin, will be fitted with a bypass. This will therefore allow the basin to be emptied through the bypass and into the adjacent floodplain, should the culvert need a dig-down repair during a storm event. The area of the basin above the culvert will be covered by a management company who will work to keep the area maintained, clear and future proof from self-seeded trees and dense vegetation, therefore maintaining an ease of access.

5.3.6 The basin has been designed such that normal flows up the a 1 in 30 year scenario remain within the lower basin level; the higher basin level is only likely to flood during storm events greater than a 1 in 30 year scenario. A dry weather channel is included to keep the area as dry as possible during common rainfall.

5.3.7 An indicative surface water layout plan is enclosed in **Appendix H.** The drawing shows that surface water attenuation can be accommodated on the site and the method of discharge on the basis that infiltration techniques are not viable. The detailed design parameters of the drainage are described below.

5.4 SUDS assessment

5.4.1 We have considered the suitability of SUDS for use on the development site. The review is set out in below Table 5.1.

SUDS Assessment		
SUDS Technique	**Suitability**	**Justification**
Rain Water Harvesting	Maybe	To be considered at detailed design stage.
Green Roofs	No	Green roofs are generally only viable on flat roofs. The proposed dwellings are to have pitched roofs.
Infiltration	Maybe	Subject to site investigation
Filter Strips / Filter Drains	Maybe	Subject to site investigation
Swales	Maybe	To be considered at detailed design stage, where levels allow.
Bioretention Systems	No	Attenuation will be provided in the form of a detention basin.
Trees	Yes	Most existing trees will remain on the site, plus new trees and landscaping areas will be planted.
Pervious Pavements	No	Treatment of surface water will be achieved by the low-flow channel and micro-pool within the online detention basin.
Attenuation Tanks	No	Surface water will be attenuated above ground within a detention basin.
Detention Basin	Yes	Surface water attenuation to be provided above-ground within an online detention basin, to include micro-pool and low flow channel.
Ponds and Wetlands	No	Attenuation will be provided above-ground using detention basins.
Trapped Drainage	No	Treatment of surface water will be achieved by the low-flow channel and micro-pool within the online detention basin.

Table 5.1 SUDS Assessment

5.4.2 With reference to the Environmental Health consultation response, the inclusion of reed beds has been considered within the wider site. This is not considered viable due to the steeply sloping nature of the site. The proposed detention basin is to be online in nature, with a low flow channel and micro-pool which will offer water quality benefits, as discussed further in Section 5.5 below. The inclusion of planting, such as reeds, will be considered within the design of the detention basin.

5.5 Water quality

5.5.1 Chapter 26 of The SuDS Manual 2015 (CIRIA 753) provides guidance on the methods that should be used to design SuDS to meet the water quality design criteria and good practice design standards. Based on the simple index approach, the pollution hazard indices for different land use classifications are listed in Table 26.2, Chapter 26 of the SuDS Manual. Table 5.2 below summarises the pollution hazard indices that are applicable for residential land use development.

Pollution Hazard Indices for Different Land Use Classifications				
Land Use	**Pollution Hazard Level**	**Total Suspended Solids (TSS)**	**Metals**	**Hydro-carbons**
Residential Roofs	Very low	0.2	0.2	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg school, offices) ie <300 traffic movements/day	Low	0.5	0.4	0.4
Source: Table 26.2 of The SuDS Manual				

Table 5.2 Pollution Hazard Indices for Different Land Use Classifications

5.5.2 Surface water run-off from the development will pass through an online detention basin. Additional SUDS measures, such as filter drains and swales, will be considered as part of the detailed drainage design.

5.5.3 Table 26.3 of The SuDS Manual shows the mitigation indices for a range of SuDS components for discharges to surface waters. A copy of this is provided in Table 5.3 below.

Indicative SuDS Mitigation Indices for Discharges to Surface Waters			
Type of SuDS Component	**Mitigation Indices**		
	TSS	**Metals**	**Hydro-carbons**
Filter strip	0.4	0.4	0.5
Filter drain	0.4	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond	0.7	0.7	0.5
Wetland	0.8	0.8	0.8
Source: Table 26.3 of The SuDS Manual			

Table 5.3 Indicative SuDS Mitigation Indices for Discharges to Surface Waters

5.5.4 As set out in The SuDS Manual, where two or more components are utilised, *"a factor of 0.5 is used to account for the reduced performance of the secondary or tertiary components"*. This will therefore need to be considered where multiple SUDS components are proposed.

5.5.5 As the detention basin will be online and include a low flow channel and micropool, it is considered to be a pond for this the purpose of this water quality assessment. Based on the information and assessment set out above, the online detention basin is considered to provide sufficient water treatment for the development proposals.

5.5.6 Additional SuDS features will be considered at detailed design stage, which would offer further water quality benefits.

5.6 Surface water drainage design and management

5.6.1 Proposals are to design the surface water drainage system to accommodate storms up to the 1 in 100 year event plus an allowance of 40% for climate change. The design life of a residential development is considered to be greater than 60 years. Table 5.4 below is a copy of Table 2 from the Environment Agency's guidance 'Flood risk assessments: climate change allowances' to support the National Planning Policy Framework, which defines the climate change allowances. This information is provided for the Derwent Derbyshire Management Catchment in which the proposed development is located within.

Peak Rainfall Intensity Allowance in Small and Urban Catchments			
Allowance	**Epoch**	**Central Allowance**	**Upper End Allowance**
3.3%	2050s	20%	35%
	2070s	25%	35%
1%	2050s	20%	40%
	2070s	30%	40%
Source: https://environment.data.gov.uk/hydrology/climate-change-allowances/rainfall			

Table 5.4 Peak Rainfall Allowance: Derwent Derbyshire Management Catchment

5.7 Existing run-off rates

5.7.1 To reflect the changes in the near surface geology across the site the greenfield run-off rates have been calculated. The method used to calculate the greenfield run off rates is the ICP SUDS and the calculations are enclosed in **Appendix I**.

5.7.2 The greenfield run-off rates, for the application site, are:

Greenfield Run-off Rates			
Return Period	**Existing Discharge Rate (l/s)**	**Proposed Discharge Rate (l/s)**	**Betterment**
Qbar Total Site Area	45.2	45.2	0%
1 in 1 Year	37.5	37.5	0%
1 in 30 Year	88.6	45.2	49%
1 in 100 Year	116.2	45.2	61%
1 in 100 Year + Climate Change	-	45.2	

Table 5.5 Greenfield Run-off Rates

5.7.3 Surface water run-off from the proposed development will be limited to the greenfield equivalent rate of 45.2 l/s via a vortex flow control device.

5.7.4 With reference to the results of the fluvial hydraulic modelling study, as discussed in Chapter 4.0, restricting flows to the greenfield equivalent rate of 45.2 l/s is considered to be appropriate.

5.8 Attenuation requirements

5.8.1 Surface water will discharge into the watercourse located to the west of the site and will be attenuated to the greenfield run-off rate of 45.2 l/s. To achieve this, surface water will be attenuated via an online detention basin in the north-west corner of the site to accommodate a 1 in 100 year event plus an allowance of 40% for climate change.

5.8.2 The proposed drained area of the development is 1.883 ha, as shown on the plan enclosed in **Appendix J**. An allowance of 10% has been applied for urban creep. Therefore, the drainage calculation have been prepared based on a total drained area of 1.940 ha.

5.8.3 Based on the proposed drained area and allowable discharge rate of 45.2 l/s, the storage requirement for the 1 in 100 year plus climate change event has been calculated utilising the following parameters. Calculations are enclosed in **Appendix K**.

Rainfall profile	= Flood Estimation Handbook
Return period	= 100 year
Durations	= 60 to 10080 minutes
Climate change	= 40%
Drained area	= 1.940 ha
Limiting flow to watercourse	= 45.2 l/s
Control	= Vortex flow control
Total storage required	= 1,084m^3

5.8.4 The indicative surface water drainage layout incorporating the attenuation is shown on the plan enclosed in **Appendix H.**

5.9 Overland flows

5.9.1 Proposals are to design the surface water drainage to accommodate the 1 in 100 year storm event taking into account the predicted future effects of climate. Clearly there is a risk of this storm event being exceeded, albeit this risk is considered very low. In such an event the proposed drainage systems will become overwhelmed and overland flows could occur. Overland flows will be directed to follow the path that overland flows currently follow.

5.9.2 Predicted overland flows are shown on the plan enclosed in **Appendix L**.

6.0 Foul water drainage strategy

6.1 Severn Trent Water's asset plan is enclosed in **Appendix C.** The asset plan identifies a foul water sewer located in Barms Way to the south. This is a 150mm diameter sewer, which then flows south along Nunsfield Road, where is transitions to a 225mm diameter combined water sewer.

6.2 The intention is for foul water to discharge to Severn Trent Water's sewer network at manhole 5203, located at the junction of Barms Way and Nunsfield Road. A pre-development enquiry has been undertaken with Severn Trent Water (STW) with regards to this connection, see response enclosed in **Appendix M**. STW have confirmed that a gravity connection to this sewer *"at a new or existing manhole (5203)"* would be acceptable, subject to a formal Section 106 approval.

7.0 Maintenance

7.1 Surface water drainage maintenance

7.1.1 The drainage system will be designed to minimise maintenance requirements, however, a full maintenance scheme will be established for those elements not being offered for adoption. The various areas will be maintained as set out in Table 7.1 below.

Maintenance Areas – Surface Water	
Aspect	**Maintainer**
Private Drains	Home owner
SUDS – Private	Home owner
SUDS – Communal	Management Company
Adopted Sewers	Severn Trent Water

Table 7.1 Maintenance Areas – Surface Water

7.1.2 Additional maintenance information is set out below for the various components of the surface water drainage strategy.

7.1.3 Hydrobrake

7.1.3.1 A hydrobrake will be utilised to restrict surface water flows.

7.1.3.2 Responsibility for the maintenance of the hydrobrake is with the management company, in line with the manufacturer's specifications.

7.1.4 Detention basins

7.1.4.1 Surface water attenuation will be provided within an online detention basin with low flow channel and micropool. The operation and maintenance requirements for detention basins are outlined in Table 7.2 below.

Operation and Maintenance: Detention Basins		
Maintenance schedule	**Required action**	**Typical Frequency**
Regular maintenance	Remove litter and debris	Monthly
	Cut the grass – for spillways and access routes	Monthly (during growing season), or as required
	Cut grass – meadow grass in and around basin	Half yearly (spring – before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually
Occasional Maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial actions	Repair erosion or other damage reseeding or re-turfing	As required
	Realignment of rip-rap	As required.
	Repair/rehabilitation of inlets, outlets and overflows	As required.
	Relevel uneven surfaces and reinstate design levels	As required
Source: Table 22.1 from Source: The SuDs Manual - 2015		

Table 7.2 Operation and Maintenance: Detention Basins

7.1.4.2 Responsibility for the maintenance of detention basins is as follows:

- Management company – shared detention basins.

7.2 Foul water drainage maintenance

7.2.1 The drainage system will be designed to minimise maintenance requirements, however, a full maintenance scheme will be established for those elements not being offered for adoption. The various areas will be maintained as set out in Table 7.3 below.

Maintenance Areas – Foul Water	
Aspect	**Maintainer**
Private Drains	Home owner
Adopted Sewers	Severn Trent Water

Table 7.3 Maintenance Areas – Foul Water

8.0 Summary and conclusions

8.1 The proposed Residential development is located at Hogshaw Farm, off Nunsfield Road, Buxton. The site is bound by agricultural land to the north, a golf course and dwellings to the east, Hogshaw Brook and dwellings to the south and a railway line to the west.

8.2 The proposed development will comprise 99 residential dwellings.

8.3 The development is located within Flood Zone 1 and at low risk of flooding from rivers and sea. The site is shown to be at low risk of flooding from surface water, groundwater, sewers and reservoirs.

8.4 A fluvial hydraulic modelling study has been undertaken by JBA Consulting Ltd. The results of which identify a slight reduction in the existing flood extent identified downstream of the site, and also a reduction in these flood depths. The proposals are therefore shown to offer flood alleviation downstream of the site, achieving a betterment on the existing scenario.

8.5 The proposed surface water drainage strategy will comprise a piped network with attenuation provided in an online detention basin, with an outfall to Nun Brook restricted to the greenfield run-off rate of 45.2 l/s. A total volume of 1,084m^3 of attenuation will be provided, sufficient to accommodate storms up to and including the 1 in 100 + 40% climate change event.

8.6 The intention is for foul water to discharge to Severn Trent Water's sewer network at the junction of Barms Way and Nunsfield Road. A pre-development enquiry has been undertaken with Severn Trent Water (STW) with regards to this connection. STW have confirmed that a gravity connection to this sewer *"at a new or existing manhole (5203)"* would be acceptable, subject to a formal Section 106 approval.

8.7 National, Regional and Local planning policy requires that:

- Development is directed to sites at the lowest probability of flooding;
- Development accommodates the potential impacts of climate change;
- Development should not be permitted if it would be at an unacceptable risk of flooding or create an unacceptable risk elsewhere; and
- New development should facilitate safe access and exit during flood conditions.

8.8 The proposals for a residential development at Hogshaw Farm, off Nunsfield Road, Buxton are therefore fully compliant with policy in respect of development and flood risk, such that flood risk considerations do not constitute a barrier to the granting of planning consent.

Appendix A

Planning Layout

Barratt Homes drawing no. H8797-BAH-XX-XX-DR-UD-203001-P03

SCHEDULE OF ACCOMMODATION

Barratt Type	House Type	Sqft	No	Total Sqft
Private Units				
Rowan - End	2 Bed Terraced House	866	10	8660
Rowan - Mid	2 Bed Terraced House	866	1	866
Oakmoor - End	3 Bed Bed Semi / Mews House Duel Aspect End Unit	1049	1	1049
Birchmoor - End	3 Bed Terraced House	1025	3	3075
Rathlin	3 Bed Detached House	990	11	10890
Matlock - End	3 Bed Semi / Mews House	970	23	22310
Hopton	3 Bed Detached / Semi Detached Dual Aspect House	1017	9	9153
Hopton - End	3 Bed Detached / Semi Detached Dual Aspect House	1017	1	1017
Knightwood - End	4 Bed Townhouse	1122	18	20196
Ashtead	4 Bed Dual Aspect Detached House	1265	4	5060
Wallasea	4 Bedroom Int. Garage Detached House	1206	11	13266
Haweswater	4 Bedroom Int. Garage Detached House	1495	7	10465
Total number of units and square footage			**99**	**106007**
Gross Site Area in Acres				**10.39**
Open Space & Undevelopable Area in Acres				**3.18**
Net Site Area in Acres				**7.21**
Density (Units per Acre)				**14**
Density (Units per Hectare)				**34**
Square Foot / Acre				**14,703**

North

AGRICULTURAL LAND

PUMPING STATION

SUDS

LOCAL WILDLIFE AREA

GOLF COURSE

Nunsfield Farm

Fairfield Commc

Potential Future Link Road

Existing connection to remain open

Existing connection to remain open

ENTRANCE STATEMENT

SUBSTATION

TEMP SALES PARKING

PLAY AREA (LAP) Refer to drawing 2402.4/929

Nestle Water Main 5m

Buxton FP 2

Buxton FP 1

Buxton FP 77

Nestle Water Main 5m

ARM 4

ARM 3

B.O.A.T

BARMS WAY

GLENMOOR ROAD

NORTH ROAD

Links View

St Peter's Church

The Devonshire Coach House

Northlands

Nunsfield Farm

Sub Sta

324.3m

Legend:

- Proposed dwelling and house type code.
- Proposed garage to be built.
- Grass, refer to detailed landscpaing plans for details.
- Wall (Refer to BTL01/BTD01&02 for details)
- Timber gates to be erected to rear gardens. (as indicated on site layout).
- Existing trees to be retained & protected during works.
- Trees to be removed, refer to 1795_ARB_AIA & 1795_ARB_AMS for details.
- Root Protection Zone
- Indicates a tree with a TPO.
- Water main easement, 5m wide as confirmed by Ward Hadaway.
- AS OPP — Dwelling handing - as / opposite see the construction dwg.
- Refuse collection area
- EV — Car charging point, refer to EVCP info pack for specs & positioning details.
- PROW.
- GRP Chimney
- Indicative Landscaping, refer to UG_1795_Lan_SI_01-05 for details.

HOGSHAW FARM BUXTON

Revision	Description	Date	Design By
03	Flipped plot 16, pulled 16&17 south 1m, revised multi use footpath position, various minor tweaks to suit ENG comments	28/06/24	GB
02	Layout updated to various internal comments.	18/06/24	GB

Project: HOGSHAW FARM

Description: PLANNING LAYOUT

Design By:	Date:	Scale at A0:	Revision:
GB	11/06/2024	1:500	3

Project	Originator	Functional	Spatial	Form	Discipline	Number
H8797	- BAH -	XX	- XX -	DR -	UD -	203001

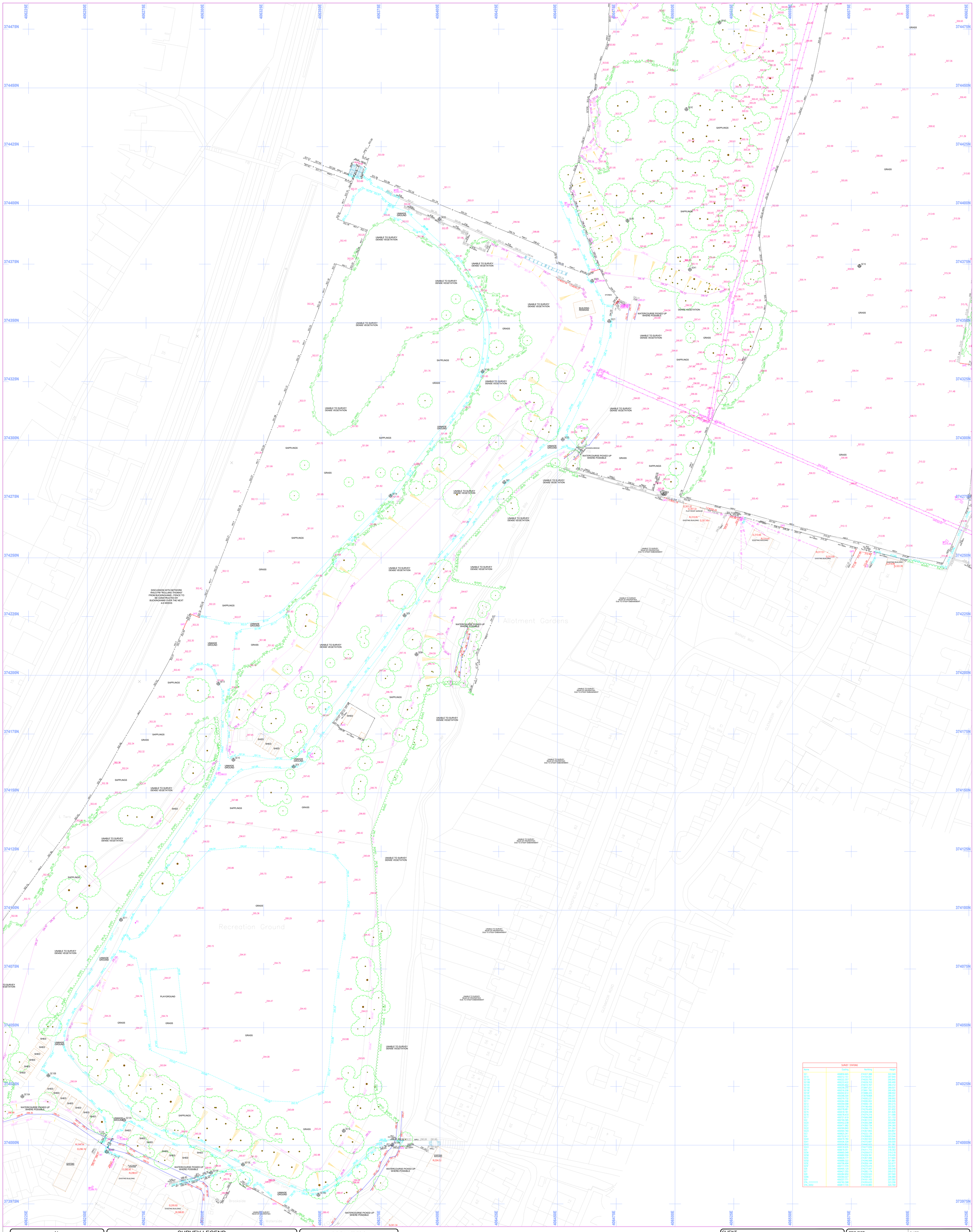
BARRATT HOMES

Do not scale from this drawing. Work to given dimensions only. Any discrepancies are to be reported to Originator.
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Appendix B

Topographical Land Survey

Survey Eng Ltd drawing no BH.TS.12-C



SURVEY STATIONS			
Name	Easting	Northing	Height
SE1	406859.665	374327.388	322.569
SE1A	406812.151	374164.057	297.944
SE1B	406222.357	374020.795	290.945
SE1B	406313.430	374029.703	290.490
SE1C	406295.662	374010.787	289.372
SE1D	406316.350	373997.257	289.501
SE1E	406316.206	373991.782	290.400
SE1F	406307.613	373988.525	289.555
SE1G	406346.304	373978.868	289.203
SE1H	406379.753	374000.011	289.992
SE11	406264.306	374066.952	296.505
SE12	406359.098	374056.134	293.215
SE13	406305.728	374196.456	302.202
SE14	406378.981	374216.405	301.622
SE15	406418.181	374329.536	301.626
SE16	406578.433	374374.216	311.508
SE17	406721.619	374566.998	321.153
SE2	406749.395	374361.510	321.258
SE20	406452.238	374300.398	293.464
SE21	406471.982	374292.734	294.365
SE22	406389.840	374394.173	301.364
SE23	406464.760	374367.855	294.827
SE3	406825.541	374222.136	323.056
SE4	406752.613	374308.805	313.544
SE40	406479.784	374193.502	300.805
SE41	406508.328	374172.667	300.000
SE42	406504.852	374440.935	301.581
SE43	406513.976	374477.839	302.823
SE5	406679.351	374311.710	318.343
SE54	406693.048	374259.673	316.218
SE56	406680.559	374329.391	319.455
SE5C	406823.177	374367.466	313.664
SE5D	406689.322	374346.568	321.991
SE5E	406736.494	374368.144	322.477
SE5F	406717.370	374370.470	322.591
SE6	406495.120	374277.097	300.548
SE7	406427.355	374283.179	295.072
SE8	406384.952	374225.520	297.580
SE9A	406390.027	374208.921	296.989
SE9	406331.771	374161.165	297.553
STN_11111111	406760.398	374355.633	323.306
STN_5002	406811.735	374144.880	324.769

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SURVEY ORIENTATED TO OS GRID (OSGB36-15)

SURVEY NOTES

ALL LEVELS ARE RELATED TO O.S DATUM (OSGB36-15)
ESTABLISHED AT SE1 USING THE LEICA SMARTNET GPS NETWORK

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SURVEY LEGEND

FEATURES	BOUNDARY ANNOTATIONS			
TOP OF BANK	BARB WIRE FENCE	BW.F	SECURITY FENCE	SEC.F
BOTTOM OF BANK	CHAIN LINK FENCE	CL.F	TIMBER FENCE	T.F
SURVEY STATION	CONC POST AND PANEL	CP&P.F	BRICK WALL	B.W
TREE	CONC POST TIMB PANEL	CP&TP.F	BLOCK WALL	BL.W
HEDGE	ELECTRIC FENCE	EL.F	CONCRETE WALL	C.W
TREE CANOPY	HERAS FENCE	HER.F	GABIEN WALL	G.W
BUSHES	IRON RAIL FENCE	IR.F	MISCELLANEOUS WALL	MISC.W
VEGETATION	KNEE RAIL FENCE	KR.F	RETAINING WALL	R.W
	MISCELLANEOUS FENCE	MISC.F	RETAINING LOG WALL	RL.W
	POST AND WIRE FENCE	PAW.F	STONE WALL	S.W
	RANCH STYLE FENCE	RS.F		

LEVEL PREFIX ANNOTATIONS

ASL	ARCH SPRING LEVEL	IL	INVERT LEVEL		
BL	BED LEVEL	PL	PARAPET LEVEL	TRH	TREE HEIGHT
BD	BACK DROP	RL	ROOF/RIDGE LEVEL	THR	THRESHOLD LEVEL
CL	COVER LEVEL	SL	SOFFIT LEVEL	WL	WATER LEVEL
DH	TOP OF DOOR	TOF	TOP OF FENCE	WS	WINDOW SILL
DTC	DEPTH TO CROWN	TOP	TOP OF PIPE	WSF	WINDOW SOFFIT
FFL	FINISHED FLOOR LEVEL	TOW	TOP OF WALL		

GEOTECHNICAL INFORMATION

TRIAL HOLE / PIT	TH
BORE HOLE	BH
WINDOW SAMPLE	WS
MONITORING POINT	MP

SURVEY ANNOTATIONS

AV	AIR VALVE	OHC	OVERHEAD CABLES
B	BOLLARD	PB	POST BOX
BS	BUS STOP	PM	PARKING METER
BT	BRITISH TELECOM IC	PS	POST
CPS	CONCRETE PAVING SLABS	PYL	ELECTRICITY PYLON
CP	CATCH PIT	RE	RODDING EYE
DR	DRAIN	RS	ROAD SIGN
EB	ELECTRIC CONTROL BOX	RWP	RAIN WATER PIPE
EL	ELECTRICAL IC	ST	STOP TAP
EP	ELECTRICITY POLE	SM	SERVICE MARKER
ER	EARTH ROD	SP	SIGN POST
FH	FIRE HYDRANT	SV	STOP VALVE / SLUICE VALVE
FP	FLAG POLE	SVP	SOIL VENT PIPE
G	GULLY	TB	TELEPHONE BOX
GH	GREENHOUSE	TL	TRAFFIC LIGHTS
GP	GATE POST	TM	TELEPHONE MAST
GV	GAS VALVE	TP	TELEGRAPH POLE
IC	INSPECTION COVER	TPS	TACTILE PAVING SLABS
JB	JUNCTION BOX	VP	VENT PIPE
JKW	JAPANESE KNOT WEED	WM	WATER METER
KO	KERB OUTLET	WO	WASH OUT
LH	LAMP HOLE	UTL	UNABLE TO LIFT
LP	LAMP POST/LIGHT COLUMN	UTS	UNABLE TO SURVEY
MH	MANHOLE		
MP	MONITOR POINT		
NP	NAME PLATE		

CLIENT
BARRATT HOMES

PROJECT ENGINEER AS | DATE 10.12.2018
DRAWN BM | SCALE 1:500@A0

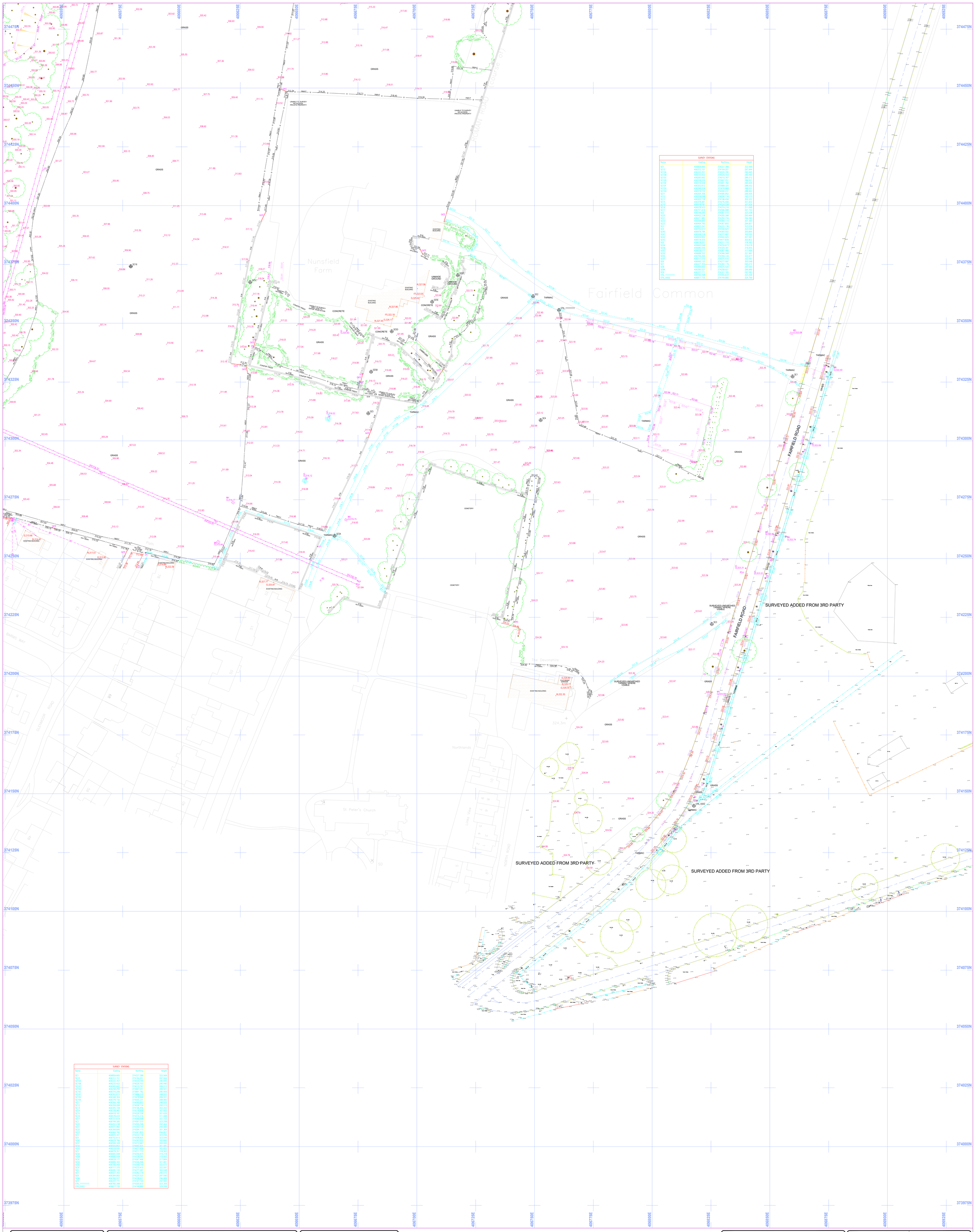
PROJECT TITLE
BUXTON, FAIRFIELD

DESCRIPTION	REV	DATE	DRWN	APPR
TOPO SURVEY UPDATED	C	26.03.21	BM	-
SURVEY ADDED FROM 3RD PARTY	B	28-03-19	BM	-
ADDITIONAL TOPO SURVEY ADDED	A	11.03.19	BM	-

DRAWING DETAIL
TOPOGRAPHICAL LAND SURVEY
SHEET 1 OF 2

DRAWING NUMBER BH.TS.12 | REVISION C

SurveyEng Ltd
Land Surveyors & Engineers
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SURVEY ORIENTATED TO OS GRID (OSGB36-15)

SURVEY NOTES

ALL LEVELS ARE RELATED TO O.S DATUM (OSGB36-15)
ESTABLISHED AT SE1 USING THE LEICA SMARTNET GPS NETWORK

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SURVEY LEGEND

FEATURES

TOP OF BANK
BOTTOM OF BANK
SURVEY STATION
TREE
HEDGE
TREE CANOPY
BUSHES
VEGETATION

BOUNDARY ANNOTATIONS

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CHAIN LINK FENCE — CL.F
CONC POST AND PANEL — CP&P.F
CONC POST TIMB PANEL — CP&TP.F
ELECTRIC FENCE — EL.F
HERAS FENCE — HER.F
IRON RAIL FENCE — IR.F
KNEE RAIL FENCE — KR.F
MISCELLANEOUS FENCE — MISC.F
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TIMBER FENCE — T.F
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MISCELLANEOUS WALL — MISC.W
RETAINING WALL — R.W
RETAINING LOG WALL — RL.W
STONE WALL — S.W

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BORE HOLE — BH
WINDOW SAMPLE — WS
MONITORING POINT — MP

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GP	GATE POST	TM	TELEPHONE MAST
GV	GAS VALVE	TP	TELEGRAPH POLE
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MH	MANHOLE		
MP	MONITOR POINT		
NP	NAME PLATE		

CLIENT
BARRATT HOMES

PROJECT ENGINEER: AS
DRAWN: BM
DATE: 10.12.2018
SCALE: 1:500@A0

PROJECT TITLE
BUXTON, FAIRFIELD

DRAWING DETAIL
TOPOGRAPHICAL LAND SURVEY
SHEET 2 OF 2

DRAWING NUMBER: BH.TS.12
REVISION: C

DESCRIPTION	REV	DATE	DRWN	APPR
TOPO SURVEY UPDATED	C	26.03.21	BM	-
SURVEY ADDED FROM 3RD PARTY	B	28-03-19	BM	-
ADDITIONAL TOPO SURVEY ADDED	A	11.03.19	BM	-

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Appendix C
Severn Trent Water Asset Plan



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Scale: 1:1250 | Date: 28/03/23 | Wastewater Plan A2

Data updated: 14/03/23 | Map Centre: 406645,374389 | Our Ref: 1121913 - 1 | Powered by digdat

Public Foul Gravity/Lateral Drain		Highway Drain		Manhole Foul	
Public Combined Gravity/Lateral Drain		Overflow Pipe		Manhole Surface	
Public Surface Water Gravity/Lateral Drain		Disposal Pipe		Abandoned Pipe	
Pressure Foul		Culverted Water Course		Chamber	
Pressure Combined		Pumping Station			
Pressure Surface Water		Fitting			

Section 104 sewers are shown in green

Private sewers are shown in magenta

nathan.reed@jppuk.net

11024 Buxton

SEVERN TRENT

Do not scale off this map. The plan and any information supplied with it is furnished as a general guide, is only valid at the date of issue and no warranty as to its correctness is given or implied. In particular this plan and any information shown on it must not be relied upon in the event of any development or works (including but not limited to excavations) in the vicinity of SEVERN TRENT WATER assets or for the purposes of determining the suitability of a point of connection to the sewerage or distribution systems. Reproduction by permission of Ordnance Survey on behalf of HMSO. ©Crown Copyright and database rights 2023 All rights reserved. Ordnance Survey licence number 100031673. Document users other than SEVERN TRENT WATER business users are advised that this document is provided for reference purpose only and is subject to copyright, therefore, no further copies should be made from it.

GENERAL CONDITIONS AND PRECAUTIONS TO BE TAKEN WHEN CARRYING OUT WORK ADJACENT TO SEVERN TRENT WATER'S APPARATUS

Please ensure that a copy of these conditions is passed to your representative and/or your contractor on site. If any damage is caused to Severn Trent Water Limited (STW) apparatus (defined below), the person, contractor or subcontractor responsible must inform STW immediately on:
0800 783 4444 (24 hours)

a) These general conditions and precautions apply to the public sewerage, water distribution and cables in ducts including (but not limited to) sewers which are the subject of an Agreement under Section 104 of the Water Industry Act 1991(a legal agreement between a developer and STW, where a developer agrees to build sewers to an agreed standard, which STW will then adopt); mains installed in accordance with an agreement for the self-construction of water mains entered into with STW and the assets described at condition b) of these general conditions and precautions. Such apparatus is referred to as "STW Apparatus" in these general conditions and precautions.

b) Please be aware that due to The Private Sewers Transfer Regulations June 2011, the number of public sewers has increased, but many of these are not shown on the public sewer record. However, some idea of their positions may be obtained from the position of inspection covers and their existence must be anticipated.

c) On request, STW will issue a copy of the plan showing the approximate locations of STW Apparatus although in certain instances a charge will be made. The position of private drains, private sewers and water service pipes to properties are not normally shown but their presence must be anticipated. This plan and the information supplied with it is furnished as a general guide only and STW does not guarantee its accuracy.

d) STW does not update these plans on a regular basis. Therefore the position and depth of STW Apparatus may change and this plan is issued subject to any such change. Before any works are carried out, you should confirm whether any changes to the plan have been made since it was issued.

e) The plan must not be relied upon in the event of excavations or other works in the vicinity of STW Apparatus. It is your responsibility to ascertain the precise location of any STW Apparatus prior to undertaking any development or other works (including but not limited to excavations).

f) No person or company shall be relieved from liability for loss and/or damage caused to STW Apparatus by reason of the actual position and/or depths of STW Apparatus being different from those shown on the plan.

In order to achieve safe working conditions adjacent to any STW Apparatus the following should be observed:

1. All STW Apparatus should be located by hand digging prior to the use of mechanical excavators.

2. All information set out in any plans received from us, or given by our staff at the site of the works, about the position and depth of the mains, is approximate. Every possible precaution should be taken to avoid damage to STW Apparatus. You or your contractor must ensure the safety of STW Apparatus and will be responsible for the cost of repairing any loss and/or damage caused (including without limitation replacement parts).

3. Water mains are normally laid at a depth of 900mm. No records are kept of customer service pipes which are normally laid at a depth of 750mm; but some idea of their positions may be obtained from the position of stop tap covers and their existence must be anticipated.

4. During construction work, where heavy plant will cross the line of STW Apparatus, specific crossing points must be agreed with STW and suitably reinforced where required. These crossing points should be clearly marked and crossing of the line of STW Apparatus at other locations must be prevented.

5. Where it is proposed to carry out piling or boring within 20 metres of any STW Apparatus, STW should be consulted to enable any affected STW Apparatus to be surveyed prior to the works commencing.

6. Where excavation of trenches adjacent to any STW Apparatus affects its support, the STW Apparatus must be supported to the satisfaction of STW. Water mains and some sewers are pressurised and can fail if excavation removes support to thrust blocks to bends and other fittings.

7. Where a trench is excavated crossing or parallel to the line of any STW Apparatus, the backfill should be adequately compacted to prevent any settlement which could subsequently cause damage to the STW Apparatus. In special cases, it may be necessary to provide permanent support to STW Apparatus which has been exposed over a length of the excavation before backfilling and reinstatement is carried out. There should be no concrete backfill in contact with the STW Apparatus.

8. No other apparatus should be laid along the line of STW Apparatus irrespective of clearance. Above ground apparatus must not be located within a minimum of 3 metres either side of the centre line of STW Apparatus for smaller sized pipes and 6 metres either side for larger sized pipes without prior approval. No manhole or chamber shall be built over or around any STW Apparatus.

9. A minimum radial clearance of 300 millimetres should be allowed between any plant or equipment being installed and existing STW Apparatus. We reserve the right to increase this distance where strategic assets are affected.

10. Where any STW Apparatus coated with a special wrapping is damaged, even to a minor extent, STW must be notified and the trench left open until the damage has been inspected and the necessary repairs have been carried out. In the case of any material damage to any STW Apparatus causing leakage, weakening of the mechanical strength of the pipe or corrosion-protection damage, the necessary remedial work will be recharged to you.

11. It may be necessary to adjust the finished level of any surface boxes which may fall within your proposed construction. Please ensure that these are not damaged, buried or otherwise rendered inaccessible as a result of the works and that all stop taps, valves, hydrants, etc. remain accessible and operable. Minor reduction in existing levels may result in conflict with STW Apparatus such as valve spindles or tops of hydrants housed under the surface boxes. Checks should be made during site investigations to ascertain the level of such STW Apparatus in order to determine any necessary alterations in advance of the works.

12. With regard to any proposed resurfacing works, you are required to contact STW on the number given above to arrange a site inspection to establish the condition of any STW Apparatus in the nature of surface boxes or manhole covers and frames affected by the works. STW will then advise on any measures to be taken, in the event of this a proportionate charge will be made.

13. You are advised that STW will not agree to either the erection of posts, directly over or within 1.0 metre of valves and hydrants,

14. No explosives are to be used in the vicinity of any STW Apparatus without prior consultation with STW.

TREE PLANTING RESTRICTIONS

There are many problems with the location of trees adjacent to sewers, water mains and other STW Apparatus and these can lead to the loss of trees and hence amenity to the area which many people may have become used to. It is best if the problem is not created in the first place. Set out below are the recommendations for tree planting in close proximity to public sewers, water mains and other STW Apparatus.

15. Please ensure that, in relation to STW Apparatus, the mature root systems and canopies of any tree planted do not and will not encroach within the recommended distances specified in the notes below.

16. Both Poplar and Willow trees have extensive root systems and should not be planted within 12 metres of a sewer, water main or other STW Apparatus.

17. The following trees and those of similar size, be they deciduous or evergreen, should not be planted within 6 metres of a sewer, water main or other STW Apparatus. E.g. Ash, Beech, Birch, most Conifers, Elm, Horse Chestnut, Lime, Oak, Sycamore, Apple and Pear. Asset Protection Statements Updated May 2014

18. STW personnel require a clear path to conduct surveys etc. No shrubs or bushes should be planted within 2 metre of the centre line of a sewer, water main or other STW Apparatus.

19. In certain circumstances, both STW and landowners may wish to plant shrubs/bushes in close proximity to a sewer, water main of other STW Apparatus for screening purposes. The following are shallow rooting and are suitable for this purpose: Blackthorn, Broom, Cotoneaster, Elder, Hazel, Laurel, Privet, Quickthorn, Snowberry, and most ornamental flowering shrubs.

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
	C			
	C			
	C			
	C			
4007	C	-	0	0
4008	C	-	0	0
4010	C	303.19	302.83	0.36
4011	C	302.58	302.27	0.32
4012	C	302.64	301.9	0.74
4110	C	306.37	305.21	1.16
4111	C	305.51	0	0
4112	C	304.53	304.15	0.38
4113	C	304.58	303.76	0.82
4114	C	303.48	302.61	0.87
4115	C	304.47	0	0
4195	C	305.15	303.4	1.75
4196	C	304.96	0	0
4198	C	304.04	300.84	3.2
4199	C	302.11	299.36	2.75
5092	C	319.61	316.99	2.62
5191	C	306.59	305.98	0.61
5192	C	306.44	305.73	0.71
7091	C	324.68	320.8	3.88
7191	C	324.63	323.54	1.09
7192	C	324.69	323.47	1.22
7193	C	324.61	322.72	1.89
7194	C	324.8	322.63	2.17
7195	C	324.97	322.68	2.29
7197	C	324.99	322.08	2.91
7198	C	324.72	321.61	3.11
7291	C	324.47	323.64	0.83
8012	C	324.04	321.95	2.09
8151	C	323.5	322.27	1.23
	F			
	F			
	F			
	F			
	F			
4101	F	307.87	306.61	1.26
5201	F	309.91	308.58	1.33
5203	F	306.18	304.78	1.4
4152	S	307.86	306.84	1.02
4153	S	307.58	306.89	0.69
4157	S	304.97	303.54	1.43
5153	S	310.7	309.35	1.35
5154	S	308.91	308.04	0.87
5252	S	309.94	308.57	1.37
5254	S	306.24	304.93	1.31

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Appendix D
Environment Agency Product 4 Data

Product 4 : Flood Risk Data Package for
Nunsfield Farm, Buxton, SK17 7HN – SK 06585 74410

EMD 299476 **Date: 24/02/202**

Flood Map for Planning:
The Flood Map for Planning is now classed as Open Data. As such it can be downloaded free of charge under an open data licence from the following addresses:

- https://data.gov.uk/publisher/environment-agency
- https://flood-map-for-planning.service.gov.uk/

Your development is in **flood zone 1**

The flood zones on this map:

- refer to the land at risk of flooding and do not refer to individual properties refer to the probability of river and sea flooding.
- ignore the presence of defences,
- do not take into account potential impacts of climate change.
- This data is updated on a quarterly basis as better data becomes available.

Zone 1: Low Probability	Land having a less than 0.1% annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map for Planning – all land outside Zones 2, 3a and 3b)
Zone2: Medium Probability	Land having between a 1% and 0.1% annual probability of river flooding; or land having between a 0.5% and 0.1% annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a: High Probability	Land having a 1% (1 in 100) or greater annual probability of river flooding; or Land having a 0.5% or greater annual probability of sea. (Land shown in dark blue on the Flood Map)
Zone 3b: Functional Floodplain	• land having a 3.3% or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or • land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding). • Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. • (Not separately distinguished from Zone 3a on the Flood Map)

Probability	Percentage chance of flooding each year
1 in 2 year	50%
1 in 5 year	20%
1 in 20 year	5%
1 in 50 year	2%
1 in 100 year	1%
1 in 1000 year	0.1%

Updated Climate Change Guidance: On 19th February 2016, the Flood risk assessments: climate change allowances' was published on www.gov.uk website. It has replaced previous guidance Climate Change Allowances for Planners. The climate change guidance can be found at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

Defence Information There are no Environment Agency maintained raised defences in this area.

Historic Information We have no records of historic fluvial flooding at this location. However, we would advise that this does not mean there has never been historic flooding in this location or that the area is automatically free from a risk of flooding. We do not claim that all flood events have been recorded.

Surface Water & Drainage: The Environment Agency (empowered under the Water Resources Act 1991) concentrates on the major elements of the drainage system, managing flood risk arising from designated "main rivers" and the sea. The Flood & Water Management Act (2010) has given Lead Local Flood Authorities (LLFAs) responsibility for the management of local flood risk, which includes surface runoff, groundwater and flooding from ordinary watercourses (smaller rivers and streams).
The LLFA for this area is **Derbyshire County Council,** and we recommend that you contact them with concerns about any flooding issues for this area. Further information and maps for surface water, ordinary watercourses, and reservoir flooding can be found here: https://www.gov.uk/check-long-term-flood-risk ; Reservoir flood maps: when and how to use them - GOV.UK (www.gov.uk)

Open Data Information: Many datasets are now classed as Open Data and as such can be downloaded free of charge under an open data licence from the following address: https://data.gov.uk/publisher/environment-agency

Permitting Information: Under the Environmental Permitting (England and Wales) Regulations 2016, any permanent or temporary works in, over or under a designated main river will require an Environmental Permit for Flood Risk Activities from the Environment Agency. Any permanent or temporary works within 8 metres of the top of bank of a designated main river, or landward toe of a flood defence may require an Environmental Permit for Flood Risk Activities from the Environment Agency. In addition, any permanent or temporary works within the floodplain of a designated main river may also require an Environmental Permit for Flood Risk Activities. To find out whether your activity requires a permit or falls under a relevant exclusion, exemption or standard rule please follow this link: https://www.gov.uk/guidance/flood-risk-activities-environmental-permits. The Environment Agency require access to the watercourse and free movement up to 8m from the river bank/ defence for maintenance purposes.
Please note that a permit is separate to and in addition to any planning permission granted.

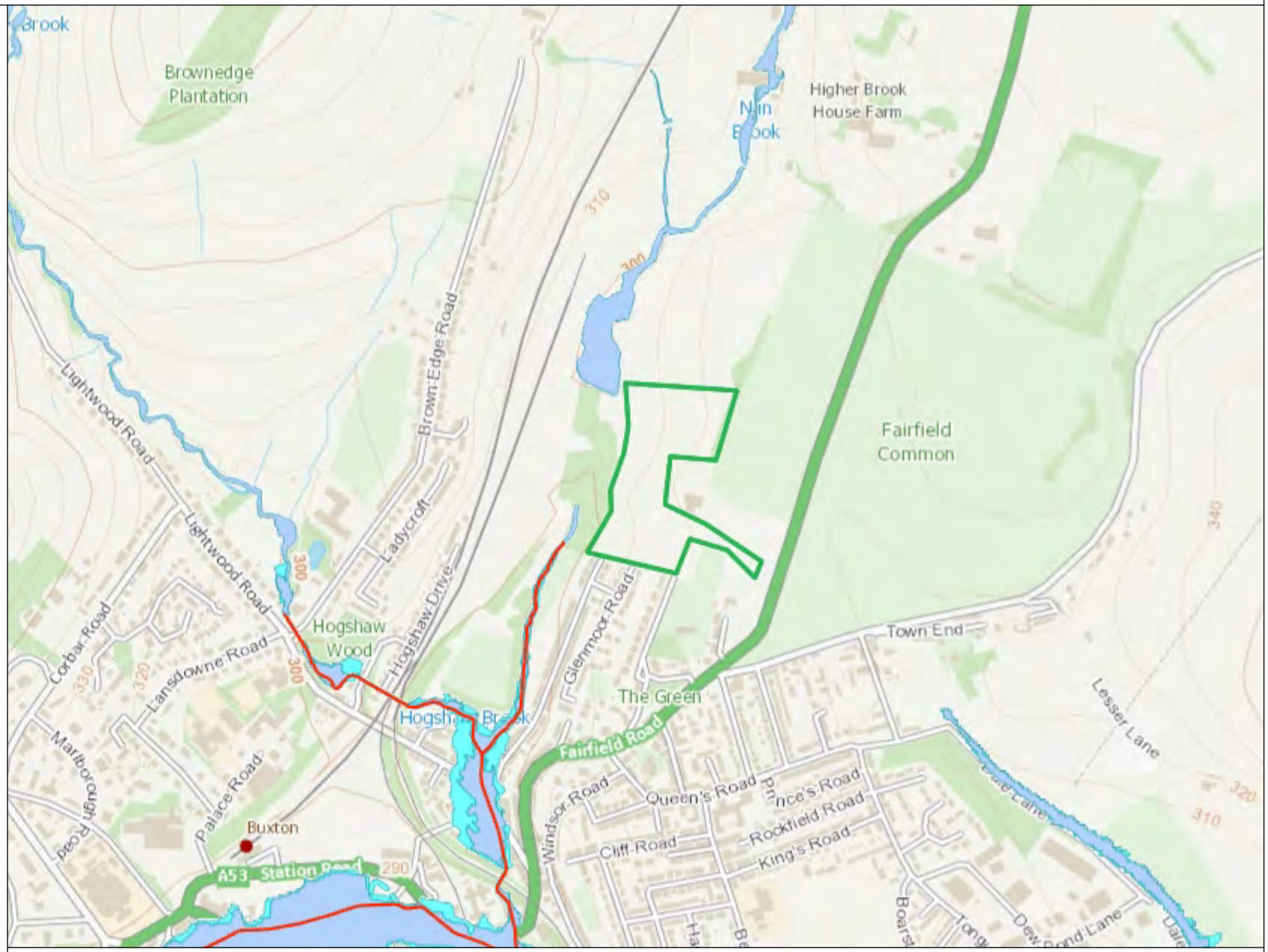
Strategic flood risk assessments: We recommend that you check the relevant local authority's strategic flood risk assessment (SFRA) as part of your work to prepare a site specific flood risk assessment. This should give you information about: the potential impacts of climate change in this catchment areas defined as functional floodplain flooding from other sources, such as surface water, ground water and reservoirs. This data has been generated by strategic scale flood models and is not intended for use at the individual property scale. If you're intending to use this data as part of a flood risk assessment, please include an appropriate modelling tolerance as part of your assessment. The Environment Agency regularly updates its modelling. We recommend that you check the data provided is the most recent, before submitting your flood risk assessment.

Detailed Flood Map, centred on Nunsfield Farm, Buxton [EMD299476]

Environment Agency

Legend

- Statutory Main Rivers
- Defences
- Flood Storage Areas
- Flood Zone 3
- Flood Zone 2



1: 10,000

0 250

Metres

N W E S

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Detailed River Network Map, centred on Nunsfield Farm, Buxton [EMD299476]

Environment Agency

Legend

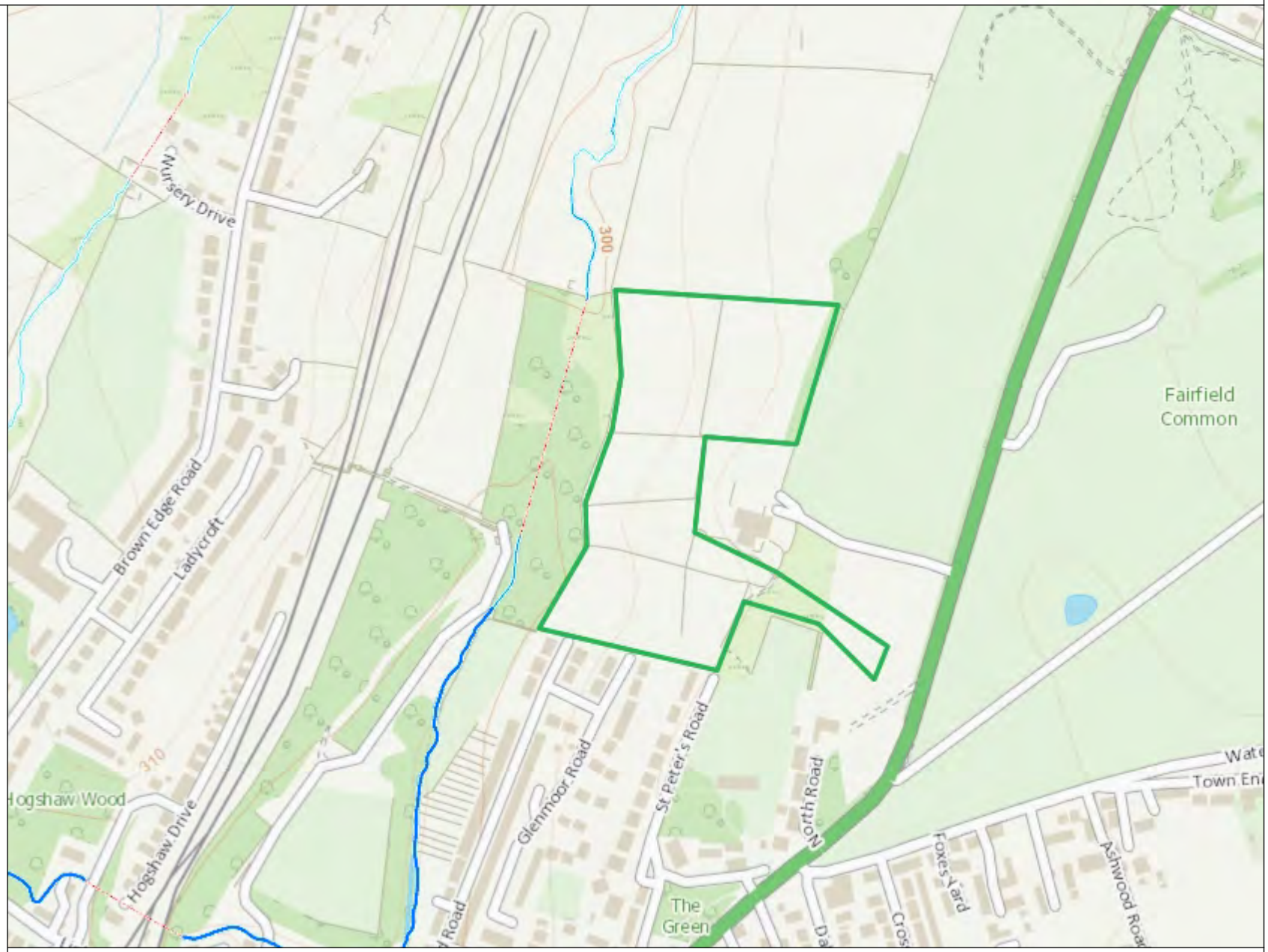
Detailed River Network

- Primary River
- Secondary River
- Tertiary River
- Lake / Reservoir
- Canal
- Canal Tunnel
- Extended Culvert
- Multiple Channel Culvert
- Underground River (potential sewer)
- Underground River (inferred)
- Underground River (local knowledge)
- Undefined

Offline Drainage features

Detailed River Network

- Primary River
- Secondary River
- Tertiary River
- Lake / Reservoir
- Canal
- Canal Tunnel
- Extended Culvert
- Multiple Channel Culvert
- Underground River (potential sewer)
- Underground River (inferred)
- Underground River (local knowledge)
- Undefined



1: 5,000

0 125

Metres

N W E S

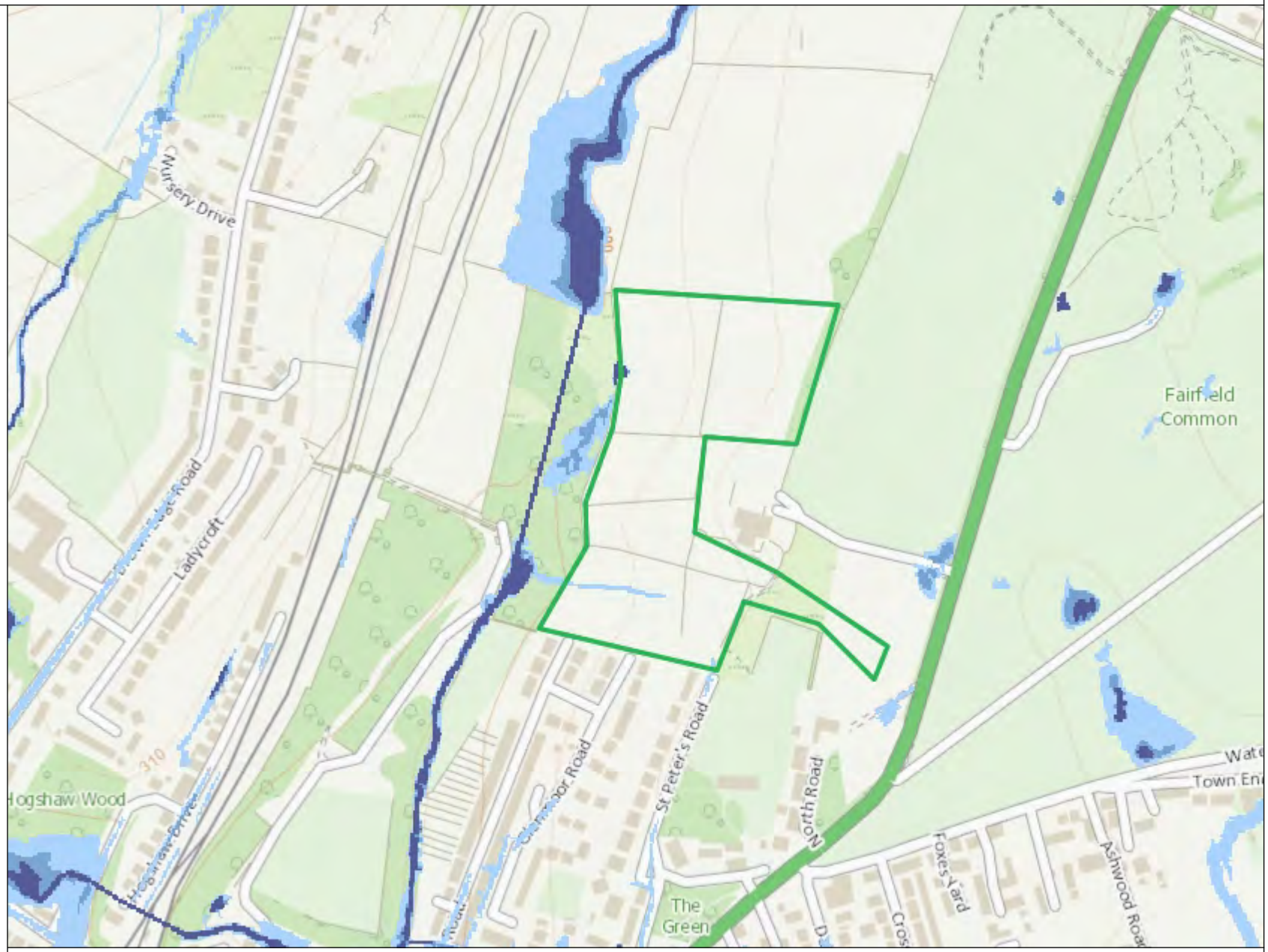
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Surface Water Flood Map, centred on Nunsfield Farm, Buxton [EMD299476]

Environment Agency

Legend

- Flood Extent 1 in 30
- Flood Extent 1 in 100
- Flood Extent 1 in 1000



1: 5,000

0 125

Metres

N W E S

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Appendix E

Extract of Ground Investigation
Soiltechnics report ref. STQ4642M-G01

soiltechnics

environmental ▪ geotechnical ▪ building fabric

Proposed residential development
Land off Nunsfield Road
Buxton

Ground Investigation Report

Revision 03

Unit 9, Clarence Avenue, Westpoint Enterprise Park, Trafford Park, Manchester, M17 1QS

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GROUND INVESTIGATION REPORT

Revision 03 – updated April 2023

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Updates from Rev00 to Rev01 are marked by a vertical solid line in the left-hand margin.

Updates from Rev01 to Rev02 are marked by a vertical dashed line in the left-hand margin.

Updates from Rev02 to Rev03 are marked by a vertical dashed line in the left-hand margin.

1 Executive summary

General

We recommend the following executive summary is not read in isolation to the main report which follows.

Site description, history and development proposals

The site is positioned in the north-eastern part of Buxton, Derbyshire, approximately 700m from the town centre and located along the eastern and western flanks of Nuns Brook. The site is approximately 21Ha in size and formed of a series of distinct parcels of land, largely unoccupied and covered in vegetation and woodland, in addition to some grazing/pasture land. A recreational ground and play area was located to the south of the site, with areas of tended landscaping located to the east. Surface levels in the eastern part of the site fall significantly from east to west down to the channel of Nun Brook, by some 20-23m. Similarly, levels in the western part of the site fall by some 5m from west to east again into the channel of Nun Brook.

Historically, the north-western part of site was open land until a refuse tip was recorded between 1967 and 1988. The eastern part of the site was used as agricultural land with Russia Mere (a pond) recorded between 1879 and 1967. The western part was used for various activities including a railway line with sidings including an engine shed (1898 to 1974), in addition to allotment gardens (1922 to 1967) and playing fields to the south (1977 to present day).

We understand the scheme will comprise the construction of a large number of dwellings, together with associated gardens, infrastructure and access roads constructed to standards allowing adoption by the local highway authority.

Ground conditions encountered

Topsoil was encountered across Zone 3 and partly within Zone 4. Within Zone 2, Made Ground was encountered, locally consistent with landfill type material (within the area of the existing recreation ground to the south, recorded as a tip by the LA) encountered in Zone 1 previously, but including increased quantities of slag, brick, coal, glass and ash. Such deposits ranged to between depths of 3.0m to >5m to the east and south, with deposits ranging between 0.8m to 1.5m to the northwest of the area. Similar deposits were encountered locally across Zone 4. Natural strata was encountered in all locations. This comprised bedrock deposits, which had generally weathered into gravels, sands and clays from their parent units of Bee Low Limestone Formation (Zone 4), Eyam Limestone Formation (Zone 3 and east of Zone 2) and Weathered Bowland Shale Formation (Zone 2 and western parts of Zone 3).

Further details on ground conditions are provided in Section 6.

Foundation solution

In our opinion naturally deposited weathered bedrock will adequately support proposed buildings on concrete strip/trench fill foundations in Zone 3 and localised areas of Zones 2 and 4. Foundations are likely to require depending in some areas due to the presence of Made Ground or natural soils with low strength/density.

Some areas of land to the west of Nun Brook (former railway land, termed Zone 2) contains deep Made Ground which will be unsuitable for supporting concentrated foundation loads. We do not consider such deposits amenable to improvement techniques such as vibrotreatment (unless screened and sorted), and therefore in our opinion a piled foundation solution will be necessary.

We would recommend that further intrusive investigations are undertaken to confirm foundation requirements on a plot specific basis once development proposals are finalised.

In addition, consideration will need to be given to the requirement for use of breaking equipment to facilitate earthworks and foundation excavations where shallow bedrock is present (Zone 3), in addition to stability of slopes in such areas.

Limestone bedrock in Zones 3 and 4 may be susceptible to formation of dissolution features, and further investigation should be undertaken to determine the risk to the proposed development.

Ground bearing floor slabs can be adopted in Zone 3 at this site where buildings are remote from trees and where Topsoil deposits are fully removed within the footprint of the building. Due to the thickness of Made Ground deposits present in Zone 2 (unless proposed cut removes all Made Ground) and the likelihood that Made Ground or reworked soils are present in Zone 4 in the area of Plots 1 to 12, we recommend a suspended ground floor is adopted.

Concrete in contact with Made Ground will need to be designed to sulphate class DS-3 and ACEC class AC-3. Naturally deposited soils and groundwater would be classified as DS-1 AC-1.

Further details are provided in Section 7.

Chemical and gaseous contamination

Providing the site is developed then the risk of harm being caused to current users from identified contamination will be a short-term issue and unlikely to require any remediation.

Concentrations of chemical contaminants have been measured above guideline values within Made Ground deposits across the site. In such areas, we are of the opinion that the site represents a medium to high risk of causing harm to future end users of the developed site, based on current development proposals. Providing the remedial measures as outlined in Section 8.9 and 13 are implemented, the risk of harm being caused to the health of end users is considered to be low.

We also consider that Topsoil/naturally deposited soils at the site are unlikely to cause significant harm to human health and can be reused within the proposed development where necessary.

The risk of damage to the health of construction operatives and other site investigators is, in our opinion, medium but locally high, primarily due to the presence of asbestos in Made Ground soils. Generally, risks would be minimised by taking adequate hygiene precautions on site, however, consideration will need to be given to the presence of localised asbestos in Made Ground soils onsite and the additional precautions that will need to be taken during groundworks to minimise contact/disturbance and potential release of fibres.

Marginally elevated concentrations of leachable benzo(a)pyrene and copper have been previously been identified in Made Ground soils in Zone 1 (landfill area), with very marginal concentrations of soluble copper identified in groundwater onsite and surface waters downstream of site. Given the marginal exceedances of soluble copper and based on the conservatism factored into the EQS value for copper, we consider the risk of leachable copper, identified in the landfill area adjacent to the developable site, adversely impacting the quality of groundwater and surface waters is low.

In our opinion, marginal contamination identified in Topsoil/natural soils across the site is unlikely to present a risk of causing significant harm to vegetation. Concentrations of contaminants exceed relevant guidelines within Made Ground deposits across the site. In our opinion, such contamination is likely to present a risk of causing significant harm to vegetation. Providing the remedial measures as outlined Section 8.9 and 13 are implemented, the risk of harm being caused to the health of vegetation is considered to be low.

In the area of Zone 2, the development will require gas protective measures which would achieve a '*gas protection score'* of 3.5. Furthermore, with such areas of the site being classified as 'Amber 1', then following NHBC report No 10627-R01(04) table 14.2, 'low level' gas protection measures are required as minimum. We recommend that this is verified by completion of further, more intensive ground gas monitoring to fully classify this area of the site.

The area of Zones 3 and 4 are unlikely to require any gas protective measures. However, we recommend that this is verified by completion of further, more intensive ground gas monitoring to fully classify these areas.

Whilst we have not carried out a full investigation set out in guidance in the UKWIR document, the subject site does exhibit a degree of localised contamination and it is likely that barrier pipes will be required.

It is advised that Japanese Knotweed remedial specialists are contacted for advice and measures to deal with the significant stands suspected to be present around the site (in Zone 2) prior to construction and commencement any earthworks activities.

We have recommended further works which are detailed in Section 12.

4 Fieldwork

4.1	General
4.2	Site restrictions
4.3	Exploratory trial pits
4.4	Boreholes formed using driven tube sampling techniques
4.5	Measurement of landfill type gases in gas monitoring standpipes
4.6	Sampling strategy

4.1 General

4.1.1 Fieldwork comprised the following activities, undertaken between 21st January and 8th February 2019: -

- Excavation of twenty exploratory trial pits (TP01-TP20)
- Excavation of twenty-eight exploratory boreholes formed using driven tube sampling equipment (DTS01-DTS13 and DTS15 to DTS29). DTS14 was not undertaken due to time constraints.
- Infiltration testing undertaken in 3 borehole locations (DTS06, DTS13 and DTS19)

4.1.2 A plan of the site showing existing site features and position of exploratory points is presented on Drawings 02. The position of exploratory points relative to site development preliminary proposals is presented on Drawing 03. The position of exploratory points shown on these plans is approximate only.

4.1.3 The extent of fieldwork activities and position of exploratory points were determined by Soiltechnics.

4.1.4 Exploratory points were positioned to avoid known locations of underground services, to avoid possible location of proposed foundations but were also positioned to provide a reasonable coverage of the site. Prior to commencement of exploratory excavations an electronic cable locating tool was used to scan the area of the excavation. If we received a response to this equipment then the excavation would be relocated.

4.1.5 All soils exposed in excavations were described in accordance with BS EN ISO 14688 *'Identification and Classification of soil'* and BS EN ISO 14689 *'Identification and classification of rock'.*

4.2 Site restrictions

4.2.1 At the time of our investigation the site was open to the public and generally accessible to mechanical excavators and the driven tube sampler borehole rig. The only exception were areas of the site with excessively steep slopes, the western area of the site (Zone 1) adjacent to the railway, which was fenced off and under construction, and the northern area of Zone 4 which formed part of the adjacent golf course. Locations were also positioned remote from potential service locations.

4.2.2 It should also be noted that in large areas of Zones 1 and 2, suspected Japanese Knotweed was present. Precautions were taken to prevent the spread of associated rhizomes by washing down equipment after each excavation and prior to moving to the next. Furthermore, suspected ACMs were encountered in soils in the landfill area of Zone 1. As such excavations were avoided where possible. However, where excavations were necessary, precautions were taken to prevent the release of possible asbestos fibres into the air, by dampening down and providing suitable welfare facilities in case of exposure.

4.3 Exploratory trial pits

4.3.1 Trial pits TP01 to TP20 were excavated to a maximum depth of 4.3m using a 360° tracked or rubber tyred excavator. The excavations were backfilled with excavated material compacted using the back of the excavator bucket. Whilst we attempted to reinstate the excavation to its original condition the soils could not be fully compacted into the trial pit and thus the soils were left proud of the ground surrounding the pit to allow for short-term settlement of the backfill. A Geotechnical Engineer supervised the excavations.

4.3.2 Sampling and logging was carried out as trial pit excavations proceeded but were not entered at depths exceeding 1.2m, or where trial pit sides were deemed unstable. The density of granular soils encountered in excavations was gauged by the ease of excavation.

4.3.3 Soil samples for subsequent laboratory determination of concentration of chemical contaminants were taken from the sides of trial pits using clean stainless-steel equipment and stored in new plastic containers, which were labelled and sealed. Samples from below access depth into trial pits were taken as a sub sample from soil contained in the excavator bucket, discarding any soil, which may have been in contact with the bucket. If as a consequence of visual or olfactory evidence, a sample was suspected to be contaminated by organic material, the sample was stored in an amber glass jar with a PTFE sealing washer.

4.3.4 Soil samples for subsequent laboratory 'classification' testing were taken from the side of trial pits or from bulk samples taken from the excavator bucket. The sample was immediately placed in a plastic bag and subsequently sealed and labelled. Samples for determination of water content were placed in sealable tubs and appropriately labelled. Soil samples were obtained to meet Category A and quality class 3 to 5 as described in BS EN I997-2:2007 (table 3.1) sufficient for laboratory testing being considered. Sample sizes were also appropriate for the laboratory test being considered (refer BS EN I997-2:2007 Annex L).

4.3.5 A pocket penetrometer was used in the cohesive (fine grained) soils encountered. This tool is deemed to measure the apparent ultimate bearing capacity of the soil under test. The pocket penetrometer is calibrated in kg/cm^2. The reading can be approximately converted to equivalent undrained shear strength by multiplying the results by a factor of 50. Tests were carried out in the sides of trial pits when access can be safety achieved otherwise testing was carried out on excavated intact clods. Details of pocket penetrometer determinations are tabulated in Appendix C2. An average of measurements taken at a specific depth are recorded on trial pit records. The pocket penetrometer is not covered by British Standards.

4.3.6 A summary of pocket penetrometer results obtained from the cohesive soils encountered in exploratory excavations are presented in graphical format on Drawings 06a to 06f.

4.3.7 Trial pit records are presented in Appendix D.

4.4 Boreholes formed using driven tube sampling techniques

4.4.1 Boreholes DTS01 to DTS29 were formed using driven tube sampling equipment to a maximum depth of 5.0m. Driven tube sampling comprises driving 1m long steel sample tubes which are screw coupled together or coupled to extension rods and fitted with a screw on cutting edge. The sample tubes are of various diameters, generally commencing with 100mm and reducing, with depth, to 50mm and include a disposable plastic liner which is changed between sampling locations in order to limit the risk of cross contamination. On completion of excavation the liner containing the sample is cut open and the soil sample logged by a geo-environmental engineer. The sample tubes are considered thick walled with reference to BS EN ISO 22475-1:2006 clause 3.3.11.

4.4.2 Samples for determination concentration of chemical contaminants are taken from samples obtained in the disposable tubes as sub-samples using stainless steel sampling equipment.

4.4.3 Soil samples for subsequent laboratory 'classification' testing were taken from samples obtained in the disposable tubes. The sample was placed in a plastic bag and subsequently sealed and labelled. Samples for determination of water content were placed in sealable tubs and appropriately labelled. These samples were obtained with a view to achieve category B sampling methods to meet quality class 3 (for fine grained soils only) as described in BS EN ISO 22475-1: 2006 (table 3). Sample sizes were appropriate for the laboratory test being considered.

4.4.4 Standard Penetration Testing (SPT) was carried out at regular frequencies in the borehole. The test was carried out in accordance with BS EN ISO 22476-3:2005. Key details of the test, as required by BS EN ISO 22476-3 are recorded in Appendix C1. SPT's were carried out using a solid 60° cone in granular material, this test is reported as SPT(C) or using an open sampler in cohesive material, reported as SPT(S). Summary of standard penetration testing is recorded on borehole logs.

4.4.5 A graphical summary of standard penetration test results is presented on Drawings 07a-07f.

4.4.6 Again, a pocket penetrometer was used in cohesive soils. Details of pocket penetrometer determinations are tabulated in Appendix C2. An average of measurements taken at a specific depth are recorded on borehole records. The pocket penetrometer is not covered by British Standards.

4.4.7 A graphical summary of pocket penetrometer measurements is presented on Drawings 06a to 06f.

4.4.8 Combined gas and groundwater monitoring standpipes were installed in boreholes DTS04, DTS06, DTS13, DTS19, DTS24. The standpipes were installed following the recommendations of BS EN ISO 22475-1:2006 '*Geotechnical Investigation and Testing – Sampling methods and groundwater measurements – Part 1: Technical Principles for execution'* (figure 6) and BS8576:2013 *'Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs)'* (figure 7). Details of the standpipe installation are recorded on Drawing 08.

4.4.9 Water levels in the standpipes have been measured during return visits to the site. The water level was measured using a measuring tape calibrated in 1mm intervals with an electronic end piece, which emits an alarm sound in contact with water. Water levels are measured from ground levels at the borehole position. Records of water levels are presented on Appendix K.

4.4.10 A description of measurement of landfill type gases in gas monitoring standpipes is provided in subsequent report paragraphs below.

4.4.11 Indicative soil infiltration testing was carried out in boreholes DTS06 and DTS13. The infiltration testing was carried out generally in accordance with the procedure described in Building Research Establishment (BRE) DG 365 (2016) "*Soakaway Design*". Records of test results and calculations to determine a soil infiltration rate are presented in Appendix C3. It should be noted that testing has not been carried out strictly in accordance with the BRE publication, as this does not specifically provide for calculating an infiltration rate in a borehole. We have adapted the BRE method and calculations in order to provide an indicative infiltration rate.

4.4.12 Permeability testing was carried out in borehole DTS19 following the procedures described in BS EN ISO 22282-2:2012 *'Water permeability tests in a borehole using open systems'*. Records of the test results and calculations to determine the coefficient of permeability (k) are presented in Appendix C3.

4.4.13 Records of boreholes formed using driven tube sampling techniques are presented in Appendix E.

4.5 Measurement of landfill type gases in gas monitoring standpipes

4.5.1 The concentrations of landfill type gases collected within gas monitoring standpipes installed in boreholes DTS04, DTS06, DTS13, DTS19, DTS24 was measured using a portable infra-red gas analyser (model GA5000, manufactured by Geotechnical Instruments). Initially the gas analyser was connected to the gas valve on the top of the standpipe to allow the flow rate to be measured. Essentially this is a measurement of gas pressure produced in the standpipe, which is compared with atmospheric pressure at the time of measurement to produce an equivalent gas 'flow' in l/hr. The equipment used is capable of measuring to an accuracy of 0.1l/hr; below this the gas analyser records zero flow. Following BS8485:2015 '*Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings* (clause 6.3.4), we assume flows of 0.1l/hr when the gas analyser reads zero, thus producing a pessimistic gas flow rate in our assessment of ground gases.

4.5.2 Following measurement of 'flow' the gas analyser pumps gases contained in the standpipe through the analyser. Initial readings of gas concentrations are noted manually, followed by subsequent recordings at regular time periods until 'steady state' concentrations are achieved. The analyser records 'peak' and 'steady' concentrations of the following gases:

- Methane (CH_4)
- Carbon dioxide (CO_2)
- Oxygen (O_2)

4.5.3 The ambient atmospheric temperature and barometric pressure was also recorded at the site. To determine if the atmospheric pressure is rising or falling we interrogate the internet on a daily basis.

4.5.4 Methane in concentrations of between 5 to 15% in air is potentially explosive. The 5% methane concentration in air is defined as the Lower Explosive Limited (LEL). The gas analyser measures a percentage of the LEL. For example, 10% LEL equates to 10% of 5%, i.e. 0.5% methane concentration in air.

4.5.5 Records of gas monitoring data are presented in Appendix K.

4.6 Sampling strategies

4.6.1 Geotechnical

4.6.1.1 In general we adopted a judgemental sampling strategy in relation to geotechnical aspects of the investigation. The location and frequency of sampling was carried out in consideration of the following:

i) Topography
ii) Geology (including Made Ground)

6 Ground conditions encountered

6.1	Soils/rocks
6.2	Geotechnical parameters
6.3	Topsoil
6.4	Groundwater
6.5	Evidence of contamination
6.6	Obstructions and instability

6.1 Soils / Rocks

6.1.1 The exploratory excavations encountered the following geological formations across the site: -

- Topsoil
- Made Ground
- Weathered Bee Low Limestone Formation
- Weathered Eyam Limestone Formation
- Weathered Bowland Shale Formation

6.1.2 In addition, locally across the main development area, reworked naturally deposited soils were suspected to be present (TP09, DTS18, DTS22 and DTS26).

6.1.2 For clarity we have referred to the composition of soils within each of the Zones as described in Section 3 and presented on Drawing 04.

6.1.3 Made Ground

6.1.3.1 Within Zone 1 Made Ground was typically encountered as medium dense, dark brown or dark grey, very gravelly SAND or very sandy GRAVEL. Gravel consisted of coarse angular bricks, concrete, glass, plastic, metal wire, vehicle parts, shoes, paper, timber ceramic tiles, roof tiles and slag, with such deposits encountered to depths beyond 5m. The material was consistent with landfilling as recorded by Envirocheck, which appeared to be of 1950-80s origin.

6.1.3.2 Within Zone 2, the Made Ground was consistent with that encountered in Zone 1 (although not physically recorded as a landfill site), but included increased volumes of slag, brick, coal and glass, and was typically much ashier in composition. It is thought that the deposition of the waste here possibly dates from around the late 1800s to early 1900s based on evidence on newspaper clippings encountered in excavations. Made Ground in Zone 2 typically ranged to between depths of 3.0m to >5m to the east and south, with deposits ranging between 0.8m to 1.5m to the northwest of the area. This is likely to be a result of the terracing that this area of the site has been subject to historically.

6.1.3.3 Made Ground in Zone 4 to the east of the site was similar in composition to that encountered in Zone 2, particularly in the location of the former mere (DTS13 and DTS18). No significant Made Ground was encountered in Zone 3.

6.1.4 Weathered Bee Low Limestone Formation

6.1.4.1 Weathered Bee Low Limestone Formation was typically encountered as medium dense orangish brown slightly silty fine SAND or stiff high strength orangish brown sandy CLAY. In the majority of excavations, such deposits extended beyond depths of 5m, however, locally refused at depths of between 1.0m to 3.3m. Refusal is likely to be attributed to encountering more competent deposits of bedrock. Such deposits were only encountered in the eastern part of the site within Zone 4.

6.1.4.2 It should be noted that deposits encountered in borehole DTS18 are suspected to have been reworked, based on their density/strength and depositional characteristics.

6.1.5 Weathered Eyam Limestone Formation

6.1.5.1 Weathered Eyam Limestone Formation was encountered in Zone 3 and the eastern most parts of Zone 2 only, locally below Made Ground deposits. Such deposits were typically encountered as medium dense brown SAND or very sandy GRAVEL of sandstone and shale in the northern parts of Zone 3, and across the rest of the areas as firm to stiff low to medium strength sandy gravelly CLAY. Gravel consisted of fine to coarse angular mudstone and limestone. Rare limestone cobbles / boulders were encountered locally. Generally, all excavations refused between depths of 0.88m to 3.9m below surface levels. Again. refusal is likely to be attributed to encountering more competent deposits of bedrock.

6.1.6 Bowland Shale Formation

6.1.6.1 Bowland Shale Formation was initially encountered as a weathered material below Made Ground, present in Zone 2 and western parts of Zone 3. Deposits typically comprised of firm to stiff, low to medium strength, light brown mottled dark brown, sandy in places, CLAY. Also, such deposits were encountered as a medium dense orangish brown SAND or loose to medium dense grey GRAVEL of angular limestone, sandstone or shale.

6.1.6.2 Locally, in the areas of TP09, DTS22 and DTS26, deposits of weathered Bowland Shale Formation were suspected to have been reworked, based on their density/strength and depositional characteristics.

6.1.6.3 In one location (DTS10), Bowland Shale was encountered as bedrock comprised of very weak dark grey thickly laminated mudstone. In the majority of excavations, such deposits extended beyond depths of 4-5m, however, locally refused at depths of between 3.3m and 3.45. Excluding DTS10, refusal was likely to be attributed to encountering more competent deposits of bedrock.

6.1.7 Summary

6.1.7.1 The following table summarises the geology encountered.

Table summarising soil types

Strata	Depth to top (m)	Depth to bottom (m)	Thickness (m)	Summary description
Topsoil (Zone 3, 4)	0.0	0.15 – 0.5 (0.3)	0.15 – 0.5 (0.3)	Dark brown SAND and CLAY.
Made Ground (Zone 1)	0.0	>5.45	Strata not penetrated (>5.45)	Medium dense, dark brown or dark grey, very gravelly SAND or very sandy GRAVEL. Gravel consists of coarse angular bricks, concrete, glass, plastic, metal wire, car parts, shoes, paper, timber, ceramic tiles, roof tiles, slag.
Made Ground (Zones 2 & 4)	0.0	0.3 ->5.45 (1.65)	0.3 – >5.45 (1.65)	Very Loose dark brown or dark grey, very gravelly slightly clayey SAND, or very sandy gravel GRAVEL. Gravel consists of coarse angular ash, slag, coal, shale, bricks, concrete with minor, glass, plastic, metal wire, car parts, shoes, paper, timber, ceramic tiles and roof tiles. Also includes suspected reworked natural soils.
Weathered Bee Low Limestone Formation (Zone 4)	0.3 – 1.6 (1.0)	Strata not penetrated	Strata not penetrated (>5.45)	Medium dense orangish brown gravelly slightly silty fine SAND or stiff high strength orangish brown sandy CLAY.
Weathered Eyam Limestone Formation (Zone 3)	0.2 – 1.5 (0.4)	Strata not penetrated	Strata not penetrated (>5.45)	Firm low strength light brown mottled dark brown CLAY or medium dense orangish brown SAND or medium dense grey GRAVEL of coarse angular limestone or shale.
Weathered Bowland Shale Formation (Zone 2, 3)	0.3 – 3.0 (1.43)	Strata not penetrated	Strata not penetrated (>5.45)	Medium dense brown very sandy GRAVEL or Firm, low strength sandy gravelly CLAY. Gravel consisted of fine to coarse angular mudstone and limestone.
Bowland Shale Formation bedrock (Zone 3)	2.8 (DTS10 only)	Strata not penetrated	Strata not penetrated (>3.45)	Very weak dark grey thickly laminated mudstone

Table 6.1.7

Figures in brackets are average values

6.1.7.2 With the exception of Made Ground, the investigation generally confirmed published geological records.

6.4 Groundwater

6.4.1 Groundwater inflows were observed in many of the exploratory excavations. A summary of our observations is tabulated below:

Table summarising groundwater observations

Exploratory point	Date of observation	Depth (m) bgl	Observations
DTS02	08/02/2019	1.3	Groundwater encountered at 1.9m, filling borehole to 1.3m in 10 minutes.
DTS03	08/02/2019	2.0	Groundwater encountered at 2.3m, filling borehole to 2.0m in 10 minutes.
DTS04	06/02/2019	3.0	Groundwater level remain constant.
DTS05	06/02/2019	3.0	Groundwater level remain constant.
DTS10	06/02/2019	1.0	Groundwater level remain constant.
DTS29	29/01/2019	3.0	Groundwater level remain constant.
TP09	22/01/2019	1.3	Groundwater seepages encountered at 1.3m and 2.0m. Not sufficient to fill the pit.
TP12	21/01/2019	4.2	Seepage observed at 4.3m, filling trial pit to 4.2m in 20 minutes.
TP20	21/02/2019	2.3	Groundwater seepage encountered at 2.3m. Not sufficient to fill the pit.
DTS04	18/02/2019 04/03/2019 20/03/2019 01/04/2019	3.97 1.3 Dry Dry	Groundwater level measured during monitoring visit.
DTS06	18/02/2019 04/03/2019 20/03/2019 01/04/2019	Dry 2.7 Dry 2.62	Groundwater level measured during monitoring visit.
DTS13	18/02/2019 04/03/2019 20/03/2019 01/04/2019	Dry 3.98 Dry Dry	Groundwater level measured during monitoring visit.
DTS19	18/02/2019 04/03/2019 20/03/2019 01/04/2019	3.16 3.05 3.1 3.1	Groundwater level measured during monitoring visit.

Table 6.4.1

6.4.2 It should be noted that water levels will vary depending generally on recent weather conditions and only long-term monitoring of levels in standpipes will provide a measure of seasonal variations in groundwater levels.

6.5 Evidence of contamination

6.5.1 During the excavation of our exploratory points, other than the presence of Made Ground within Zones 1, 2 and 4, the only other evidence of potential contamination was related to hydrocarbon odours noted within such deposits in trial pit TP05 between depths of 1.9-3.4m.

7.13.4.3 Typically NHBC and Local Authority Building Control would expect to see the use of stiff raft foundations in such areas to resist any loss of ground support due to dissolution. It is understood that due to the severity of the surface levels within Zone 3, the construction of raft foundations is likely to be difficult to successfully achieve. A highly reinforced trench fill/strip foundation is likely to be considered acceptable by the NHBC, subject to further plot specific investigations being undertaken to confirm the competency of underlying soils.

7.13.4.4 As infiltration systems may be utilised at the site, we recommend water is not concentrated in isolated locations but evenly distributed in say level trench type soakaways to minimise the risk of promoting the formation of dissolution features. Again, such soakaways need to be positioned remote from buildings and remote from settlement sensitive features.

7.13.4.5 Water supply pipes need to be watertight and flexible to minimise risks of leaks. Heavy vibration from compaction plant shall not be used.

7.14 Infiltration potential

7.14.1 Contamination considerations

7.14.1.1 With reference to Environment Agency (EA) publication '*Groundwater protection: Policy and practice (GP3) Section G,* 2012, outside of SPZ1, the EA will support sustainable drainage systems for new discharges to ground. This is subject to an appropriate risk assessment to demonstrate that ground conditions are suitable and infiltration systems do not present an unacceptable risk of promoting mobilisation of contaminants or creating new pathways for contaminant migration.

7.14.1.2 The permeability of the near surface weathered Eyam Limestone, Bowland shale and Bee low Limestone Formation in combination with the site located over Secondary A (Bowland Shale) and principal aquifers (limestone deposits) suggests the site is sensitive to migration of contaminants. The site is not located within or close to a source protection zone. Providing that surface water is restricted from freely migrating though Made Ground deposits, the risk of infiltration systems promoting mobilisation of contaminants at the site is considered low. All discharges to groundwater are subject to compliance with the Water Framework Directive (2000/60/EC) and Groundwater Daughter Directive (2006/118/EC).

7.14.2 Requirements for use of infiltration systems

7.14.2.1 It is a requirement under H3 (3) of the current building regulations to discharge stormwater collected by a development to soakaways as a priority (as opposed to water courses and sewers)

7.14.3 Infiltration measurements

7.14.3.1 The permeability of the weathered Bee Low Limestone and weathered Eyam Limestone Formations was measured in boreholes DTS06 and DTS13 respectively, following the principles described in Building Research Establishment (BRE) Digest 365 (2016) "*Soakaway Design*". Tests were carried out between depths of 1.87m and 3.0m in DTS06 (deposits of clay) and 1.75m and 3.89m in DTS13 (deposits of clay), providing infiltration rates of 3.81 x 10^{-6} m/s in DTS06 and between 2.67 x 10^{-4} m/s and 4.72 x 10^{-5} m/s in DTS13. Records of testing and calculations are presented in Appendix C3.

7.14.3.2 It should be noted that testing has not been strictly carried out in accordance with the BRE publication, as the minimum size of the test hole (BRE 365 states that the trial pit should be 0.3 to 1 m wide and 1 to 3 m long and should have vertical sides trimmed square) could not be achieved in the borehole, however the test provides an indication of the likely permeability of the soils under test. Further on-site testing is recommended using machine dug trial pits to allow test procedures to conform with the requirements of BRE digest 365. We can carry out such testing on further instructions.

7.14.3.3 The indicative permeability of weathered Bowland Shale Formation deposits was measured using falling head tests carried out in borehole DTS19 (gravels) following the Hvorslev method as defined in BS EN ISO 22282-2:2012. Records of the test results and calculations to determine the soil infiltration rate is presented in Appendix C3. The testing provided an indicative permeability between 2.94 x 10^{-6} m/s to 3.12 x 10^{-6} m/s.

7.14.4 Design of infiltration systems

7.14.4.1 With regard to the deposits of reworked weathered Bee Low Limestone Formation (refer to Section 7.15 for further details), there is evidence of possible voiding and poor compaction within soils. Such deposits will exhibit a varying degree of permeability and potentially will be able to dispose of stormwater using infiltration systems. Such a method of stormwater disposal does have the following potential drawbacks: -

- Water freely/directly discharged into the reworked soils could cause collapse of air voids contained in these deposits, which promotes compaction of the soils around the soakaway causing depression of the general area around the soakaway as well as potentially affecting pipe runs leading to the soakaway.

- Water freely/directly discharged into soils close to cutting slopes could promote instability of such slopes. Typically, railway companies (possible adjacent land owners) restrict the use of soakaways close to their land boundaries.

7.14.4.2 Naturally deposited soils exhibit some variation in composition across the site and thus likely permeability. On this basis the use of trench type soakaways will increase the likelihood of locating more permeable soils along its length and by evenly distributing stormwater along their length minimise the risk of promoting formation of solution cavities.

7.14.4.3 Testing completed to date should be considered preliminary only and we recommend further, more intensive, on site testing is carried out targeting this part of the investigation allowing detailed design of infiltration systems to be progressed if such systems are to be adopted.

7.14.4.4 If infiltration systems are adopted as a means of stormwater disposal (including permeable pavement construction), we recommend approval for the use of soakaways is sought from the Environment Agency. It should be noted that the Groundwater Regulations 1998 require that list 1 substances (e.g. Hydrocarbons) are to be prevented from entering groundwater receptors and list 2 substances (e.g. metals) are also restricted. Typically, the Environment Agency will require details of the proposed soakaway systems, showing pollution prevention measures. They will also require geological and geo-hydrological information, (contained in this report) as well as the risks of chemical contaminants in the ground affecting water resources. It is also typical requirement that there is an 'unsaturated zone' between the base of the soakaway system and the groundwater table (saturated zone) providing attenuation capacity.

7.15 Pavement foundations

7.15.1 Criteria for design of the pavement foundation

7.15.1.1 The thickness of the pavement foundation (typically unbound granular materials- or sub-base and capping materials) is derived from a combination of the following:

- Number of passes of standard (80kN) axles from construction traffic (HGV). i.e. construction traffic loading which the foundation is required to carry.
- The location of the water table.
- Weather conditions at the time of construction.
- The strength of the subgrade, determined by measurement of the California Bearing Ratio (CBR).

7.15.1.2 For road designs meeting the requirements of the Highways Agency, then subgrade CBR will derive a foundation layer thickness relating to differing subgrade stiffness's. (refer interim advice note 73/06).

Proposed residential development
Nunsfield Road, Buxton

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Key

- TP — Approximate location of trial pit formed by machine excavation
- DTS — Approximate location of borehole formed by Driven Tube Sampling techniques
- DTS — Approximate location of borehole formed by Driven Tube Sampling techniques with standpipe installation
- Approximate site boundary
- Water course OS map
- Nestle water pipe easement
- Japanese Knotweed mitigation area
- Inaccessible at time of investigation due to rail construction site
- Access not available at time of investigation

Grassed fields
New drain from rail site exhibiting orange staining
Grassed fields
Rail construction site
Mature woodland
Shrubs
Heras fence line
Dense vegetation with mature trees (10m-15m in height)
Grassing land
Golf course
Trees (~15m-20m in height)
Residential housing
Brick and stone retaining structure
Agricultural supply yard
Chicken coop
Grass track
Agricultural sales building
Trees (10m in height)
Nunsfield farm
House
Asphaltic concrete track
Fencing line
Dense vegetation
Partially wooded plateau with signs of rail structure below ground level
Disused ground
Static caravan
Golf course
A6 Fairfield Road
Railway line
Semi mature wood
Wooden bridge
Grassing land
Ex-house plots
Foothpath
Fencing line
Dense vegetation
Allotment Gardens
Allotment gardens
Open public space
Footpath
Former pub building
Graveyard
Existing shed
Demolished shed
Residential housing
Shack
Dense vegetation
Residential housing
Asphaltic concrete
Recreation ground (surrounded by rough grass land)
Play area
Garages
Trees (~15m-20m in height)
Golf course
Open public space (surfaced in grass)
Trees (~5m in height)
Residential housing
Residential housing
Residential housing
HOGSHAW

Title	Scale	Drawing number
Plan showing existing site features and location of exploratory points	1:1250 at A1	02

Report Ref: STG4642M-G01
Revision: 01

June 2019

Proposed residential development
Nunsfield Road, Buxton

soiltechnics
environmental and geotechnical consultants

Key

- TP — Approximate location of trial pit formed by machine excavation
- DTS — Approximate location of borehole formed by Driven Tube Sampling techniques
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- Approximate site boundary
- Inaccessible at time of investigation due to rail construction site
- Access not available at time of investigation
- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Nestle water pipe easement

Grassed fields
Grassed fields
Golf course
Residential housing
Agricultural supply yard
Grass track
Agricultural sales building
Nunsfield farm
House
Asphaltic concrete track
Golf course
A6 Fairfield Road
Dense vegetation
Disused ground
Semi mature wood
Railway line
Allotment gardens
Former pub building
Golf course
Open public space
(surfaced in grass)
Residential housing
Residential housing
Residential housing
Residential housing
Residential housing
Residential housing
Play area
Garages
HOGSHAW

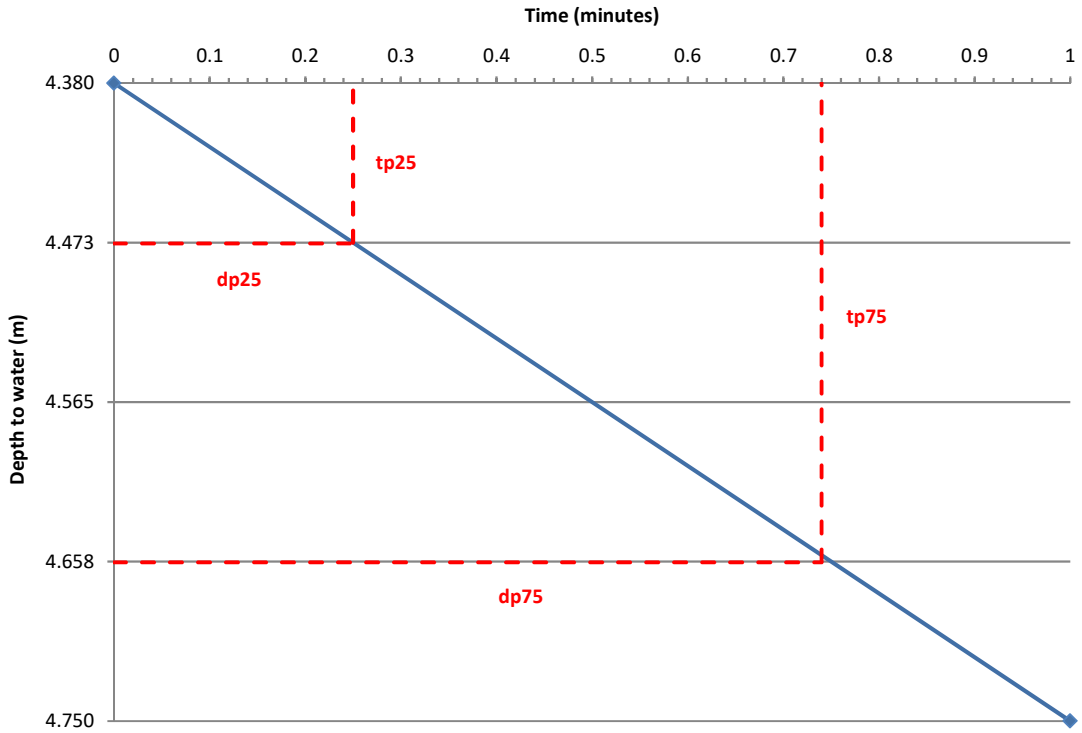
DTS01 DTS02 TP01 DTS03 DTS04 DTS27 TP02 TP03 DTS05 DTS06 TP05 DTS07 DTS12 TP18 DTS08 DTS09 DTS10 TP04 DTS29 DTS28 DTS11 TP06 TP09 DTS16 DTS17 DTS15 TP14 DTS19 TP11 TP15 TP10 TP08 DTS13 TP17 DTS20 DTS18 TP16 TP13 TP07 DTS21 TP19 DTS22 DTS23 TP20 DTS24 TP12 DTS25 DTS26

Title	Scale	Drawing number
Plan showing development proposals, location of exploratory points and zonal assessment	1:1250 at A1	04

Report Ref: ST04642M-G01
Revision: 02

August 2019

Plot showing time against depth to water:



Test observations:

TIME (mins)	DEPTH TO WATER (m)	TIME (mins)	DEPTH TO WATER (m)
0	4.38		
1	4.75		

Calculations:

Soil infiltration rate (SIR), $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$

V_{p75-25} = *effective storage volume of water in the borehole between 75% (d_{p75}) and 25% (d_{p25}) effective depth*

= ***0.00058m³***

a_{p50} = *the internal surface area of the borehole up to 50% effective depth and including the base area*

= ***0.03973m²***

$t_{p75} - t_{p25}$ = *the time for the water level to fall from 75% to 25% effective depth*

= ***0.49 (minutes)***

= ***29.4 (seconds)***

***f* = 4.97E-04 m/s**

Groundwater observations
No groundwater encountered.

Geology unit under test
Possible Reworked Weathered Bee Low Limestone Formation

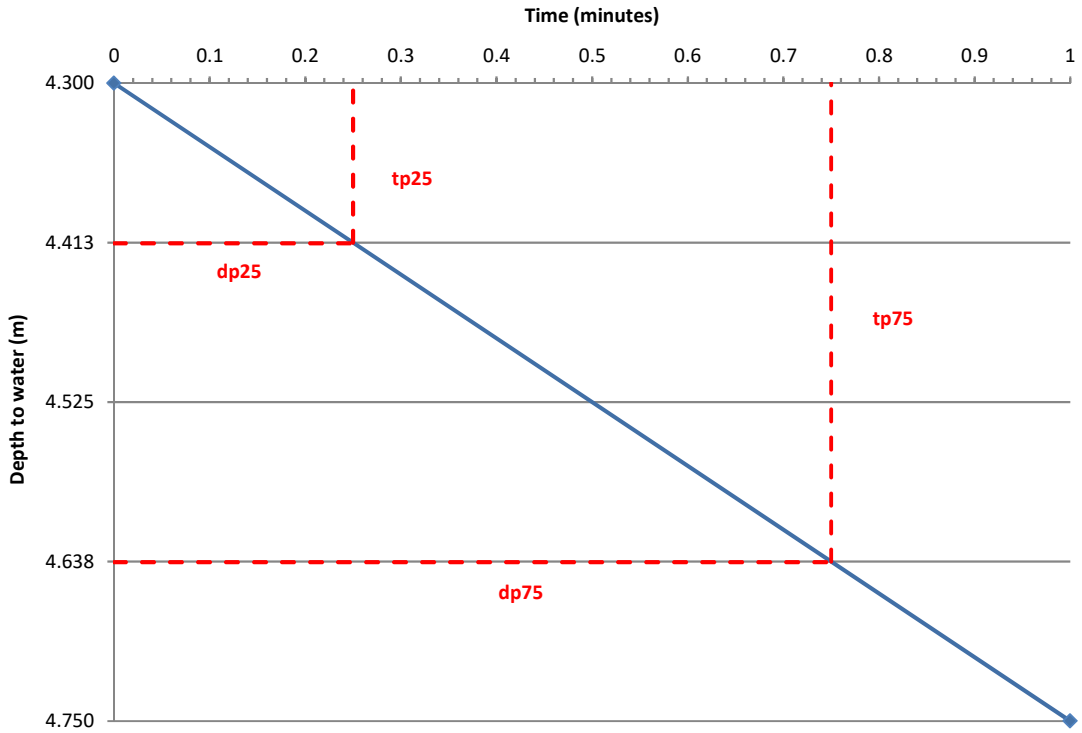
Depth of borehole at start of test (m)
4.75

Title
Soil infiltration test (following principles of BRE Digest 365 2016)

Diameter	Co-ordinates	Ground level
0.063m	-	N/A

Borehole no.	Cycle number	Date of excavation
DTS107	1	13/03/2019

Plot showing time against depth to water:



Test observations:

TIME (mins)	DEPTH TO WATER (m)	TIME (mins)	DEPTH TO WATER (m)
0	4.3		
1	4.75		

Calculations:

Soil infiltration rate (SIR), $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$

V_{p75-25} = *effective storage volume of water in the borehole between 75% (d_{p75}) and 25% (d_{p25}) effective depth*

= ***0.0007m³***

a_{p50} = *the internal surface area of the borehole up to 50% effective depth and including the base area*

= ***0.04765m²***

$t_{p75} - t_{p25}$ = *the time for the water level to fall from 75% to 25% effective depth*

= ***0.5 (minutes)***

= ***30 (seconds)***

f **= 4.90E-04 m/s**

Groundwater observations
No groundwater encountered.

Geology unit under test
Possible Reworked Weathered Bee Low Limestone Formation

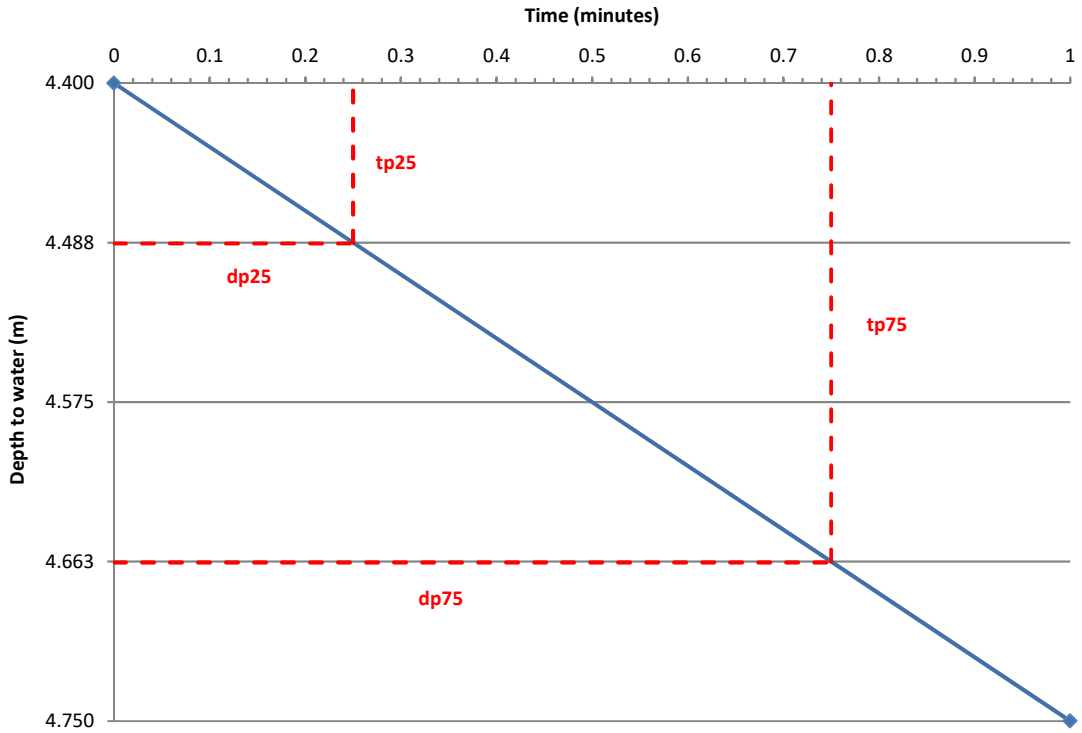
Depth of borehole at start of test (m)
4.75

Title
Soil infiltration test (following principles of BRE Digest 365 2016)

Diameter	Co-ordinates	Ground level
0.063m	-	N/A

Borehole no.	Cycle number	Date of excavation
DTS107	2	13/03/2019

Plot showing time against depth to water:



Test observations:

TIME (mins)	DEPTH TO WATER (m)	TIME (mins)	DEPTH TO WATER (m)
0	4.4		
1	4.75		

Calculations:

Soil infiltration rate (SIR), $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$

V_{p75-25} = *effective storage volume of water in the borehole between 75% (d_{p75}) and 25% (d_{p25}) effective depth*

= ***0.00055m³***

a_{p50} = *the internal surface area of the borehole up to 50% effective depth and including the base area*

= ***0.03775m²***

$t_{p75} - t_{p25}$ = *the time for the water level to fall from 75% to 25% effective depth*

= ***0.5 (minutes)***

= ***30 (seconds)***

***f* = 4.86E-04 m/s**

Groundwater observations
No groundwater encountered.

Geology unit under test
Possible Reworked Weathered Bee Low Limestone Formation

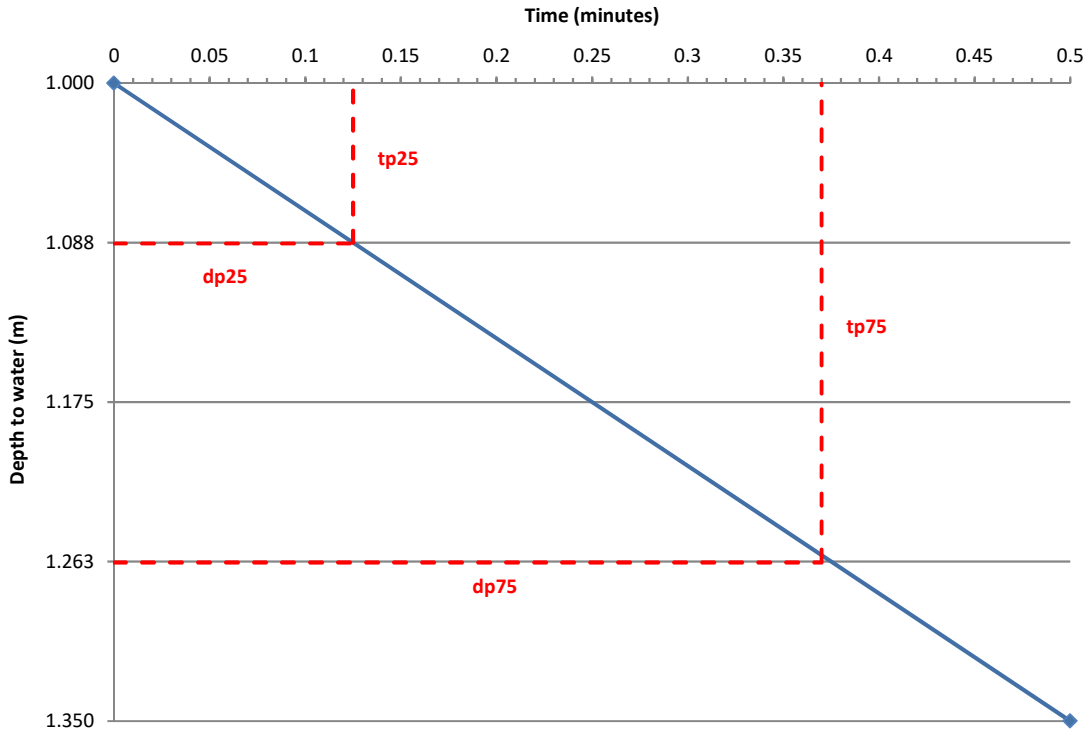
Depth of borehole at start of test (m)
4.75

Title
Soil infiltration test (following principles of BRE Digest 365 2016)

Diameter	Co-ordinates	Ground level
0.063m	-	N/A

Borehole no.	Cycle number	Date of excavation
DTS107	3	13/03/2019

Plot showing time against depth to water:



Test observations:

TIME (mins)	DEPTH TO WATER (m)	TIME (mins)	DEPTH TO WATER (m)
0	1		
0.5	1.35		

Calculations:

Soil infiltration rate (SIR), $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$

V_{p75-25} = *effective storage volume of water in the borehole between 75% (d_{p75}) and 25% (d_{p25}) effective depth*

= ***0.00055m³***

a_{p50} = *the internal surface area of the borehole up to 50% effective depth and including the base area*

= ***0.03775m²***

$t_{p75} - t_{p25}$ = *the time for the water level to fall from 75% to 25% effective depth*

= ***0.245 (minutes)***

= ***14.7 (seconds)***

f = 9.91E-04 m/s

Groundwater observations
No groundwater encountered.

Geology unit under test
Possible Reworked Weathered Bee Low Limestone Formation

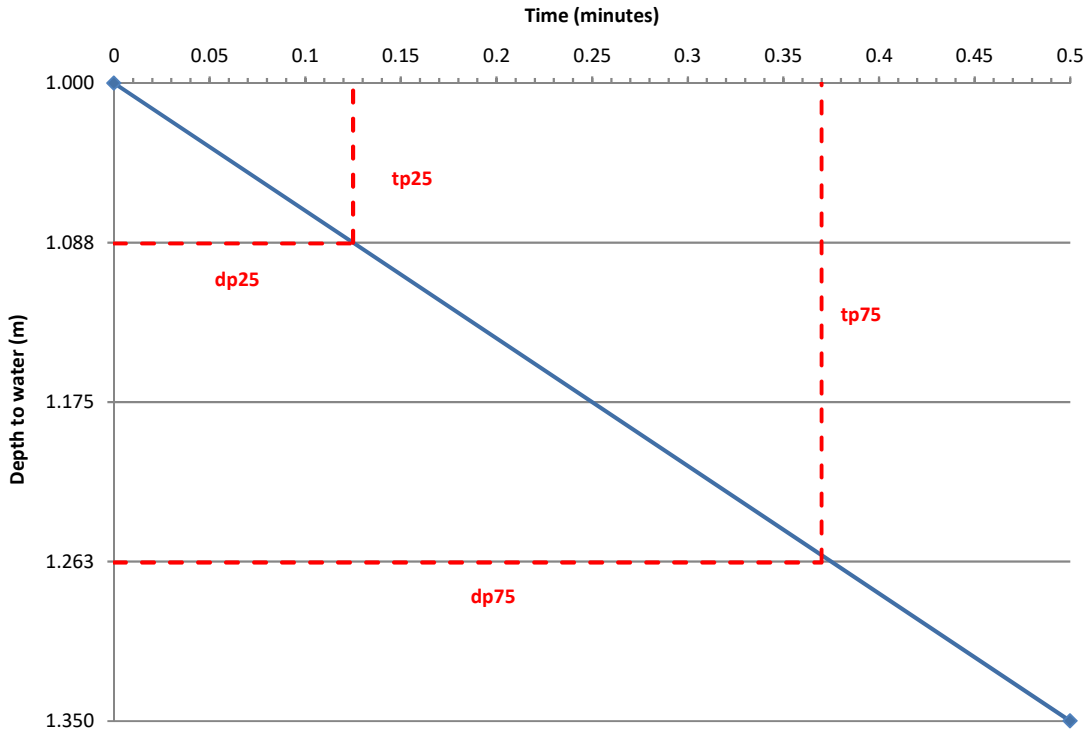
Depth of borehole at start of test (m)
1.35

Title
Soil infiltration test (following principles of BRE Digest 365 2016)

Diameter	Co-ordinates	Ground level
0.063m	-	N/A

Borehole no.	Cycle number	Date of excavation
DTS109	1	13/03/2019

Plot showing time against depth to water:



Test observations:

TIME (mins)	DEPTH TO WATER (m)	TIME (mins)	DEPTH TO WATER (m)
0	1		
0.5	1.35		

Calculations:

Soil infiltration rate (SIR), $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$

V_{p75-25} = *effective storage volume of water in the borehole between 75% (d_{p75}) and 25% (d_{p25}) effective depth*

= ***0.00055m³***

a_{p50} = *the internal surface area of the borehole up to 50% effective depth and including the base area*

= ***0.03775m²***

$t_{p75} - t_{p25}$ = *the time for the water level to fall from 75% to 25% effective depth*

= ***0.245 (minutes)***

= ***14.7 (seconds)***

f = 9.91E-04 m/s

Groundwater observations
No groundwater encountered.

Geology unit under test
Possible Reworked Weathered Bee Low Limestone Formation

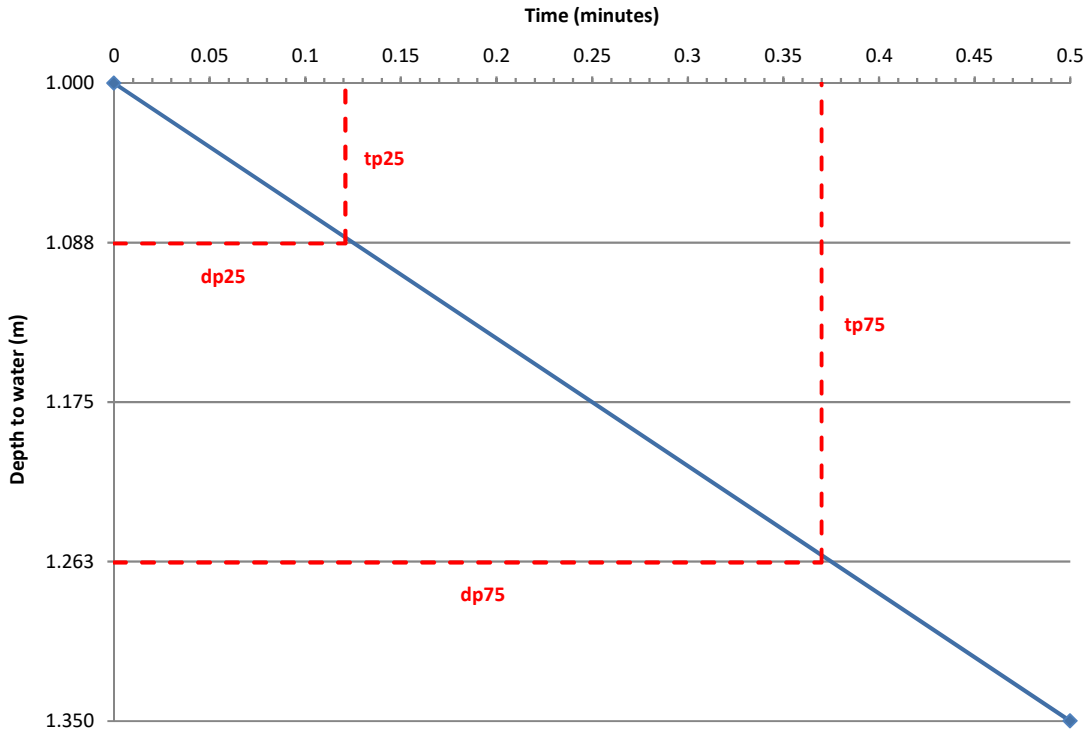
Depth of borehole at start of test (m)
1.35

Title
Soil infiltration test (following principles of BRE Digest 365 2016)

Diameter	Co-ordinates	Ground level
0.063m	-	N/A

Borehole no.	Cycle number	Date of excavation
DTS109	2	13/03/2019

Plot showing time against depth to water:



Test observations:

TIME (mins)	DEPTH TO WATER (m)	TIME (mins)	DEPTH TO WATER (m)
0	1		
0.5	1.35		

Calculations:

Soil infiltration rate (SIR), $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$

V_{p75-25} = *effective storage volume of water in the borehole between 75% (d_{p75}) and 25% (d_{p25}) effective depth*

= ***0.00055m³***

a_{p50} = *the internal surface area of the borehole up to 50% effective depth and including the base area*

= ***0.03775m²***

$t_{p75} - t_{p25}$ = *the time for the water level to fall from 75% to 25% effective depth*

= ***0.249 (minutes)***

= ***14.94 (seconds)***

f = 9.75E-04 m/s

Groundwater observations
No groundwater encountered.

Geology unit under test
Possible Reworked Weathered Bee Low Limestone Formation

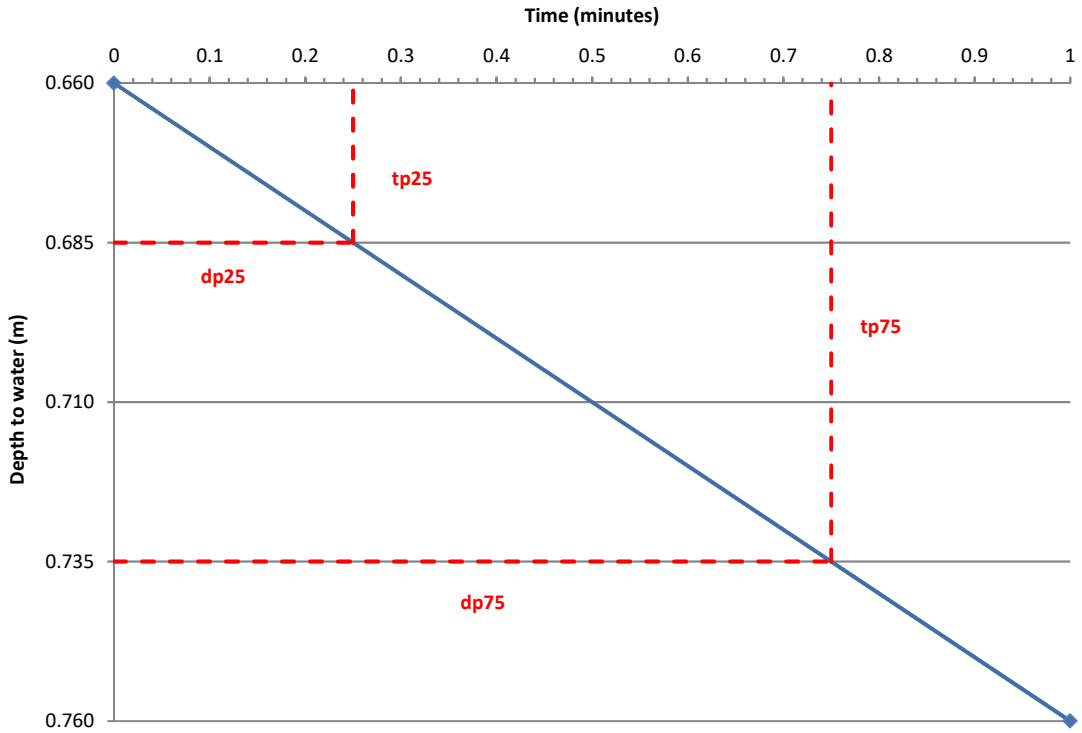
Depth of borehole at start of test (m)
1.35

Title
Soil infiltration test (following principles of BRE Digest 365 2016)

Diameter	Co-ordinates	Ground level
0.063m	-	N/A

Borehole no.	Cycle number	Date of excavation
DTS109	3	13/03/2019

Plot showing time against depth to water:



Test observations:

TIME (mins)	DEPTH TO WATER (m)	TIME (mins)	DEPTH TO WATER (m)
0	0.66		
1	0.76		

Calculations:

Soil infiltration rate (SIR), $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$

V_{p75-25} = *effective storage volume of water in the borehole between 75% (d_{p75}) and 25% (d_{p25}) effective depth*

= ***0.00016m³***

a_{p50} = *the internal surface area of the borehole up to 50% effective depth and including the base area*

= ***0.01301m²***

$t_{p75} - t_{p25}$ = *the time for the water level to fall from 75% to 25% effective depth*

= ***0.5 (minutes)***

= ***30 (seconds)***

f = 4.10E-04 m/s

Groundwater observations
No groundwater encountered.

Geology unit under test
Possible Reworked Weathered Bee Low Limestone Formation

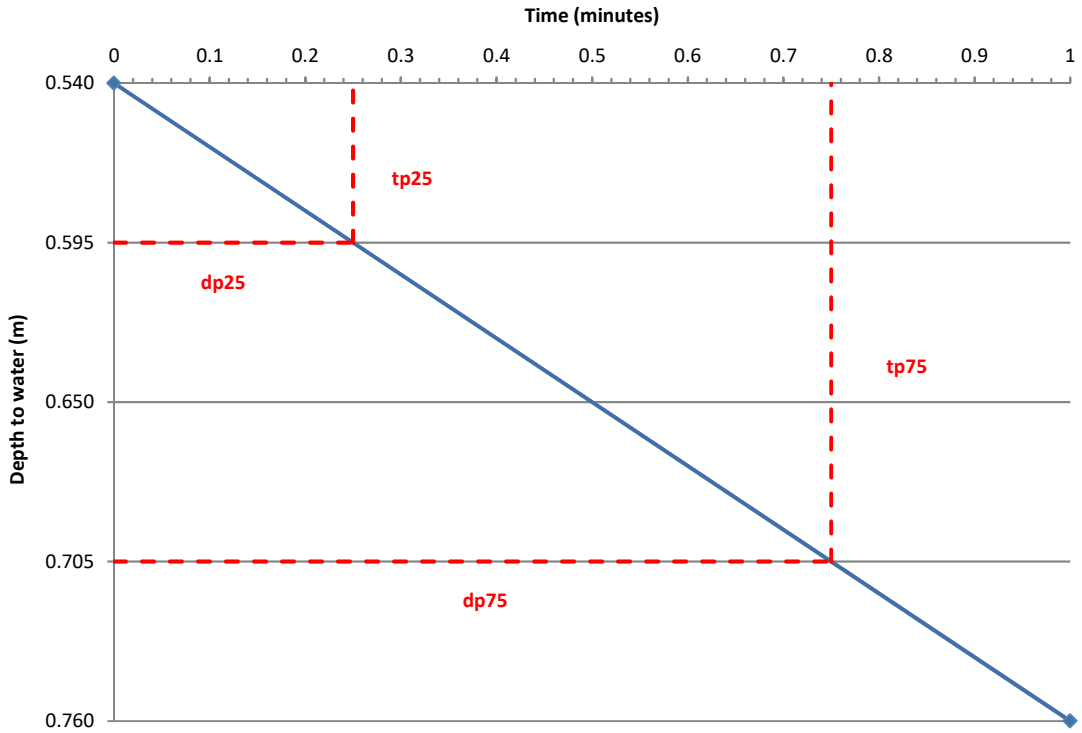
Depth of borehole at start of test (m)
0.76

Title
Soil infiltration test (following principles of BRE Digest 365 2016)

Diameter	Co-ordinates	Ground level
0.063m	-	N/A

Borehole no.	Cycle number	Date of excavation
DTS111	1	13/03/2019

Plot showing time against depth to water:



Test observations:

TIME (mins)	DEPTH TO WATER (m)	TIME (mins)	DEPTH TO WATER (m)
0	0.54		
1	0.76		

Calculations:

Soil infiltration rate (SIR), $f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$

V_{p75-25} = *effective storage volume of water in the borehole between 75% (d_{p75}) and 25% (d_{p25}) effective depth*

= ***0.00034m³***

a_{p50} = *the internal surface area of the borehole up to 50% effective depth and including the base area*

= ***0.02489m²***

$t_{p75} - t_{p25}$ = *the time for the water level to fall from 75% to 25% effective depth*

= ***0.5 (minutes)***

= ***30 (seconds)***

f = 4.55E-04 m/s

Groundwater observations
No groundwater encountered.

Geology unit under test
Possible Reworked Weathered Bee Low Limestone Formation

Depth of borehole at start of test (m)
0.76

Title
Soil infiltration test (following principles of BRE Digest 365 2016)

Diameter	Co-ordinates	Ground level
0.063m	-	N/A

Borehole no.	Cycle number	Date of excavation
DTS111	2	13/03/2019

Proposed residential development
Nunsfield Road, Buxton

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STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
Grass over dark brown SAND with frequent rootlets. (TOPSOIL)									
	0.20	309.40					0.20		D
Medium dense brown slightly clayey silty very sandy GRAVEL with rare cobbles. Gravel and cobbles consist of medium to coarse angular mudstone. (WEATHERED EYAM LIMESTONE FORMATION)							0.50		D
	0.70	308.90							
Soft very low strength brown gravelly slightly sandy CLAY. Gravel consists of medium to coarse angular mudstone. (WEATHERED EYAM LIMESTONE FORMATION)					PP 0.80	PP=17	0.80		D
	1.00	308.60							
Soft light grey gravelly CLAY. Gravel consists of fine to medium angular limestone. (WEATHERED EYAM LIMESTONE FORMATION)									
	1.20	308.40					1.20		D
TRIAL PIT TERMINATED AT 1.20m									

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Trial pit terminated due to obstruction. Backfilled with arisings. Trial pit terminated due to competency of deposits (likely bedrock).

Groundwater observations
No groundwater encountered.

Title Trial pit record	**Dimensions (w x l)** 1.30m x 1.50m	
Method Tracked excavator	**Logged by** TO	**Date(s)** 24/01/2019
Level (m OD) 309.60	**Compiled by** SA	**Sheet number** Sheet 1 of 1
Co-ordinates 406640mE, 374562mN	**Checked by** SD	**TP01**

Report ref: STQ4642M-G01 **Revision:** 0

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STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
Grass onto dark brown SAND with frequent rootlets. (TOPSOIL - MADE GROUND)	0.20	300.39					0.20		D
Medium dense brown slightly gravelly slightly silty SAND. Gravel consists of fine angular limestone. (WEATHERED EYAM LIMESTONE FORMATION)							0.30		D
							0.50		D
							0.80		D
Stiff high strength very dark grey gravelly slightly sandy CLAY. Gravel consists of fine to medium angular mudstone. (WEATHERED EYAM LIMESTONE FORMATION)	1.10	299.49			PP 1.20	PP=100	1.20		D
					PP 1.50	PP=100			
							1.80		D
					PP 1.90	PP=100			
Dense very dark grey slightly sandy GRAVEL. Gravel consists of medium to coarse angular limestone. (WEATHERED EYAM LIMESTONE FORMATION)	2.20	298.39							
							2.50		D
TRIAL PIT TERMINATED AT 2.60m	2.60	297.99							

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings. Trial pit terminated due to competency of deposits (likely bedrock).

Groundwater observations
No groundwater encountered.

Title Trial pit record	**Dimensions (w x l)** 0.90m x 2.20m	
Method Tracked excavator	**Logged by** TO	**Date(s)** 24/01/2019
Level (m OD) 300.59	**Compiled by** SA	**Sheet number** Sheet 1 of 1
Co-ordinates 406582mE, 374502mN	**Checked by** SD	**TP02**

Report ref: STQ4642M-G01 **Revision:** 0

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STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
Grass over dark brown SAND with frequent rootlets. (TOPSOIL)									
	0.20	318.81					0.20		D
Loose brown very sandy GRAVEL. Gravel consists of medium to coarse angular limestone. (WEATHERED EYAM LIMESTONE FORMATION)							0.50		D
	0.70	318.31							
Soft very low to low strength gravelly slightly sandy CLAY. Gravel consists of medium to coarse angular limestone. (WEATHERED EYAM LIMESTONE FORMATION)					PP 0.80	PP=25	0.80		D
							1.20		D
					PP 1.30	PP=17			
					PP 1.40	PP=17			
TRIAL PIT TERMINATED AT 1.70m	1.70	317.31					1.70		D

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings. Trial pit terminated due competency of deposits (likely bedrock). Collapse of trial pit sides from 0.4m to 0.7m depth on eastern wall widening trial pit by 0.3m.

Groundwater observations
No groundwater encountered.

Title Trial pit record	**Dimensions (w x l)** 1.20m x 2.70m	
Method Tracked excavator	**Logged by** TO	**Date(s)** 24/01/2019
Level (m OD) 319.01	**Compiled by** SA	**Sheet number** Sheet 1 of 1
Co-ordinates 406722mE, 374495mN	**Checked by** SD	**TP03**

Report ref: STQ4642M-G01 **Revision:** 0

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STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
Grass onto dark brown SAND with frequent rootlets. (TOPSOIL)									
	0.20	311.06					0.20		D
Medium dense greyish brown slightly clayey silty sandy GRAVEL with occasional cobbles. Gravel and cobbles consist of coarse angular limestone. (WEATHERED EYAM LIMESTONE FORMATION)							0.50		D
	0.80	310.46					0.80		D
Very weak greyish brown LIMETSONE. (WEATHERED EYAM LIMESTONE FORMATION)									
	1.00	310.26							
TRIAL PIT TERMINATED AT 1.00m									

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings. Trial pit terminated due to competency of deposits.

Groundwater observations
No groundwater encountered.

Title Trial pit record	**Dimensions (w x l)** 1.00m x 2.10m	
Method Tracked excavator	**Logged by** TO	**Date(s)** 24/01/2019
Level (m OD) 311.26	**Compiled by** SA	**Sheet number** Sheet 1 of 1
Co-ordinates 406581mE, 374368mN	**Checked by** SD	**TP04**

Report ref: STQ4642M-G01 **Revision:** 0

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STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
Rough vegetation over loose dark brown very gravelly SAND. Gravel consists of glass, brick, concrete, plastic, plastic bottles, metal, wire, car parts, shoes, paper, timber, ceramic tiles and roof tiles. Hydrocarbon odour observed between 1.9m and 3.4m depth. (MADE GROUND)							0.30		D
							0.50		D
							0.80		D
							1.20		D
							1.80		D
							2.50		D
CONTINUED ON NEXT SHEET									

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings. Collapse of trial pit sides from surface to 1.9m depth on eastern wall widening trial pit by 0.25m.

Groundwater observations
No groundwater encountered.

Title Trial pit record	**Dimensions (w x l)** 1.30m x 3.10m	
Method Tracked excavator	**Logged by** TO	**Date(s)** 23/01/2019
Level (m OD) 301.00	**Compiled by** SA	**Sheet number** Sheet 1 of 2
Co-ordinates 406520mE, 374449mN	**Checked by** SD	**TP05**

Report ref: STQ4642M-G01 **Revision:** 0

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STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
Rough vegetation over loose dark brown very gravelly SAND. Gravel consists of glass, brick, concrete, plastic, plastic bottles, metal, wire, car parts, shoes, paper, timber, ceramic tiles and roof tiles. Hydrocarbon odour observed between 1.9m and 3.4m depth. (MADE GROUND)									
TRIAL PIT TERMINATED AT 3.40m	3.40	297.60					3.40		D

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings. Collapse of trial pit sides from surface to 1.9m depth on eastern wall widening trial pit by 0.25m.

Groundwater observations
No groundwater encountered.

Title Trial pit record	**Dimensions (w x l)** 1.30m x 3.10m	
Method Tracked excavator	**Logged by** TO	**Date(s)** 23/01/2019
Level (m OD) 301.00	**Compiled by** SA	**Sheet number** Sheet 2 of 2
Co-ordinates 406520mE, 374449mN	**Checked by** SD	**TP05**

Report ref: STQ4642M-G01 **Revision:** 0

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STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
Grass onto dark brown very clayey SAND. (TOPSOIL)							0.30		D
	0.40	304.29							
Stiff high strength brown sandy slightly silty CLAY. (WEATHERED BOWLAND SHALE FORMATION)							0.50		D
					PP 0.60	PP=142			
							0.80		D
					PP 0.90	PP=126			
							1.20		D
					PP 1.50	PP=117			
	1.70	302.99							
Medium dense dark brown to dark grey slightly clayey slightly sandy GRAVEL. Gravel consists of fine to coarse angular mudstone. (WEATHERED BOWLAND SHALE FORMATION)							1.80		D
							2.50		D
CONTINUED ON NEXT SHEET									

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings. Collapse of trial pit sides from 0.0m to 1.9m depth widening trial pit by 0.25m each side.

Groundwater observations
No groundwater encountered.

Title Trial pit record	**Dimensions (w x l)** 0.70m x 3.00m	
Method Tracked excavator	**Logged by** TO	**Date(s)** 21/01/2019
Level (m OD) 304.69	**Compiled by** SA	**Sheet number** Sheet 1 of 2
Co-ordinates 406574mE, 374318mN	**Checked by** SD	**TP06**

Report ref: STQ4642M-G01 **Revision:** 0

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STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
Medium dense dark brown to dark grey slightly clayey slightly sandy GRAVEL. Gravel consists of fine to coarse angular mudstone. (WEATHERED BOWLAND SHALE FORMATION)							3.50		D
TRIAL PIT TERMINATED AT 4.00m	4.00	300.69					4.00		D

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings. Collapse of trial pit sides from 0.0m to 1.9m depth widening trial pit by 0.25m each side.

Groundwater observations
No groundwater encountered.

Title Trial pit record	**Dimensions (w x l)** 0.70m x 3.00m	
Method Tracked excavator	**Logged by** TO	**Date(s)** 21/01/2019
Level (m OD) 304.69	**Compiled by** SA	**Sheet number** Sheet 2 of 2
Co-ordinates 406574mE, 374318mN	**Checked by** SD	**TP06**

Report ref: STQ4642M-G01 **Revision:** 0

Proposed residential development
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STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
Grass onto brown slightly clayey SAND. (TOPSOIL - MADE GROUND)									
	0.20	323.80					0.20		D
Medium dense dark brown mottled orangish and reddish brown very gravelly SAND. Gravel consists of fine to coarse glass, brick, plastic, metal pipe, timber, shoes, slag, coal, clinker, tiles, car parts, wire and porcelain. (MADE GROUND)							0.30		D
							0.50		D
							0.80		D
							1.20		D
	1.60	322.40							
Medium dense orangish brown clayey very silty very gravelly SAND. Gravel consists of fine to medium sub-angular limestone and mudstone. (WEATHERED BEE LOW LIMESTONE FORMATION)							1.80		D
...from 2.5m depth, becoming grey.									
							2.60		D
CONTINUED ON NEXT SHEET									

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings. Trial pit terminated due to competency of deposits (likely bedrock).

Groundwater observations
No groundwater encountered.

Title Trial pit record	**Dimensions (w x l)** 1.30m x 2.40m	
Method Tracked excavator	**Logged by** TO	**Date(s)** 24/01/2019
Level (m OD) 324.00	**Compiled by** SA	**Sheet number** Sheet 1 of 2
Co-ordinates 406756mE, 374261mN	**Checked by** SD	**TP08**

Report ref: STQ4642M-G01 **Revision:** 0

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STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
Medium dense orangish brown clayey very silty very gravelly SAND. Gravel consists of fine to medium sub-angular limestone and mudstone. (WEATHERED BEE LOW LIMESTONE FORMATION)									
	3.20	320.80					3.20		D
Medium dense grey GRAVEL. Gravel consists of medium to coarse angular limestone. (WEATHERED BEE LOW LIMESTONE FORMATION)	3.30	320.70							
TRIAL PIT TERMINATED AT 3.30m									

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings. Trial pit terminated due to competency of deposits (likely bedrock).

Groundwater observations
No groundwater encountered.

Title Trial pit record	**Dimensions (w x l)** 1.30m x 2.40m	
Method Tracked excavator	**Logged by** TO	**Date(s)** 24/01/2019
Level (m OD) 324.00	**Compiled by** SA	**Sheet number** Sheet 2 of 2
Co-ordinates 406756mE, 374261mN	**Checked by** SD	**TP08**

Report ref: STQ4642M-G01 **Revision:** 0

Proposed residential development
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STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
Grass onto dark brown very clayey SAND. (TOPSOIL)									
	0.30	308.18					0.30		D
Stiff high strength brown sandy slightly silty CLAY. (WEATHERED EYAM LIMESTONE FORMATION)					PP 0.40	PP=100			
							0.50		D
					PP 0.70	PP=104			
							0.80		D
Medium dense dark brown to dark grey clayey silty slightly sandy GRAVEL with some cobbles. Gravel and cobbles consist of fine to coarse angular limestone and mudstone. (WEATHERED EYAM LIMESTONE FORMATION)	1.00	307.48							
TRIAL PIT TERMINATED AT 1.20m	1.20	307.28					1.20		D

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings. Trial pit terminated due to competency of deposits (likely bedrock).

Groundwater observations
No groundwater encountered.

Title Trial pit record	**Dimensions (w x l)** 1.00m x 2.10m	
Method Tracked excavator	**Logged by** TO	**Date(s)** 23/01/2019
Level (m OD) 308.48	**Compiled by** SA	**Sheet number** Sheet 1 of 1
Co-ordinates 406563mE, 374267mN	**Checked by** SD	**TP11**

Report ref: STQ4642M-G01 **Revision:** 0

Proposed residential development
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STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
Grass onto brown slightly clayey SAND. (TOPSOIL)									
	0.30	322.67					0.30		D
Medium dense orangish brown slightly clayey SAND with frequent cobbles of grey limestone. (WEATHERED BEE LOW LIMESTONE FORMATION)							0.50		D
							0.80		D
TRIAL PIT TERMINATED AT 1.00m	1.00	321.97							

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings. Trial pit terminated due to competency of deposits (likely bedrock).

Groundwater observations
No groundwater encountered.

Title Trial pit record	**Dimensions (w x l)** 1.20m x 2.30m	
Method Tracked excavator	**Logged by** TO	**Date(s)** 24/01/2019
Level (m OD) 322.97	**Compiled by** SA	**Sheet number** Sheet 1 of 1
Co-ordinates 406811mE, 374196mN	**Checked by** SD	**TP13**

Report ref: STQ4642M-G01 **Revision:** 0

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WELL	STRATA DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND	WATER STRIKES	SPT TESTING TYPE / DEPTH (m)	SPT TESTING RESULT	SPT TESTING CASING DEPTH (m)	SPT TESTING WATER LEVEL (m)	OTHER IN SITU TESTING TYPE / DEPTH (m)	OTHER IN SITU TESTING RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
	Grass over dark brown slightly clayey SAND. (TOPSOIL)													
	Medium dense brown slightly clayey SAND. (WEATHERED EYAM LIMESTONE FORMATION)	0.30	301.69									0.30		D
												0.50		D
												0.80		D
						C 1.00-1.45	(4) 11							
												1.20		D
												1.80		D
	Medium dense brown GRAVEL. Gravel consists of medium angular sandstone. (WEATHERED EYAM LIMESTONE FORMATION)	1.90	300.09			C 2.00-2.45	(3) 12							
	Medium dense dark grey to dark brown GRAVEL. Gravel consists of angular shale. (WEATHERED EYAM LIMESTONE FORMATION)	2.30	299.69									2.50		D
	CONTINUED ON NEXT SHEET													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations

Groundwater encountered at 1.9m depth, filling borehole to 1.3m in 10 minutes.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	30
1.00 - 2.00	80
2.00 - 3.00	80
3.00 - 3.90	80

Method Driven tube sampler	**Logged by** TO	**Date(s)** 08/02/2019
Level (m OD) 301.99	**Compiled by** SA	**Sheet number** Sheet 1 of 2
Co-ordinates 406582mE, 374554mN	**Checked by** SD	**DTS02**

Report ref: STQ4642M-G01 **Revision:** 0

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Medium dense dark grey to dark brown GRAVEL. Gravel consists of angular shale. (WEATHERED EYAM LIMESTONE FORMATION) *...from 3m depth, becoming very dense.*					C 3.00-3.08	(25 blows for 40mm penetration) then 50 blows for 40mm penetration					3.50		D
	BOREHOLE TERMINATED AT 3.90m	3.90	298.09											

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations

Groundwater encountered at 1.9m depth, filling borehole to 1.3m in 10 minutes.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	30
1.00 - 2.00	80
2.00 - 3.00	80
3.00 - 3.90	80

Method Driven tube sampler	**Logged by** TO	**Date(s)** 08/02/2019
Level (m OD) 301.99	**Compiled by** SA	**Sheet number** Sheet 2 of 2
Co-ordinates 406582mE, 374554mN	**Checked by** SD	**DTS02**

Proposed residential development
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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Grass onto dark brown slightly clayey SAND with occasional gravel of fine angular bricks. (MADE GROUND)													
	Stiff medium strength brown slightly sandy CLAY. (WEATHERED EYAM LIMESTONE FORMATION)	0.30	320.45									0.30		D
										PP 0.50	PP=54	0.50		D
	Brown coarse SAND. (WEATHERED EYAM LIMESTONE FORMATION)	0.80	319.95									0.80		D
	Stiff medium strength brown gravelly sandy CLAY. Gravel of fine to medium angular limestone and sandstone. (WEATHERED EYAM LIMESTONE FORMATION)	1.00	319.75			C 1.00-1.45	(5) 14							
										PP 1.30	PP=58	1.20		D
										PP 1.70	PP=63	1.80		D
						C 2.00-2.21	(16) then 50 blows for 60mm penetration							
										PP 2.20	PP=58			
	BOREHOLE TERMINATED AT 2.30m	2.30	318.45									2.30		D

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations

Groundwater encountered at 2.3m depth, filling borehole to 2.0m in 10 minutes.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	100
1.00 - 2.00	100
2.00 - 2.30	100

Method Driven tube sampler	**Logged by** TO	**Date(s)** 08/02/2019
Level (m OD) 320.75	**Compiled by** SA	**Sheet number** Sheet 1 of 1
Co-ordinates 406734mE, 374550mN	**Checked by** SD	**DTS03**

Report ref: STQ4642M-G01 **Revision:** 0

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WELL	STRATA DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND	WATER STRIKES	SPT TESTING TYPE / DEPTH (m)	SPT TESTING RESULT	SPT TESTING CASING DEPTH (m)	SPT TESTING WATER LEVEL (m)	OTHER IN SITU TESTING TYPE / DEPTH (m)	OTHER IN SITU TESTING RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
	Grass over dark brown slightly clayey SAND. (TOPSOIL - MADE GROUND)													
	Stiff very high strength brown mottled grey very gravelly very sandy CLAY. Gravel consists of fine to medium angular limestone and sandstone. (MADE GROUND)	0.30	301.36									0.30		D
										PP 0.50	PP=192	0.50		D
	Very loose to loose dark grey slightly clayey GRAVEL. Gravel consists of plastic, shale, slag, coal, timber, pottery and bricks. (MADE GROUND)	0.70	300.96									0.80		D
	...between 1m and 4m depth, 5% recovery.					C 1.00-1.45	(5) 2							
												1.80		D
						C 2.00-2.45	(3) 3							
												2.50		D
	CONTINUED ON NEXT SHEET													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Combined gas and water monitoring standpipe installed.

Groundwater observations

Groundwater encountered at 3m depth. Water level remained constant.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	90
1.00 - 2.00	5
2.00 - 3.00	5
3.00 - 4.00	5
4.00 - 5.00	30

Method Driven tube sampler	**Logged by** TO	**Date(s)** 06/02/2019
Level (m OD) 301.66	**Compiled by** SA	**Sheet number** Sheet 1 of 2
Co-ordinates 406539mE, 374528mN	**Checked by** SD	**DTS04**

Report ref: STQ4642M-G01 **Revision:** 0

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Very loose to loose dark grey slightly clayey GRAVEL. Gravel consists of plastic, shale, slag, coal, timber, pottery and bricks. (MADE GROUND)				▼	C 3.00-3.45	(1) 5					3.50		D
						C 4.00-4.45	(5) 6					4.50		D
	BOREHOLE TERMINATED AT 5.00m	5.00	296.66			C 5.00-5.45	(0) 5							

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Combined gas and water monitoring standpipe installed.

Groundwater observations

Groundwater encountered at 3m depth. Water level remained constant.

Recovery details

Range (m)	Recovery (%)
0.00 - 1.00	90
1.00 - 2.00	5
2.00 - 3.00	5
3.00 - 4.00	5
4.00 - 5.00	30

Title

Driven tube sampler record

Method
Driven tube sampler

Logged by
TO

Date(s)
06/02/2019

Level (m OD)
301.66

Compiled by
SA

Sheet number
Sheet 2 of 2

Co-ordinates
406539mE, 374528mN

Checked by
SD

DTS04

Report ref: STQ4642M-G01

Revision: 0

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WELL	STRATA DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND	WATER STRIKES	SPT TESTING TYPE / DEPTH (m)	SPT TESTING RESULT	SPT TESTING CASING DEPTH (m)	SPT TESTING WATER LEVEL (m)	OTHER IN SITU TESTING TYPE / DEPTH (m)	OTHER IN SITU TESTING RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
	Grass over dark brown slightly clayey SAND. (TOPSOIL)													
	Firm medium strength brown gravelly CLAY. Gravel consists of medium to coarse angular limestone. (WEATHERED EYAM LIMESTONE FORMATION)	0.30	308.79									0.30		D
										PP 0.50	PP=50	0.50		D
												0.80		D
						C 1.00-1.45	(0) 0			PP 1.00	PP=54			
										PP 1.20	PP=0	1.20		D
										PP 1.40	PP=50			
										PP 1.80	PP=50	1.80		D
						C 2.00-2.45	(13) 27							
										PP 2.20	PP=63			
												2.50		D
										PP 2.70	PP=50			
	CONTINUED ON NEXT SHEET													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Combined gas and water monitoring standpipe installed. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	100
1.00 - 2.00	30
2.00 - 3.20	60

Method Driven tube sampler	**Logged by** TO	**Date(s)** 08/02/2019
Level (m OD) 309.09	**Compiled by** SA	**Sheet number** Sheet 1 of 2
Co-ordinates 406639mE, 374479mN	**Checked by** SD	**DTS06**

Report ref: STQ4642M-G01 **Revision:** 0

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Firm medium strength brown gravelly CLAY. Gravel consists of medium to coarse angular limestone. (WEATHERED EYAM LIMESTONE FORMATION)					S 3.00-3.21	(25) then 50 blows for 60mm penetration							
	BOREHOLE TERMINATED AT 3.20m	3.20	305.89											

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Combined gas and water monitoring standpipe installed. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	100
1.00 - 2.00	30
2.00 - 3.20	60

Method Driven tube sampler	**Logged by** TO	**Date(s)** 08/02/2019
Level (m OD) 309.09	**Compiled by** SA	**Sheet number** Sheet 2 of 2
Co-ordinates 406639mE, 374479mN	**Checked by** SD	**DTS06**

Report ref: STQ4642M-G01 **Revision:** 0

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Grass over dark brown slightly clayey SAND. (TOPSOIL)													
	Stiff medium strength brown gravelly CLAY. Gravel consists of medium to coarse angular limestone. (WEATHERED EYAM LIMESTONE FORMATION)	0.30	301.69							PP 0.40	PP=50	0.30		D
										PP 0.60	PP=54	0.50		D
						C 0.80-0.88	(25 blows for 60mm penetration) then 50 blows for 20mm penetration					0.80		D
	BOREHOLE TERMINATED AT 0.88m	0.88	301.11											

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations
No groundwater encountered.

Title
Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 0.80	100

Method Driven tube sampler	**Logged by** TO	**Date(s)** 08/02/2019
Level (m OD) 301.99	**Compiled by** SA	**Sheet number** Sheet 1 of 1
Co-ordinates 406569mE, 374447mN	**Checked by** SD	**DTS07**

Report ref: STQ4642M-G01 **Revision:** 0

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Rough vegetation over loose dark brown to brown very clayey sandy GRAVEL. Gravel consists of fine to medium angular bricks, slag, coal, wood, glass, textile, sandstone and shale. (MADE GROUND)											0.30		D
												0.50		D
												0.80		D
						C 1.00-1.45	(3) 7							
												1.20		D
												1.80		D
						C 2.00-2.45	(1) 1							
												2.50		D
	CONTINUED ON NEXT SHEET													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Borehole terminated due to obstruction.

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	40
1.00 - 2.00	40
2.00 - 3.00	60
3.00 - 4.00	60
4.00 - 5.00	70

Method Driven tube sampler	**Logged by** TO	**Date(s)** 29/01/2019
Level (m OD) 300.57	**Compiled by** SA	**Sheet number** Sheet 1 of 2
Co-ordinates 406513mE, 374408mN	**Checked by** SD	**DTS08**

Report ref: STQ4642M-G01 **Revision:** 0

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Rough vegetation over loose dark brown to brown very clayey sandy GRAVEL. Gravel consists of fine to medium angular bricks, slag, coal, wood, glass, textile, sandstone and shale. (MADE GROUND)					C 3.00-3.45	(25) 36					3.50		D
	...between 3m and 4m depth, becoming dense.					C 4.00-4.45	(4) 15					4.50		D
	BOREHOLE TERMINATED AT 5.00m	5.00	295.57											

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Borehole terminated due to obstruction.

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	40
1.00 - 2.00	40
2.00 - 3.00	60
3.00 - 4.00	60
4.00 - 5.00	70

Method: Driven tube sampler
Logged by: TO
Date(s): 29/01/2019
Level (m OD): 300.57
Compiled by: SA
Sheet number: Sheet 2 of 2
Co-ordinates: 406513mE, 374408mN
Checked by: SD

DTS08

Report ref: STQ4642M-G01 **Revision:** 0

Proposed residential development
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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Grass onto firm dark brown slightly CLAY. (TOPSOIL)											0.30		D
	Stiff dark grey CLAY. (WEATHERED EYAM LIMESTONE FORMATION)	0.50	313.33			S 0.50-0.52	(25 blows for 20mm penetration)					0.50		D
	BOREHOLE TERMINATED AT 0.60m	0.60	313.23									0.60		D

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations
No groundwater encountered.

Title
Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 0.60	100

Method
Driven tube sampler

Logged by
TO

Date(s)
08/02/2019

Level (m OD)
313.83

Compiled by
SA

Sheet number
Sheet 1 of 1

Co-ordinates
406629mE, 374422mN

Checked by
SD

DTS09

Report ref: STQ4642M-G01

Revision: 0

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WELL	STRATA DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND	WATER STRIKES	SPT TESTING TYPE / DEPTH (m)	SPT TESTING RESULT	SPT TESTING CASING DEPTH (m)	SPT TESTING WATER LEVEL (m)	OTHER IN SITU TESTING TYPE / DEPTH (m)	OTHER IN SITU TESTING RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
	Vegetation over dark brown very clayey SAND. (TOPSOIL)													
	Stiff medium strength brown very sandy CLAY. (WEATHERED BOWLAND SHALE FORMATION)	0.30	301.18									0.30		D
										PP 0.50	PP=71	0.50		D
	Medium dense dark grey GRAVEL. Gravel consists of fine angular mudstone. (WEATHERED BOWLAND SHALE FORMATION)	0.80	300.68		▼							0.80		D
						C 1.00-1.45	(6) 17							
												1.20		D
												1.80		D
	...below 2m depth, becoming dense.					C 2.00-2.45	(11) 33							
												2.50		D
	Very weak dark grey thickly laminated MUDSTONE.	2.80	298.68											
	CONTINUED ON NEXT SHEET													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations

Groundwater encountered at 1m depth. Water level remained constant.

Recovery details

Range (m)	Recovery (%)
0.00 - 1.00	100
1.00 - 2.00	80
2.00 - 3.00	100

Title

Driven tube sampler record

Method Driven tube sampler	**Logged by** TO	**Date(s)** 06/02/2019
Level (m OD) 301.48	**Compiled by** SA	**Sheet number** Sheet 1 of 2
Co-ordinates 406524mE, 374385mN	**Checked by** SD	**DTS10**

Report ref: STQ4642M-G01 **Revision:** 0

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Very weak dark grey thickly laminated MUDSTONE. (WEATHERED BOWLAND SHALE FORMATION)	3.00	298.48			C 3.00-3.45	(15) 40					3.00		D
	BOREHOLE TERMINATED AT 3.00m													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations

Groundwater encountered at 1m depth. Water level remained constant.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	100
1.00 - 2.00	80
2.00 - 3.00	100

Method
Driven tube sampler

Logged by
TO

Date(s)
06/02/2019

Level (m OD)
301.48

Compiled by
SA

Sheet number
Sheet 2 of 2

Co-ordinates
406524mE, 374385mN

Checked by
SD

DTS10

Report ref: STQ4642M-G01

Revision: 0

Proposed residential development
Nunsfield Road, Buxton

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Grass over dark brown slightly sandy CLAY. (TOPSOIL)											0.30		D
	Stiff medium strength brown to grey very gravelly slightly sandy CLAY. Gravel consists of fine to coarse angular limestone. (WEATHERED EYAM LIMESTONE FORMATION)	0.50	316.51									0.50		D
										PP 0.80	PP=58	0.80		D
						S 1.00-1.45	(6) 19							
										PP 1.20	PP=63	1.20		D
						S 1.50-1.72	(17) then 50 blows for 75mm penetration							
	BOREHOLE TERMINATED AT 1.72m	1.72	315.29											

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	100
1.00 - 1.50	100

Method
Driven tube sampler

Logged by
TO

Date(s)
08/02/2019

Level (m OD)
317.01

Compiled by
SA

Sheet number
Sheet 1 of 1

Co-ordinates
406660mE, 374339mN

Checked by
SD

DTS11

Report ref: STQ4642M-G01

Revision: 0

Proposed residential development
Nunsfield Road, Buxton

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Grass over dark brown slightly clayey SAND. (TOPSOIL)											0.30		D
	Stiff medium strength brown gravelly slightly sandy CLAY. Gravel consists of medium to coarse angular limestone. (WEATHERED EYAM LIMESTONE FORMATION)	0.40	317.61									0.50		D
						S 1.00-1.45	(6) 19			PP 1.00	PP=50	0.80		D
										PP 1.40	PP=54	1.20		D
										PP 1.80	PP=50	1.80		D
	Stiff brown gravelly slightly sandy CLAY. Gravel consists of medium to coarse angular limestone. (WEATHERED EYAM LIMESTONE FORMATION) *...between 1.9m and 2.2m depth, very weak light grey limestone cobble encountered.*	1.90	316.11			S 2.00-2.45	(17) then 50 blows for 446mm penetration							
	BOREHOLE TERMINATED AT 2.44m	2.45	315.56									2.40		D

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	90
1.00 - 2.00	40
2.00 - 2.40	60

Method Driven tube sampler	**Logged by** TO	**Date(s)** 08/02/2019
Level (m OD) 318.01	**Compiled by** SA	**Sheet number** Sheet 1 of 1
Co-ordinates 406691mE, 374450mN	**Checked by** SD	**DTS12**

Report ref: STQ4642M-G01 **Revision:** 0

Proposed residential development
Nunsfield Road, Buxton

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WELL	STRATA DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND	WATER STRIKES	SPT TESTING TYPE / DEPTH (m)	SPT TESTING RESULT	SPT TESTING CASING DEPTH (m)	SPT TESTING WATER LEVEL (m)	OTHER IN SITU TESTING TYPE / DEPTH (m)	OTHER IN SITU TESTING RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
	Grass onto dark brown clayey SAND. (TOPSOIL - MADE GROUND)													
	Loose dark brown mottled orangish brown clayey very gravelly SAND. Gravel consists of fine angular slag, brick, coal and glass. (MADE GROUND)	0.30	322.96									0.30		D
												0.50		D
												0.80		D
						C 1.00-1.45	(3) 3							
												1.20		D
	Stiff high strength orangish brown sandy CLAY. (WEATHERED BEE LOW LIMESTONE FORMATION)	1.30	321.96											
										PP 1.50	PP=100			
												1.80		D
						S 2.00-2.45	(7) 16			PP 2.00	PP=104			
										PP 2.50	PP=117	2.50		D
	CONTINUED ON NEXT SHEET													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Combined gas and water monitoring standpipe installed.

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	90
1.00 - 2.00	70
2.00 - 3.00	100
3.00 - 4.00	100
4.00 - 5.00	90

Method Driven tube sampler	**Logged by** TO	**Date(s)** 31/01/2019
Level (m OD) 323.26	**Compiled by** SA	**Sheet number** Sheet 1 of 2
Co-ordinates 406827mE, 374235mN	**Checked by** SD	**DTS13**

Report ref: STQ4642M-G01 **Revision:** 0

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Stiff high strength orangish brown sandy CLAY. (WEATHERED BEE LOW LIMESTONE FORMATION)					S 3.00-3.45	(8) 15			PP 3.00	PP=85			
										PP 3.50	PP=92	3.50		D
						S 4.00-4.45	(10) 11			PP 4.00	PP=96			
										PP 4.50	PP=96	4.50		D
						S 5.00-5.45	(9) 16							
	BOREHOLE TERMINATED AT 5.45m	5.45	317.81											

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Combined gas and water monitoring standpipe installed.

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	90
1.00 - 2.00	70
2.00 - 3.00	100
3.00 - 4.00	100
4.00 - 5.00	90

Method Driven tube sampler	**Logged by** TO	**Date(s)** 31/01/2019
Level (m OD) 323.26	**Compiled by** SA	**Sheet number** Sheet 2 of 2
Co-ordinates 406827mE, 374235mN	**Checked by** SD	**DTS13**

Report ref: STQ4642M-G01 **Revision:** 0

Proposed residential development
Nunsfield Road, Buxton

soiltechnics
environmental and geotechnical consultants

WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Grass over dark brown slightly clayey SAND. (TOPSOIL)											0.30		D
	Stiff medium strength brown gravelly CLAY. Gravel consists of medium to coarse angular limestone. (WEATHERED EYAM LIMESTONE FORMATION)	0.50	313.89									0.50		D
										PP 0.80	PP=50	0.80		D
						S 1.00-1.45	(1) 2							
										PP 1.20	PP=50	1.20		D
	BOREHOLE TERMINATED AT 1.50m	1.50	312.89			C 1.50-1.52	(25 blows for 10mm penetration) then 50 blows for 10mm penetration							

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	100
1.00 - 1.52	100

Method
Driven tube sampler

Logged by
TO

Date(s)
08/02/2019

Level (m OD)
314.39

Compiled by
SA

Sheet number
Sheet 1 of 1

Co-ordinates
406643mE, 374289mN

Checked by
SD

DTS15

Report ref: STQ4642M-G01

Revision: 0

Proposed residential development
Nunsfield Road, Buxton

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Grass over dark brown clayey SAND. (MADE GROUND - REWORKED TOPSOIL)													
	Loose to medium dense dark brown mottled orangish brown dark grey slightly sandy GRAVEL. Gravel consists of fine angular slag, brick, coal and glass. (MADE GROUND)	0.30	323.96									0.30		D
												0.50		D
												0.80		D
						S 1.00-1.45	(4) 13			PP 1.00	PP=96			
												1.20		D
										PP 1.50	PP=100			
												1.80		D
						S 2.00-2.45	(1) 5			PP 2.00	PP=100			
										PP 2.50	PP=92	2.50		D
	CONTINUED ON NEXT SHEET													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings.

Groundwater observations
No groundwater encountered.

Title
Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	80
1.00 - 2.00	90
2.00 - 3.00	90
3.00 - 4.00	50
4.00 - 5.00	30

Method
Driven tube sampler

Logged by
TO

Date(s)
31/01/2019

Level (m OD)
324.26

Compiled by
SA

Sheet number
Sheet 1 of 2

Co-ordinates
406749mE, 374220mN

Checked by
SD

DTS18

Report ref: STQ4642M-G01

Revision: 0

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environmental and geotechnical consultants

WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Loose to medium dense dark brown mottled orangish brown dark grey slightly sandy GRAVEL. Gravel consists of fine angular slag, brick, coal and glass. (MADE GROUND)	3.00	321.26			S 3.00-3.45	(1) 2			PP 3.10	PP=0			
	Soft low strength orangish brown sandy CLAY. (POSSIBLE REWORKED WEATHERED BEE LOW LIMESTONE FORMATION)									PP 3.60	PP=0	3.50		D
						S 4.00-4.45	(0) 0			PP 4.10	PP=4			
										PP 4.70	PP=4	4.50		D
						S 5.00-5.45	(0) 0							
	BOREHOLE TERMINATED AT 5.45m	5.45	318.81											

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings.

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	80
1.00 - 2.00	90
2.00 - 3.00	90
3.00 - 4.00	50
4.00 - 5.00	30

Method
Driven tube sampler

Logged by
TO

Date(s)
31/01/2019

Level (m OD)
324.26

Compiled by
SA

Sheet number
Sheet 2 of 2

Co-ordinates
406749mE, 374220mN

Checked by
SD

DTS18

Report ref: STQ4642M-G01

Revision: 0

Proposed residential development
Nunsfield Road, Buxton

soiltechnics
environmental and geotechnical consultants

WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Grass over dark brown slightly clayey SAND. (TOPSOIL - MADE GROUND)													
	Stiff brown mottled grey very gravelly very sandy CLAY. Gravel consists of fine to medium angular limestone and sandstone. (MADE GROUND)	0.30	303.29									0.30		D
	Dark brown very clayey GRAVEL. Gravel consists of fine to medium angular shell, bricks, plastic, timber, slag and coal. (MADE GROUND)	0.50	303.09									0.50		D
												0.80		D
												1.20		D
												1.80		D
												2.50		D
	CONTINUED ON NEXT SHEET													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings.

Groundwater observations
No groundwater encountered.

Title
Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	90
1.00 - 2.00	60
2.00 - 3.00	40
3.00 - 4.00	100

Method
Driven tube sampler

Logged by
TO

Date(s)
06/02/2019

Level (m OD)
303.59

Compiled by
SA

Sheet number
Sheet 1 of 2

Co-ordinates
406486mE, 374505mN

Checked by
SD

DTS27

Report ref: STQ4642M-G01

Revision: 0

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environmental and geotechnical consultants

WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Dark brown very clayey GRAVEL. Gravel consists of fine to medium angular shell, bricks, plastic, timber, slag and coal. (MADE GROUND)											3.50		D
	BOREHOLE TERMINATED AT 4.00m	4.00	299.59											

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings.

Groundwater observations
No groundwater encountered.

Title
Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	90
1.00 - 2.00	60
2.00 - 3.00	40
3.00 - 4.00	100

Method
Driven tube sampler

Logged by
TO

Date(s)
06/02/2019

Level (m OD)
303.59

Compiled by
SA

Sheet number
Sheet 2 of 2

Co-ordinates
406486mE, 374505mN

Checked by
SD

DTS27

Proposed residential development
Nunsfield Road, Buxton

soiltechnics
environmental and geotechnical consultants

WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Vegetation over dark brown very clayey SAND. (TOPSOIL)													
	Stiff medium strength brown very sandy CLAY. (WEATHERED BOWLAND SHALE FORMATION)	0.30	299.13									0.30		D
												0.50		D
	Dark grey GRAVEL. Gravel consists of fine angular shale. (WEATHERED BOWLAND SHALE FORMATION)	0.80	298.63									0.80		D
												1.20		D
												1.50		D
	BOREHOLE TERMINATED AT 2.80m	2.80	296.63											

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	95
1.00 - 1.50	100

Method
Driven tube sampler

Logged by
TO

Date(s)
06/02/2019

Level (m OD)
299.43

Compiled by
SA

Sheet number
Sheet 1 of 1

Co-ordinates
406514mE, 374343mN

Checked by
SD

DTS28

Report ref: STQ4642M-G01

Revision: 0

Proposed residential development
Nunsfield Road, Buxton

soiltechnics
environmental and geotechnical consultants

WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Stiff high to very high strength dark grey very gravelly CLAY. Gravel consists of fine to medium angular slag. (MADE GROUND)				▼					PP 3.00	PP=113			
										PP 3.50	PP=138	3.50		D
										PP 4.00	PP=142			
										PP 4.50	PP=125	4.50		D
	BOREHOLE TERMINATED AT 5.00m	5.00	289.59											

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings.

Groundwater observations

Groundwater encountered at 3m depth. Water level remained constant.

Title

Driven tube sampler record

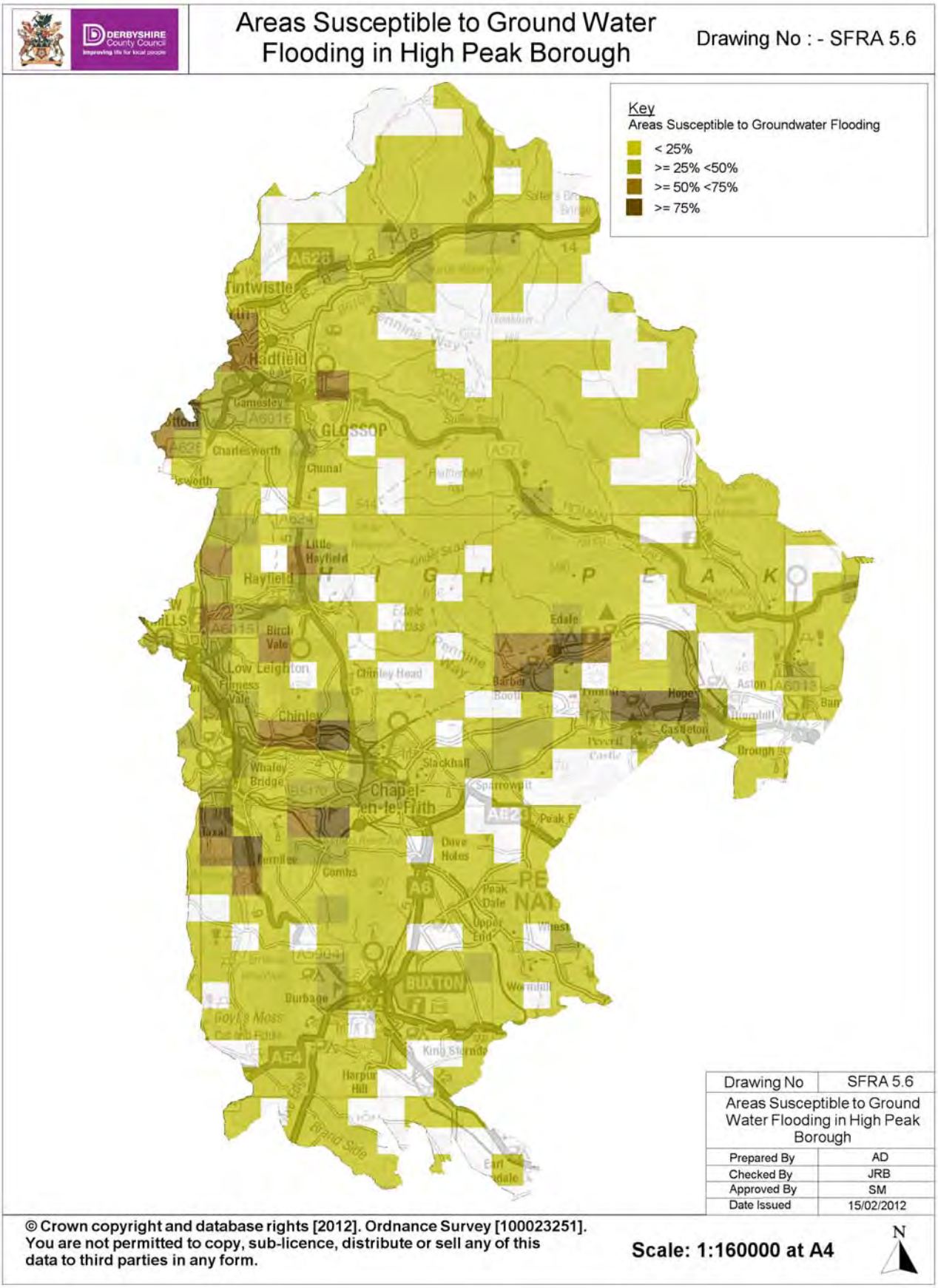
Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	100
1.00 - 2.00	40
2.00 - 3.00	70
3.00 - 4.00	100
4.00 - 5.00	100

Method Driven tube sampler	**Logged by** TO	**Date(s)** 29/01/2019
Level (m OD) 294.59	**Compiled by** SA	**Sheet number** Sheet 2 of 2
Co-ordinates 406458mE, 374338mN	**Checked by** SD	**DTS29**

Report ref: STQ4642M-G01 **Revision:** 0

Appendix F

Areas Susceptible to Groundwater Flooding (High Peak Borough)
DCC Level 1 SFRA: Map 5.6

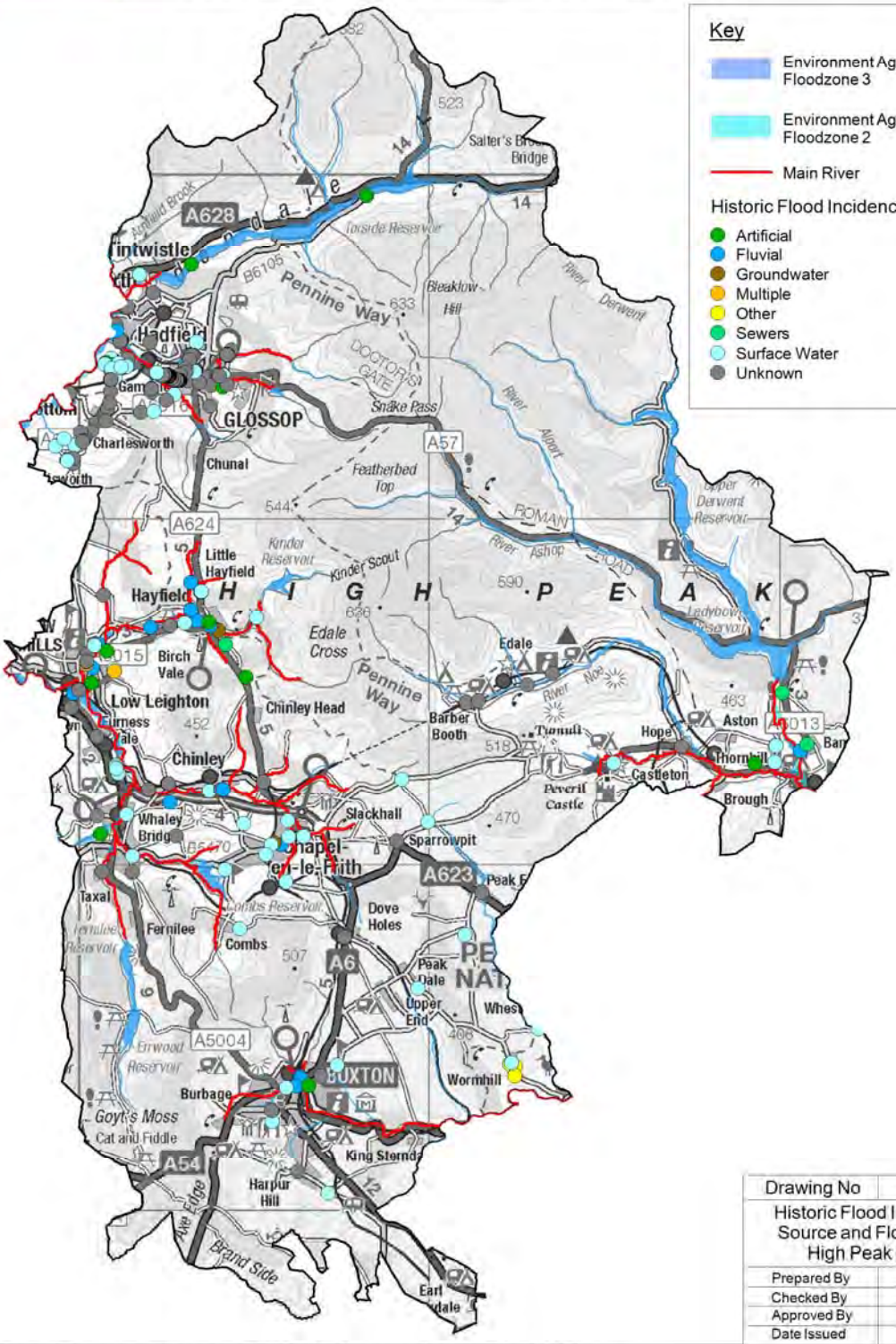

Areas Susceptible to Ground Water Flooding in High Peak Borough
Drawing No : - SFRA 5.6
Key
Areas Susceptible to Groundwater Flooding
< 25%
>= 25% <50%
>= 50% <75%
>= 75%
Hadfield
Glossop
Chinley
Whaley Bridge
Chapel-en-le-Frith
Buxton
Hayfield
Edale
Castleton
Hope
Drawing No
SFRA 5.6
Areas Susceptible to Ground Water Flooding in High Peak Borough
Prepared By
AD
Checked By
JRB
Approved By
SM
Date Issued
15/02/2012
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Scale: 1:160000 at A4
N

Appendix G

Historic Flood Incidence by Source and Floodzones (High Peak Borough)
DCC Level 1 SFRA: Map 3.6

Historic Flood Incidence by Source and Floodzones in High Peak Borough

Drawing No : - SFRA 3.6



Drawing No	SFRA 3.6
Historic Flood Incidence by Source and Floodzones in High Peak Borough	
Prepared By	AD
Checked By	JRB
Approved By	SM
Date Issued	02/08/2012

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Scale: 1:160000 at A4

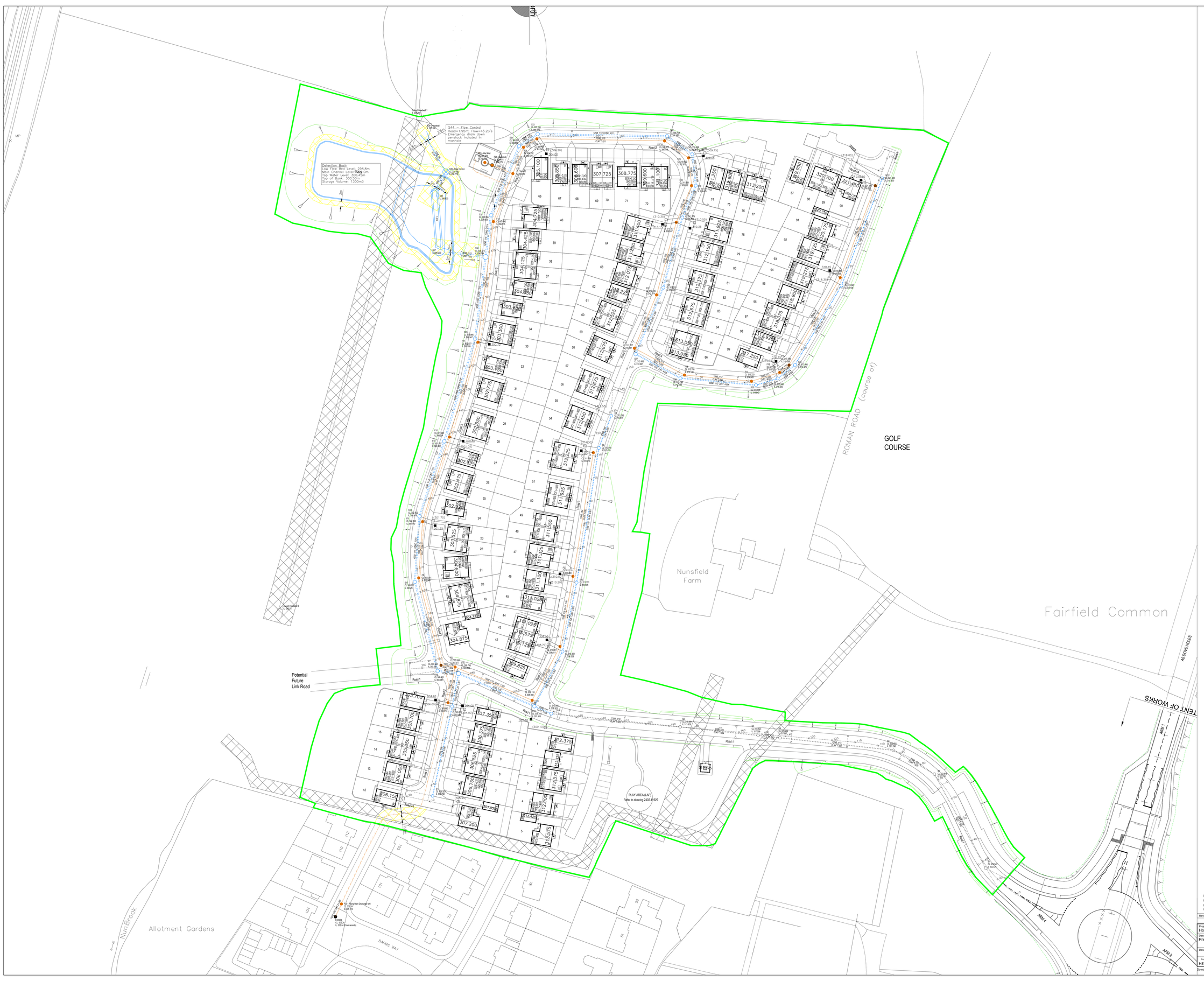
N

K
L

Appendix H

Preliminary Drainage Layout

Barratt Homes drawing no. H8797-BAH-XX-XX-DR-CE-300001-P07



Warning to House Purchasers

Buyers are warned that this is a working drawing and the contents of this drawing may be subject to change during the build process. The layout, form, content, and dimensions specified are included for general guidance only. Finishes or features shown may alter in respect of individual properties. Whilst we make every effort to ensure our drawings are up to date there may from time to time be an unavoidable delay in updating these due to changes in regulations and/or Planning Authority requirements. Please check with your Sales Advisor for the latest information on your property. The contents of this drawing do not constitute a contract, part of any contract or warranty unless specifically incorporated into the contract. They should not be relied upon for the purposes of entering into a contract to purchase any property.

ENGINEERING LAYOUT NOTES

1. All adoptable drainage works have been designed and are to be constructed in accordance with "Sewerage Sector Guidance Appendix C – Design and Construction Guide (C.T. and United Utilities Guidelines. Where specification conflicts, UU guidelines shall take precedence.
2. All clay pipe work shall be extra strength clayware to BS 295 and BSEN (SW only).
3. All precast concrete pipework shall be to Class 120 in accordance with BS08911–Part 1, BS EN 1916 and bear the BS Kitemark.
4. All adoptable drainage to be bedded in Class S granular surround unless otherwise stated on the longsections.
5. All concrete manhole and soakaways rings, and concrete cover slabs to be manufactured to BS EN 1917 and BS08111-Part 3.
6. Rising mains to be black polyethylene pipes complying to BS EN 13244-2. Polyethylene fittings, including fusion joints, and electro-fusion fittings shall comply with BS EN 13244-2.
7. All levels relate to Ordnance Datum. Contractor to ensure that this drawing is read in conjunction with the site specific topographical survey provided by Barratt Manchester and the benchmark information provided.
8. This drawing is to be read in accordance with all other relevant drawings.
9. The contractor shall be responsible for ensuring that any existing invert levels indicated on the drawings are correct before work commences.
10. All proposed connections to the sewer shall be 150ø unless stated otherwise.
11. All private house drainage shall be 100ø and all drag-out connections shall be 150ø at a minimum gradient of 1:80 unless otherwise stated, and laid in accordance with Part H of the Building Regulations.
12. Runoff from private surfaces shall not discharge across the highway. Gullies or channels shall be provided as appropriate to prevent this.
13. Pram crossings shall be provided at the inner tangent points of all junctions.
14. Pipes shall be protected from concentrated loading by construction traffic during the construction period when insufficient cover to the pipe may make them vulnerable to damage.
15. Insitu CBR tests of the road formation levels are to be carried out to determine the depth of pavement construction required. This is to be approved by Derbyshire County Council prior to construction of the road pavements.
16. Groundworker to ensure that plot drainage be within the curtilage of the plot they serve where possible and inspection covers kept within hardstanding where possible.
17. Contractor to provide Severn Trent Water with sufficient notice prior to commencement of sewer works on their inspections telephone number.
18. Contractor to obtain all necessary highway opening notices from Derbyshire County Council, obtain approval to work on United Utilities Sewerage System, obtain approval to method statement from the Environment Agency and/or the Local Lead Flood Authority for any works affecting a watercourse.

ENGINEERING KEY

- S104 Adoptable Surface Water Sewer & Manhole
- Private Surface Water Drag-Out and Invert (10.25)
- S38 Adoptable Surface Water Sewer & Manhole
- S38 Adoptable Road Gully
- S104 Adoptable Foul Water Sewer & Manhole
- Private Foul Drag-Out and Invert 10.25
- Proposed Adoptable Foul Water Rising Main
- Proposed S104 Sewer Easement
- Proposed Adoptable Foul Water Pumpstation

Revision	Description	Date	Design By
P07	Updated design to suit planning layout revision Rev. 3	01.07.24	CD
P06	Updated design to suit planning layout revision Rev. 2	27.06.24	CD
P05	Reverted to pumped solution for the whole site.	14.02.24	BJM
P04	Updated design to suit planning layout revision N.	09.02.24	BJM

Project: Hogshaw Farm, Buxton
Description: Preliminary Drainage Layout

Design By	Date	Scale at A0	Revision
CD	Feb 2024	1:500	P07

Project	Originator	Functional	Spatial Form	Discipline	Number
H8797 - BAH -		XX	- XX - DR -	CE -	300001

BARRATT HOMES

Do not scale from this drawing. Work to given dimensions only. Any discrepancies are to be reported to Originator.
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Appendix I
Greenfield Calculations

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.500
Area (ha)	3.720	Urban	0.000
SAAR (mm)	1374	Region Number	Region 4

Results l/s

QBAR Rural	45.2
QBAR Urban	45.2
Q100 years	116.2
Q1 year	37.5
Q30 years	88.6
Q100 years	116.2

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Appendix J

Drained Area Plan

JPP Consulting drawing no. 11024-FRA05B

General notes

All dimensions are in metres unless otherwise stated.

All levels are in metres.

This drawing is to be read in conjunction with all relevant Engineers and Architect's drawings, Specifications, Reports and Engineering Details.

Do not scale from this drawing.

Based on Topographical Land Survey by SurveyEng Ltd, drawing number BH.TS.12 Rev C dated 26.03.2021.

Based on Planning Layout by Barratt Homes, drawing number H8797-BAH-XX-XX-DR-UD-203001-P03 dated 28.06.2024.

Drawing Key

Plot Areas = 5,665m^2

Driveway Areas = 3,904m^2

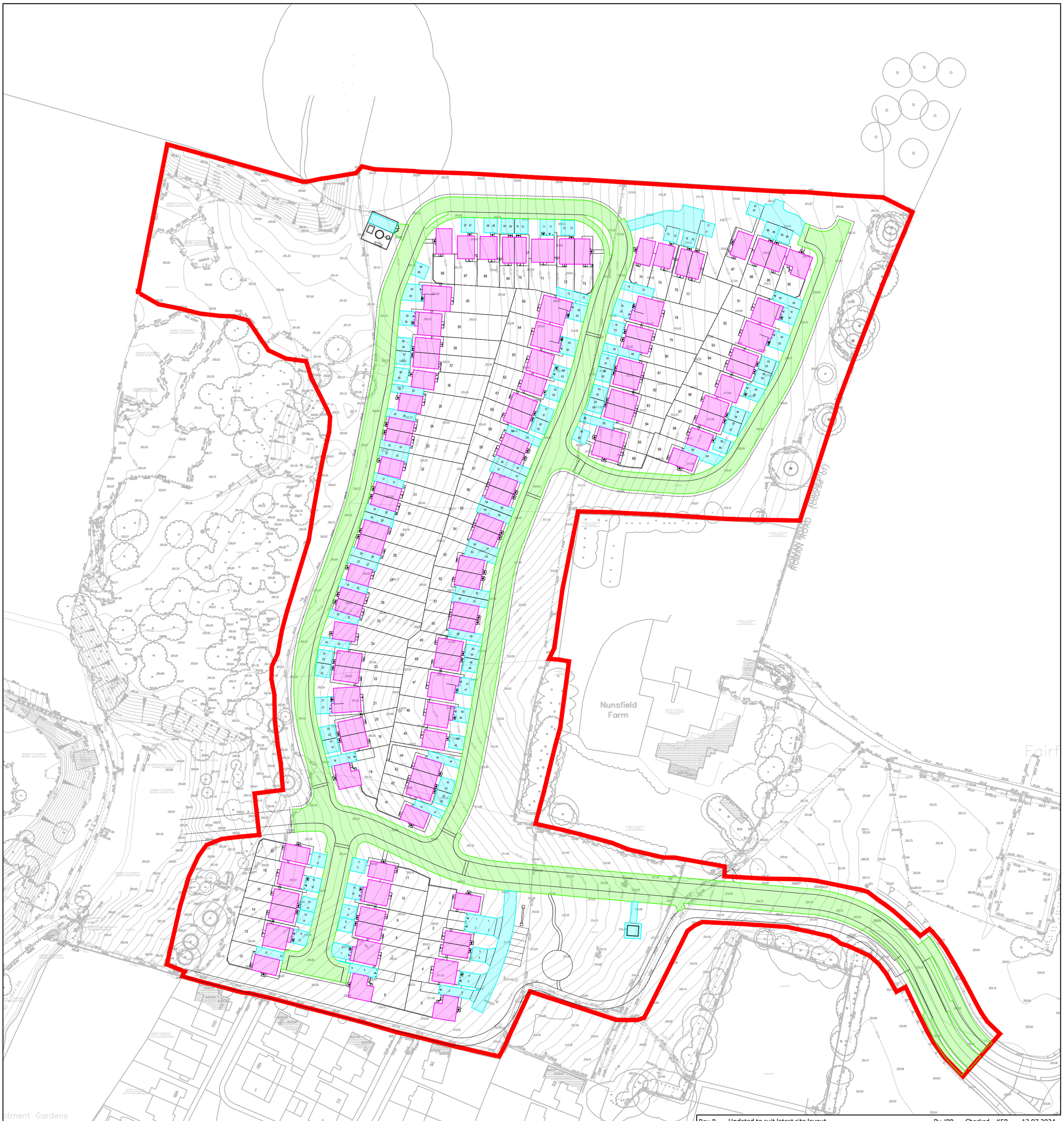
Road Areas = 9,260m^2

Total Area = 18,829m^2

10% Urban Creep to Plots = 567m^2

Total Drained Area including 10% Urban Creep = 19,396m^2

Site Boundary



Drawing is not to be used for construction until status is CONSTRUCTION

Rev B	Updated to suit latest site layout	By JPB	Checked	KER	12.07.2024
Rev A	Updated to suit latest site layout	By NCR	Checked	KER	31.01.2024

jpp

- Infrastructure Design
- Structural Engineering
- Development Planning
- Professional Advice
- Geotechnical & Environmental
- Surveying

Northampton
Grand Union Works, Whilton Locks, Daventry
Northamptonshire, NN11 2NH
T: 01604 781811

Poole & Milton Keynes

E: mail@jppuk.net **W**: jppuk.net

Client	Barratt Homes
Project	Proposed Residential Develolpment Land at Hogshaw Farm, Nunsfield Road, Buxton
Title	Drained Area Plan

Scale at A2	Drawn by	Checked by	Date
1:1000	IH	KER	26.04.2023

Status	Project ref	Drawing no.	Revision
FOR PLANNING	11024	FRA05	B

Appendix K
Attenuation Calculations

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	98.525	0.525	45.1	568.6	O K
30 min Summer	98.627	0.627	45.1	680.2	O K
60 min Summer	98.736	0.736	45.1	797.8	O K
120 min Summer	98.831	0.831	45.1	900.9	O K
180 min Summer	98.863	0.863	45.1	935.1	O K
240 min Summer	98.878	0.878	45.1	952.0	O K
360 min Summer	98.888	0.888	45.1	962.5	O K
480 min Summer	98.881	0.881	45.1	955.4	O K
600 min Summer	98.866	0.866	45.1	938.4	O K
720 min Summer	98.845	0.845	45.1	915.8	O K
960 min Summer	98.790	0.790	45.1	856.5	O K
1440 min Summer	98.662	0.662	45.1	717.6	O K
2160 min Summer	98.502	0.502	45.1	544.2	O K
2880 min Summer	98.390	0.390	45.0	422.3	O K
4320 min Summer	98.270	0.270	42.7	292.4	O K
5760 min Summer	98.232	0.232	35.9	252.0	O K
7200 min Summer	98.209	0.209	31.0	226.8	O K
8640 min Summer	98.192	0.192	27.3	208.4	O K
10080 min Summer	98.179	0.179	24.5	194.4	O K
15 min Winter	98.590	0.590	45.1	639.5	O K
30 min Winter	98.708	0.708	45.1	767.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	164.198	0.0	582.3	18
30 min Summer	100.796	0.0	717.7	33
60 min Summer	61.875	0.0	892.8	62
120 min Summer	37.983	0.0	1097.5	120
180 min Summer	28.551	0.0	1238.2	166
240 min Summer	23.316	0.0	1348.8	196
360 min Summer	17.526	0.0	1521.4	260
480 min Summer	14.313	0.0	1657.1	330
600 min Summer	12.232	0.0	1770.5	400
720 min Summer	10.759	0.0	1868.9	470
960 min Summer	8.754	0.0	2027.5	608
1440 min Summer	6.545	0.0	2273.0	866
2160 min Summer	4.894	0.0	2558.3	1228
2880 min Summer	3.982	0.0	2774.5	1560
4320 min Summer	2.943	0.0	3070.9	2208
5760 min Summer	2.374	0.0	3313.1	2944
7200 min Summer	2.010	0.0	3505.4	3672
8640 min Summer	1.755	0.0	3669.9	4408
10080 min Summer	1.564	0.0	3811.9	5136
15 min Winter	164.198	0.0	653.7	18
30 min Winter	100.796	0.0	805.3	32

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	98.833	0.833	45.1	903.2	O K
120 min Winter	98.943	0.943	45.1	1022.7	O K
180 min Winter	98.984	0.984	45.1	1066.9	O K
240 min Winter	98.996	0.996	45.1	1079.4	O K
360 min Winter	99.000	1.000	45.2	1083.5	O K
480 min Winter	98.983	0.983	45.1	1065.3	O K
600 min Winter	98.954	0.954	45.1	1033.9	O K
720 min Winter	98.918	0.918	45.1	995.2	O K
960 min Winter	98.830	0.830	45.1	899.8	O K
1440 min Winter	98.621	0.621	45.1	673.3	O K
2160 min Winter	98.392	0.392	45.0	425.2	O K
2880 min Winter	98.276	0.276	43.4	299.5	O K
4320 min Winter	98.219	0.219	33.1	237.2	O K
5760 min Winter	98.190	0.190	26.9	206.5	O K
7200 min Winter	98.172	0.172	22.8	186.4	O K
8640 min Winter	98.159	0.159	20.0	171.9	O K
10080 min Winter	98.148	0.148	17.8	160.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	61.875	0.0	1000.7	62
120 min Winter	37.983	0.0	1230.0	118
180 min Winter	28.551	0.0	1387.6	172
240 min Winter	23.316	0.0	1511.4	222
360 min Winter	17.526	0.0	1704.9	278
480 min Winter	14.313	0.0	1856.8	356
600 min Winter	12.232	0.0	1983.8	434
720 min Winter	10.759	0.0	2094.0	508
960 min Winter	8.754	0.0	2271.7	656
1440 min Winter	6.545	0.0	2547.3	922
2160 min Winter	4.894	0.0	2865.9	1256
2880 min Winter	3.982	0.0	3108.3	1532
4320 min Winter	2.943	0.0	3441.2	2244
5760 min Winter	2.374	0.0	3711.0	2944
7200 min Winter	2.010	0.0	3926.7	3680
8640 min Winter	1.755	0.0	4111.3	4408
10080 min Winter	1.564	0.0	4271.4	5144

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	406450 374300 SK 06450 74300
C (1km)	-0.025
D1 (1km)	0.411
D2 (1km)	0.398
D3 (1km)	0.369
E (1km)	0.301
F (1km)	2.404
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.940

Time (mins) From:	To:	Area (ha)
0	4	1.940

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Model Details

Storage is Online Cover Level (m) 100.000

Tank or Pond Structure

Invert Level (m) 98.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1084.0	1.000	1084.0	1.001	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0282-4520-1000-4520
Design Head (m)	1.000
Design Flow (l/s)	45.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	282
Invert Level (m)	98.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	45.2
Flush-Flo™	0.432	45.1
Kick-Flo®	0.774	40.0
Mean Flow over Head Range	-	36.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.8	1.200	49.3	3.000	76.8	7.000	116.1
0.200	29.0	1.400	53.1	3.500	82.8	7.500	120.1
0.300	43.9	1.600	56.7	4.000	88.4	8.000	124.0
0.400	45.0	1.800	60.0	4.500	93.6	8.500	127.7
0.500	44.8	2.000	63.1	5.000	98.5	9.000	131.3
0.600	44.0	2.200	66.1	5.500	103.2	9.500	134.8
0.800	40.6	2.400	69.0	6.000	107.7		
1.000	45.2	2.600	71.7	6.500	112.0		

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Appendix L
Overland Flows
JPP Consulting drawing no. 11024-FRA06B

General notes

All dimensions are in metres unless otherwise stated.

All levels are in metres.

This drawing is to be read in conjunction with all relevant Engineers and Architect's drawings, Specifications, Reports and Engineering Details.

Do not scale from this drawing.

Based on Topographical Land Survey by SurveyEng Ltd, drawing number BH.TS.12 Rev C dated 26.03.2021.

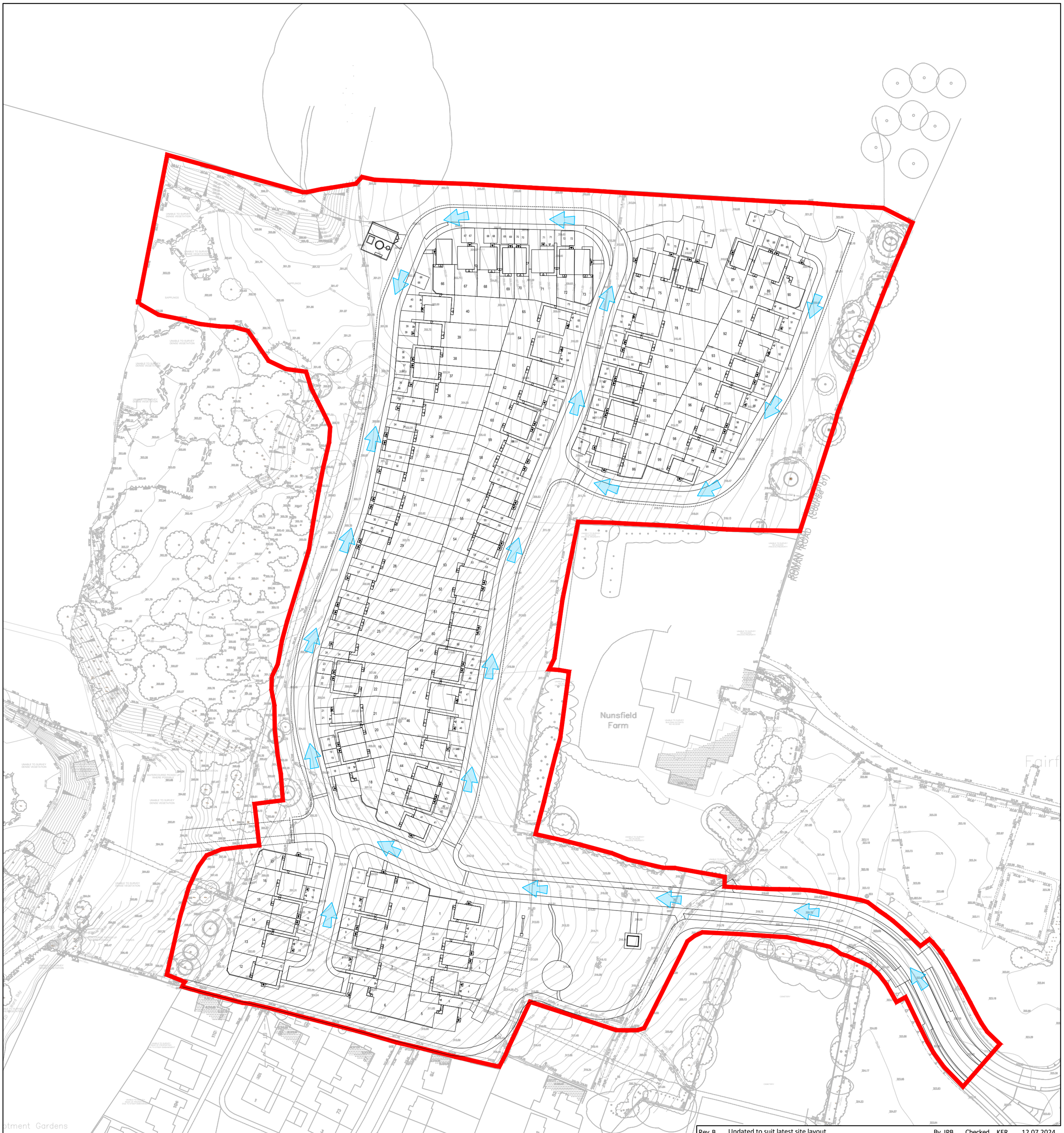
Based on Planning Layout by Barratt Homes, drawing number H8797-BAH-XX-XX-DR-UD-203001-P03 dated 28.06.2024.

Based on Drainage Layout by Barratt Homes, drawing number H8797-BAH-XX-XX-DR-CE-300001-P07 dated 01.07.2024.

Drawing Key

Predicted Overland Flows

Site Boundary



Drawing is not to be used for construction until status is CONSTRUCTION

Rev B	Updated to suit latest site layout	By	JPB	Checked	KER	12.07.2024
Rev A	Updated to suit latest site layout	By	JPB	Checked	KER	31.01.2024

jpp
- Infrastructure Design
- Structural Engineering
- Development Planning
- Professional Advice
- Geotechnical & Environmental
- Surveying

Northampton
Grand Union Works, Whilton Locks, Daventry
Northamptonshire, NN11 2NH
T: 01604 781811

Poole & Milton Keynes

E: mail@jppuk.net **W**: jppuk.net

Client	Barratt Homes
Project	Proposed Residential Develolpment Land at Hogshaw Farm, Nunsfield Road, Buxton
Title	Predicted Overland Flows

Scale at A2	Drawn by	Checked by	Date
1:1000	KER	KER	26.04.2023

Status	Project ref	Drawing no.	Revision
FOR PLANNING	11024	FRA06	B

Appendix M

Severn Trent Water Pre-Development Enquiry

WONDERFUL ON TAP

Severn Trent Water Ltd
Leicester Water Centre
Gorse Hill
Anstey
Leicester
LE7 7GU

Contact: Emma Nowak
Mob: 07970361864

Email:
Network.Solutions@SevernTrent.co.uk

Our ref: 1080322

JPP Consulting Ltd,
4 Ironstone Way,
Brixworth,
Northampton,
NN6 9UD.

FAO: Katherine Rose

20th April 2023

Dear Katherine,

Proposed Residential Development (116 Residential Dwellings) at: Land at Hogshaw Farm, Nunsfield Road, Buxton

X: 406585 / Y: 374410

I refer to your Development Enquiry Request submitted in respect of the above site. Please find enclosed the sewer records that are included in the fee together with the Supplementary Guidance Notes (SGN) referred to below.

Public Sewers in Site – Required Protection

There are no public sewers crossing the site.

Please Note: On 1st October 2011 many private sewers were transferred into the ownership of Severn Trent Water as public sewers, where two or more properties in separate ownership are served by those sewers. Most of these former private sewers will not be shown on the public sewer records, therefore a full site survey should be carried out prior to any layout design or construction works to identify where these sewers may be and to avoid later delays and possible added costs.

Foul Water Drainage

The most convenient point of connection for gravity foul flows from the site is at the 150mm public foul sewer southwest of the site at the junction of Barms Way & Nunsfield Road. A gravity connection for an additional 116 dwellings (1.8 l/s 2DWF) would be acceptable at this sewer at a new or existing manhole (5203) subject to formal 106 approval.

Please note that a gravity connection should be viable for the whole site, however should after investigations, a pumped

connection be required for any part of the site, please notify us as soon as possible further modelling may be required to understand the impact of increased flows in the foul network.

Surface Water Drainage

Under the terms of Section H of the Building Regulations 2000, the disposal of surface water by means of soakaways should be considered as the primary method. If this is not practical a connection to the watercourse southeast of the site would be acceptable subject to LLFA approval. In addition, other sustainable drainage methods should also be explored before a discharge to the public sewerage system is considered.

If these are found to be unsuitable, satisfactory evidence will need to be submitted. The evidence should be either percolation test results or by the submission of a statement from the SI consultant (extract or a supplementary letter).

The site drainage should be discussed with the Local Lead Flood Authority with a view to implement suitable SuDS techniques to land soakaways or other land drainage systems prior to any consideration of discharges to public sewers being accepted. Any discharge rate to a watercourse or drainage ditch will be determined by the LLFA.

Should soakaways / SuDs prove not to be viable, the Nun Brook runs west of the proposed development. A connection to the watercourse should be pursued but may require the crossing of third-party land. Please note, that if you cannot gain consent from the landowner, a S98 Sewer Requisition may be required. For your information, STW have the right to lay sewers through 3rd party land even unregistered land, however, STW do not have the right to discharge to a watercourse/ditch. In order to discharge to a watercourse we require a Deed Of Grant Of Easement (DOGOE) from the watercourse owner. Please liaise with the LLFA as statutory consultee in the planning process to agree flow rates at this location.

No impact on the public network.

WONDERFUL ON TAP

SEVERN TRENT

New Connections

For any new connections including the use, reuse and indirect to the public sewerage system, the developer will need to submit Section 106 application. Our Developer Services department are responsible for handling all such enquiries and applications. To contact them for an application form and associated guidance notes, please call 0800 707 6600, email new.connections@severntrent.co.uk or download from www.stwater.co.uk

Please quote the above reference number in any future correspondence (including e-mails) with STW Limited. Please send **all correspondence** to the network.solutions@severntrent.co.uk email inbox address, a response will be made within 15 days.

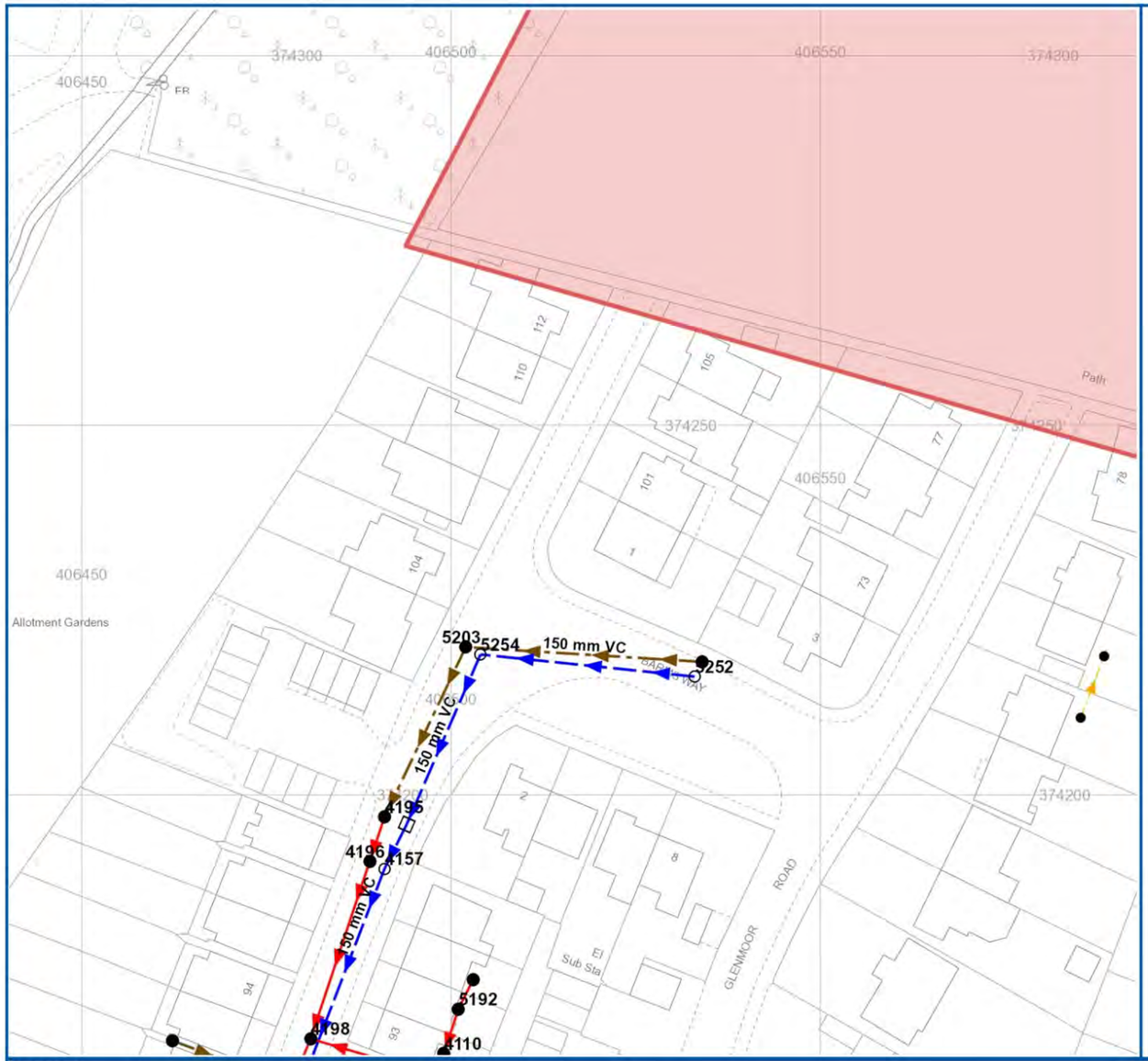
If you require a VAT receipt for the application fee please email MISCINCOME.NC@SEVERNTRENT.CO.UK quoting the above Reference Number.

Please note that Developer Enquiry responses are only valid for 6 months from the date of this letter.

Yours sincerely,

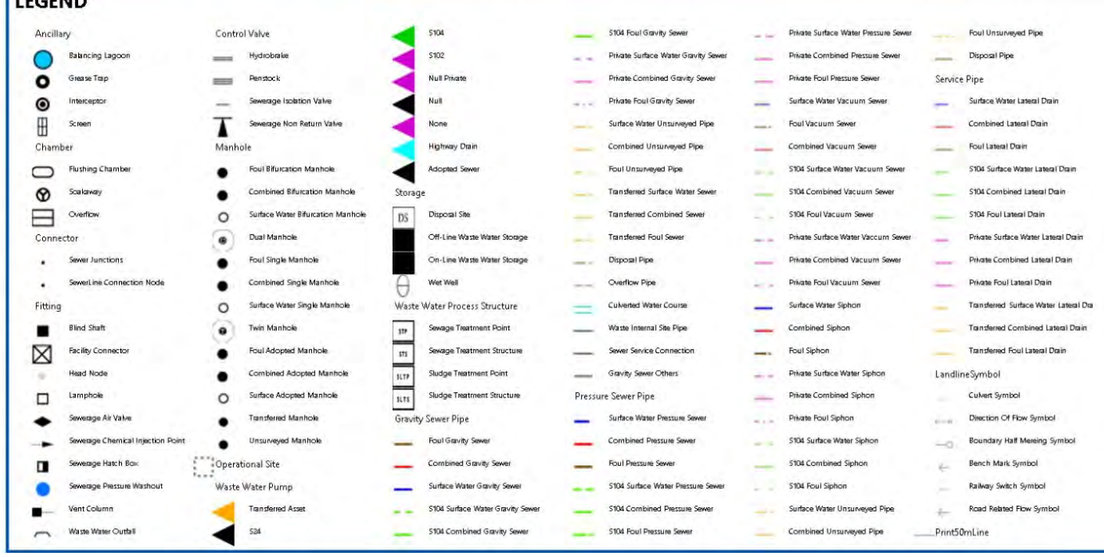


Emma Nowak.
Senior Evaluation Technician
Network Solutions
Developer Services



Reference	Cover Level	Invert Level Upstream	Invert Level Downstream	Purpose	Material	Pipe Shape	Max Size	Min Size	Gradient	Year Laid
SK06745203	306.1759	304.78	303.4	F	VC	C	150	<UNK>	18.48	31/12/1899 00:00:00
SK06745254	306.242	304.93	303.91	S	VC	C	150	<UNK>	24.59	31/12/1899 00:00:00
SK06744196	304.957	<UNK>	300.86	C	VC	C	<UNK>	<UNK>	0	31/12/1899 00:00:00
SK06745201	309.9079	308.58	304.79	F	VC	C	150	<UNK>	8.46	31/12/1899 00:00:00
SK06744195	305.1549	303.4	<UNK>	C	VC	C	150	<UNK>	0	31/12/1899 00:00:00
SK06745191	306.591	305.981	305.746	C	VC	C	100	<UNK>	18.63	31/12/1899 00:00:00
SK06744110	306.3659	305.206	<UNK>	C	VC	C	100	<UNK>	0	31/12/1899 00:00:00
SK06745252	309.9419	308.572	304.94	S	VC	C	150	<UNK>	8.03	31/12/1899 00:00:00
SK06745192	306.436	305.726	305.226	C	VC	C	100	<UNK>	12.64	31/12/1899 00:00:00
SK06744198	304.035	300.84	299.375	C	VC	C	225	<UNK>	33.86	31/12/1899 00:00:00
SK06744157	304.967	303.537	<UNK>	S	VC	C	150	<UNK>	0	31/12/1899 00:00:00
<UNK>	<UNK>	<UNK>	<UNK>	F	VC	<UNK>	<UNK>	<UNK>	<UNK>	05/07/2020 00:00:00
<UNK>	<UNK>	<UNK>	<UNK>	F	VC	<UNK>	<UNK>	<UNK>	<UNK>	14/04/2021 00:00:00

LEGEND



MATERIALS

- - NONE
- AC - ASBESTOS CEME
- BR - BRICK
- CC - CONCRETE BOX CULVERT
- CI - CAST IRON
- CO - CONCRETE
- CSB CONCRETE SEGMENTS (BOLTED)
- CSU - CONCRETE SEGMENTS (UNBOLTED)
- DI - DUCTILE IRON
- GRP - GLASS REINFORCED PLASTIC
- MAC - MASONRY IN REGULAR COURSES
- MAR - MASONRY RANDOMLY COURSED
- PE - POLYETHLENE
- PF - PITCH
- PP - POLYPROPYLENE
- PSC - PLASTIC STEEL COMPOSITE
- PVC - POLYVINYL CHLORIDE
- RPM - REINFORCED PLASTIC MATRIX
- SI - SPUN (GREY) IRON
- ST - STEEL
- U - UNKNOWN
- VC - VITRIFIED CLAY
- XXX - OTHER

CATEGORIES

- W - WEIR
- C - CASCADE
- DB - DAMBOARD
- SE - SIDE ENTRY
- FV - FLAP VALVE
- BD - BACK DROP
- S - SIPHON
- D - HIGHWAY DRAIN
- S104 - SECTION 104

SHAPE

- C - CIRCULAR
- E - EGG SHAPED
- O - OTHER
- R - RECTANGLE
- S - SQUARE
- T - TRAPEZOIDAL
- U - UNKNOWN

PURPOSE

- C - COMBINED
- E - FINAL EFFLUENT
- F - FOUL
- L - SLUDGE
- S - SURFACE WATER

Severn Trent Water Limited
Asset Data Management
PO Box 5344
Coventry
CV3 9FT
Telephone: 0345 601 6616

SEWER RECORD (Tabular)

O/S Map Scale: 1:750 **This map is centred upon:**

Date of Issue: 20-04-23 **X:** 406516.49 **Y:** 374235.53

Disclaimer Statement:

1 Do not scale off this Map.

2 This plan and any information supplied with it is furnished as a general guide, is only valid at the date of issue and no warranty as to its correctness is given or implied. In particular this plan and any information shown on it must not be relied upon in the event of any development or works (including but not limited to excavations) in the vicinity of SEVERN TRENT WATER assets or for the purposes of determining the suitability of a point of connection to the sewerage or distribution systems.

3 On 1 October 2011 most private sewers and private lateral drains in Severn Trent Water's sewerage area, which were connected to a public sewer as at 1 July 2011, transferred to the ownership of Severn Trent Water and became public sewers and public lateral drains. A further transfer takes place on 1 October 2012. Private pumping stations, which form part of these sewers or lateral drains, will transfer to ownership of Severn Trent Water on or before 1 October 2016. Severn Trent Water does not possess complete records of these assets. These assets may not be displayed on the map.

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Appendix N

Hydraulic Modelling Report
JBA Technical Note 2023s1142

JBA Project Code	2023s1142
Contract	Hydraulic Modelling at Hogshaw Farm
Client	Barratt Homes Manchester
Date	January 2024
Author	Ella Albrighton BSc
Reviewer / Sign-off	Amy Evans BSc MCIWEM C.WEM
Subject	Hydraulic Modelling at Hogshaw Farm, Buxton

1 Introduction

1.1 Terms of reference

JBA Consulting were commissioned by JPP Consulting Ltd on behalf of Barratt Homes Manchester to undertake a fluvial hydraulic modelling study in order to support their planning application for a proposed development at their site at Hogshaw Farm, Buxton.

The Nun Brook, which becomes an Environment Agency Main River downstream of the site, flows in a southerly direction through the north-western part of the site. The watercourse is culverted during this reach. The culvert has a diameter of 1.22m. The location of the site and the Nun Brook are included within Figure 1-1 below.

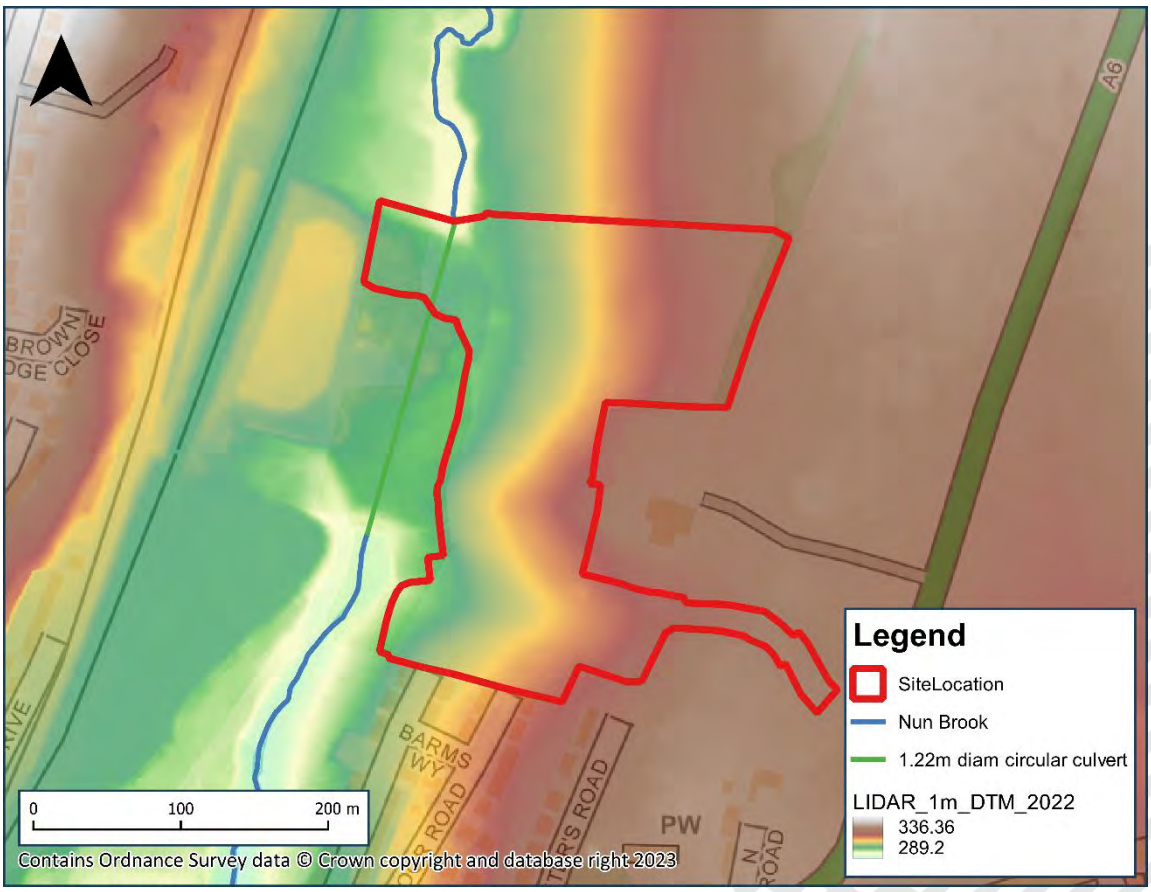


Figure 1-1 - Site Location

2 Baseline Hydraulic modelling

2.1 Modelling Approach

A license to re-use the 1D-2D ESTRY-TUFLOW 2022 Hogshaw and Nun Brook hydraulic model was obtained from the Environment Agency for use in this study. The hydrology inflows, calculated in 2022 as part of the original modelling, were retained as these still reflect best practises.

The extent of the existing model in relation to the site is shown within Figure 2-1 below.

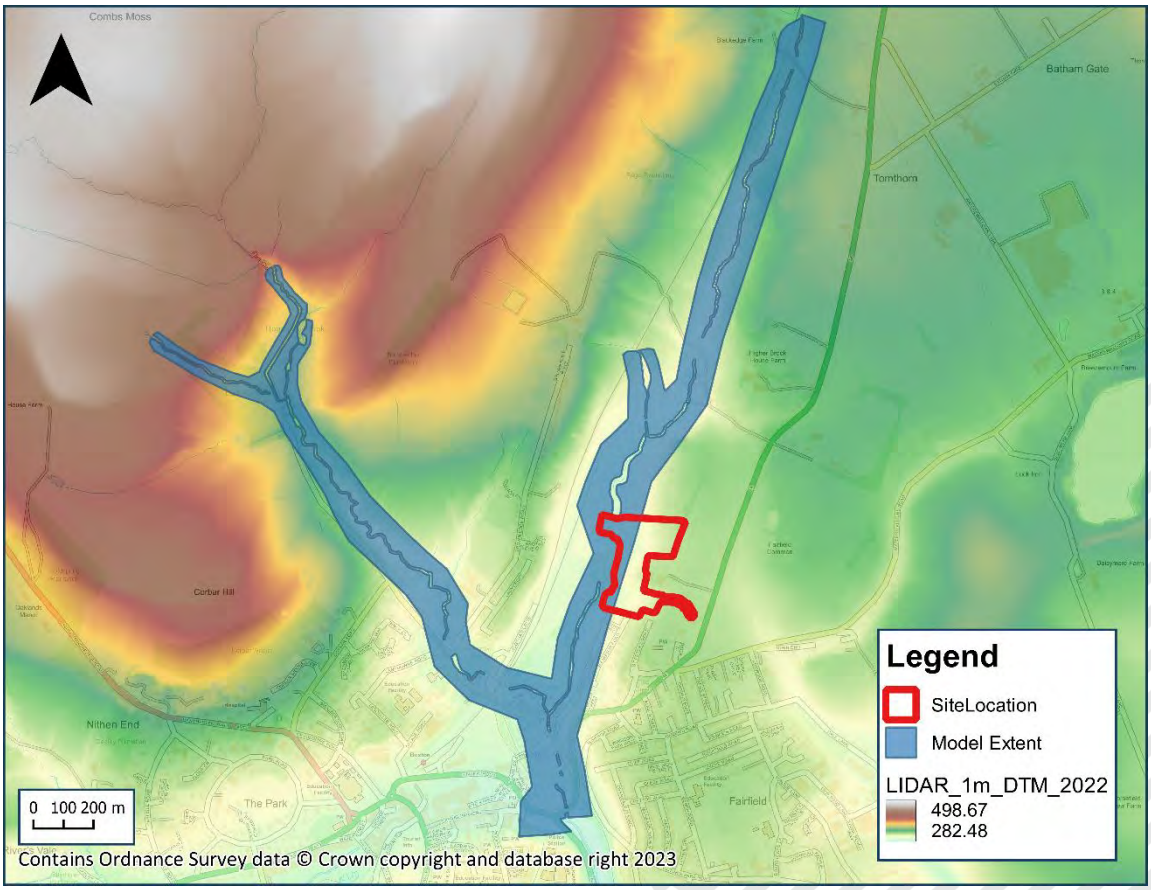


Figure 2-1: Existing model extent

New topographic survey data (included within Appendix A) representing the current ground levels within the site was integrated within the model.

The updated and refined baseline model was run with TUFLOW version 2023-03-AA-iDP-w64 for the 30-year, 100-year, 100-year with climate change (29%) and 1000-year fluvial flood events.

2.2 Baseline model results

2.2.1 Baseline flood extents

The baseline flood extents during the 30-year, 100-year and 1000-year events are shown in Figure 2-2 below. Figure 2-3 shows the impact of climate change on the 100-year flood extents.

This shows that only the north-western area of the site is included with the maximum flood extent during all of the modelled flood extents.

Figure 2-3 shows that, when 29% climate change is applied to the 100-year event, there is no impact on flood extents within the site. Upstream of the site, there is a slight increase in flood extent.

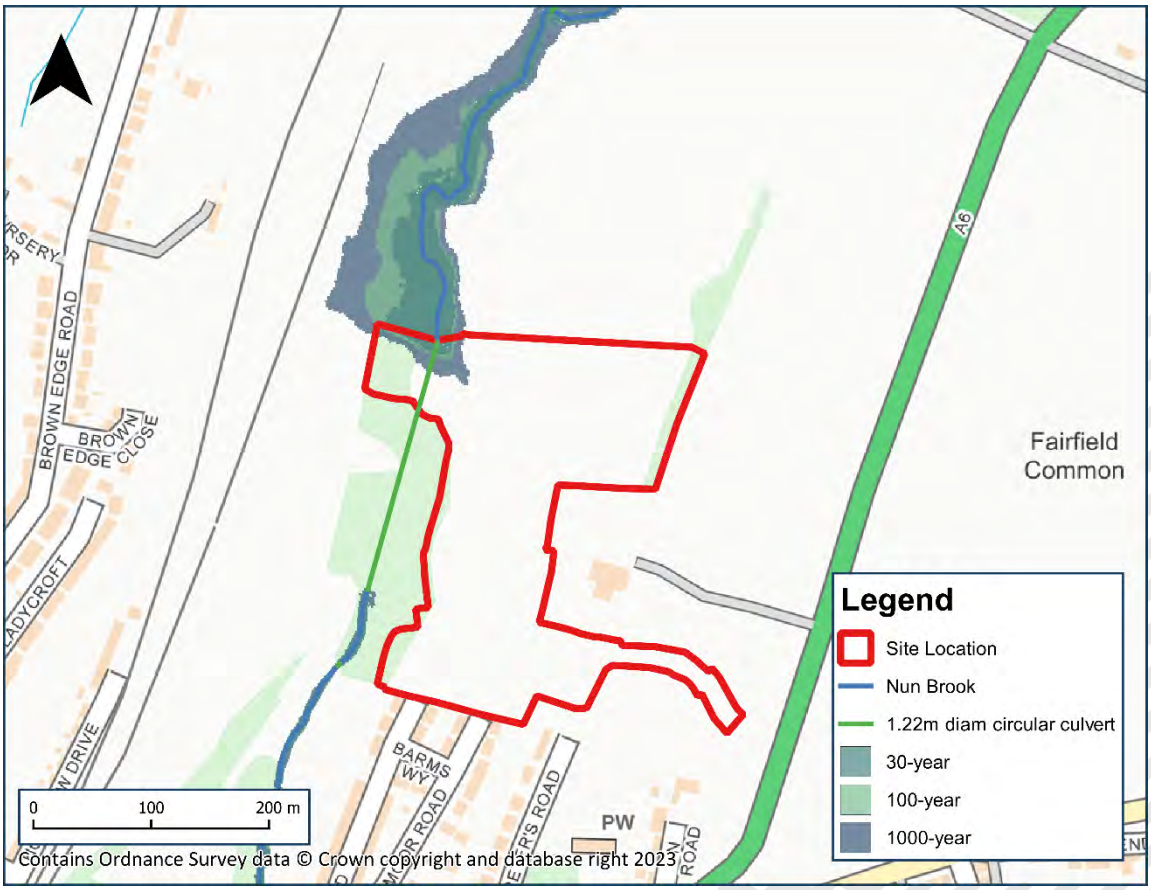


Figure 2-2: Baseline flood extents

JBA Project Code	2023s1142
Contract	Hydraulic Modelling at Hogshaw Farm
Client	Barratt Homes Manchester
Date	January 2024
Author	Ella Albrighton BSc
Reviewer / Sign-off	Amy Evans BSc MCIWEM C.WEM
Subject	Hydraulic Modelling at Hogshaw Farm, Buxton

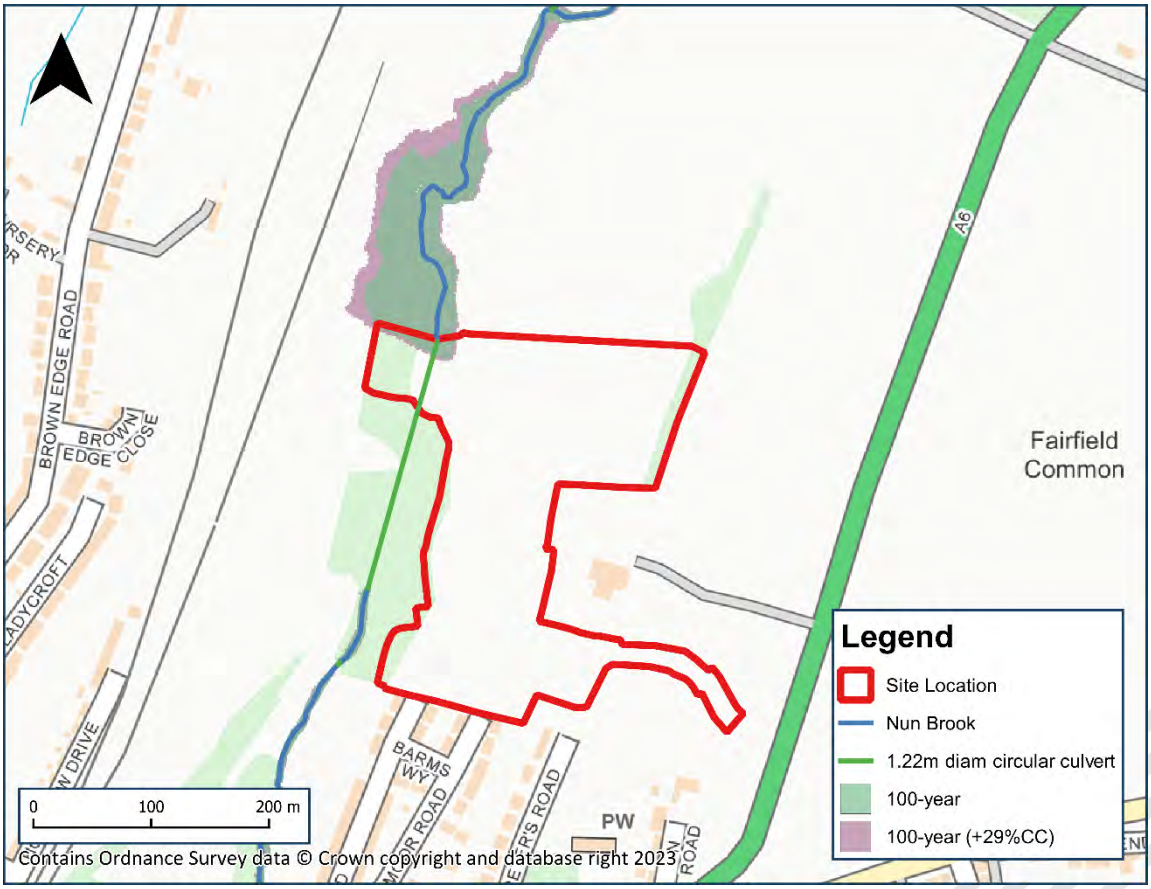


Figure 2-3: Baseline flood extent with climate change

2.2.2 Baseline flood depths

The flood depths within the site during the 100-year with 29% climate change flood event (i.e. the design event) are shown within Figure 2-4.

This shows that within the site, the maximum flood depths are upstream of the 1.22m diameter culvert inlet. The maximum flood depth in this area is 4.02m, within the area of low elevation surrounding the channel.

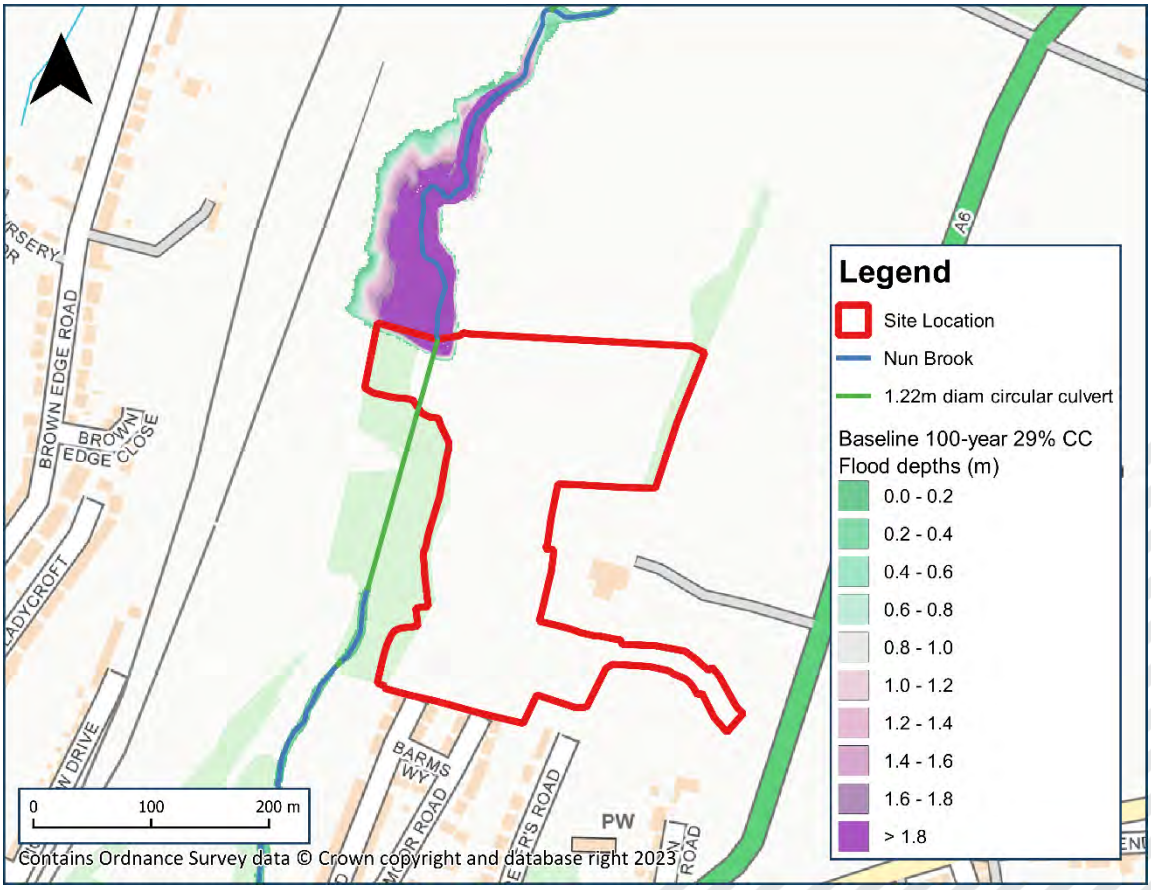


Figure 2-4: Baseline flood depths

2.2.3 Baseline water levels

The water levels during the baseline 100-year with 29% climate change are shown in Figure 2-5. During the baseline 100-year with 29% climate change event, the peak water level onsite and at the inlet of the culvert is 299.90m AOD.

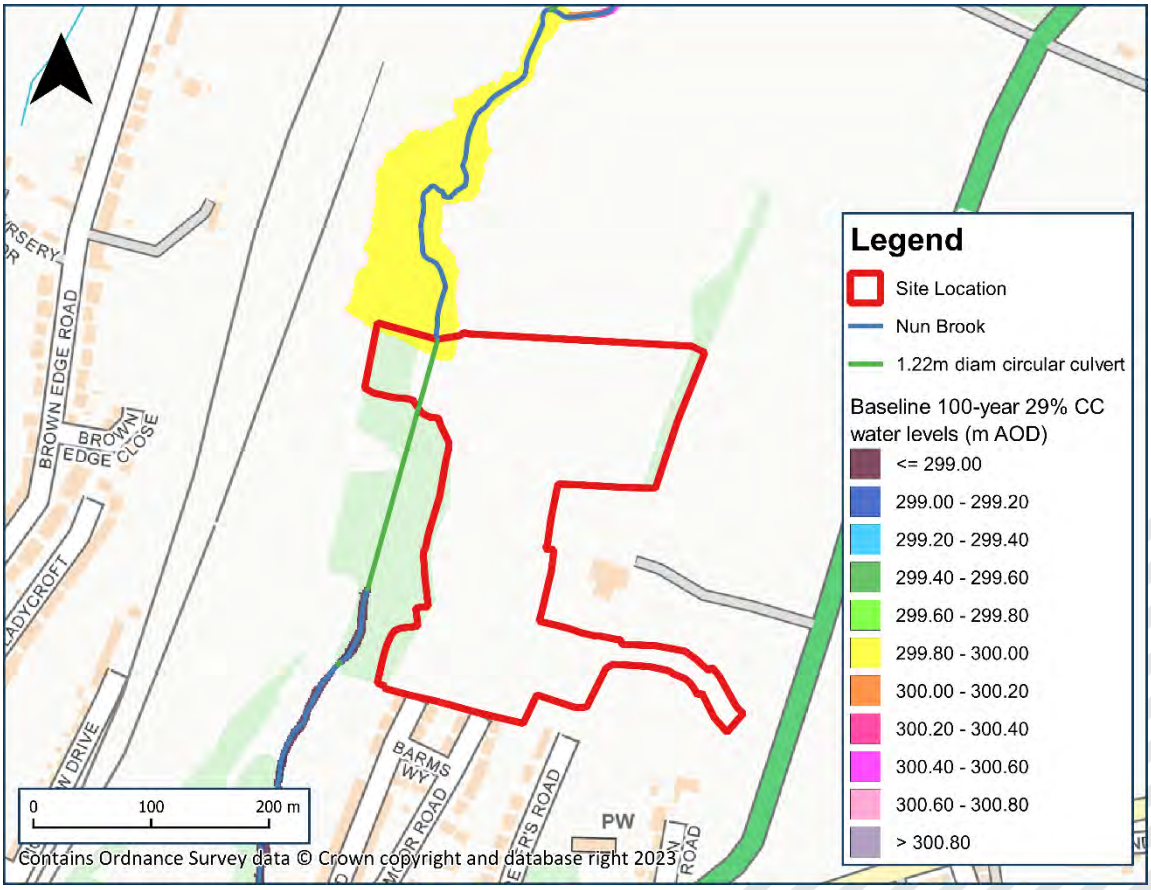


Figure 2-5: Baseline water levels

2.2.4 Baseline hazard to people

The fluvial hazard-to-people rating during a 100-year with 29% climate change flood scenario has been mapped using the formula as suggested in Defra's FD2321/TR2 "Flood Risk to People". The different hazard categories are shown in Table 2-1 and the hazard classification to the site during the 100-year with 29% climate change scenario is shown in Figure 2-6.

Table 2-1 Flood Risk to People Hazard to People

Flood hazard rating depth x (velocity+0.5) +DF	Level of Flood Hazard Description	Class label
<0.75	Low	Caution "Flood zone with shallow flowing water or deep standing water"
0.75 to 1.25	Moderate	Dangerous for some (i.e. Children) "Danger: flood zone with deep or fast flowing water"
1.25 to 2.00	Significant	Danger for most "Danger: flood zone with deep fast flowing water"
>2.00	Extreme	Dangerous for all "Extreme danger: flood zone with deep fast flowing water"
Using the hazard equation HR = d*(v+0.5) + DF Where d = depth of flooding (m) v = velocity of floodwaters (m/sec) DF = debris factor		

JBA Project Code	2023s1142
Contract	Hydraulic Modelling at Hogshaw Farm
Client	Barratt Homes Manchester
Date	January 2024
Author	Ella Albrighton BSc
Reviewer / Sign-off	Amy Evans BSc MCIWEM C.WEM
Subject	Hydraulic Modelling at Hogshaw Farm, Buxton

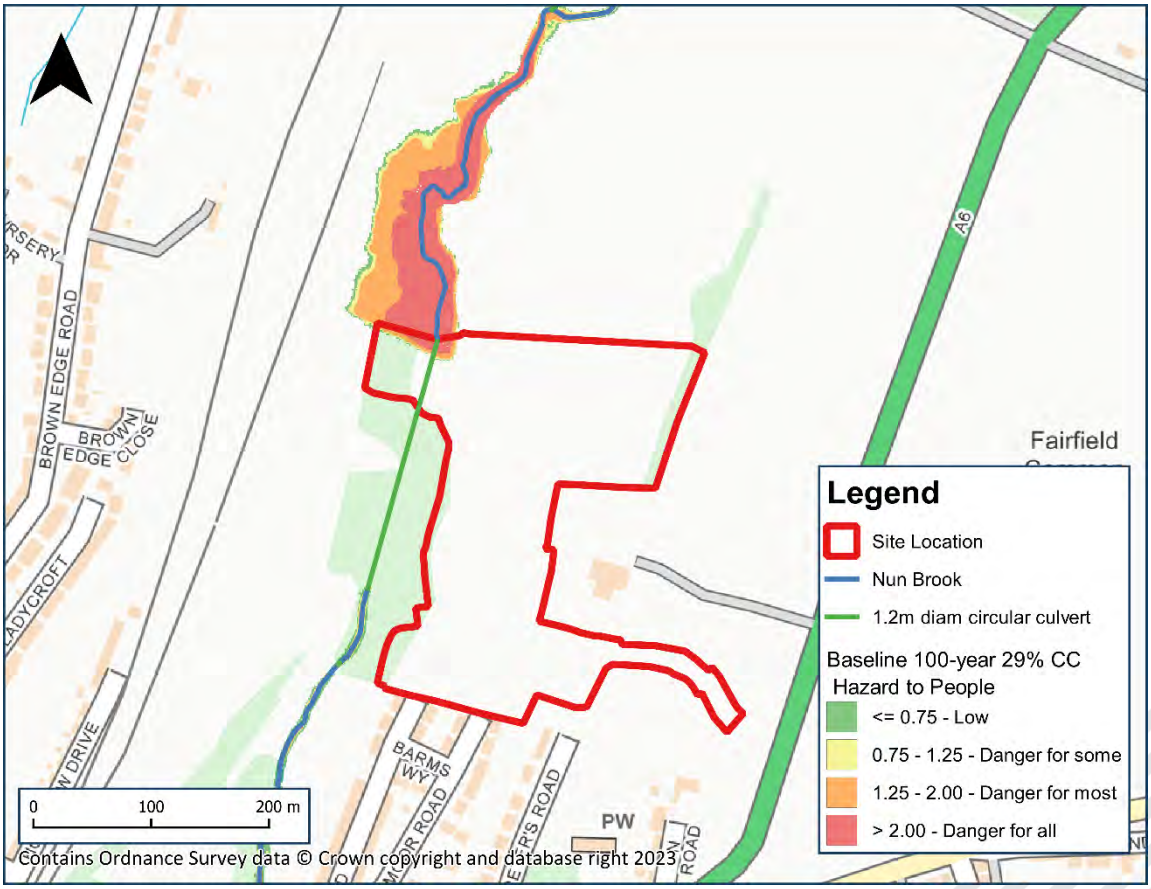


Figure 2-6: Baseline hazard to people

Figure 2-6 shows that during the baseline 100-year with 29% climate change event the north-western area of the site is partially within the 'danger for all' hazard category. However, this is primarily the channel and immediate floodplain of the Nun Brook.

2.3 Blockage analysis

The residual risk of a blockage at the inlet of the 1.22m diameter culvert has been considered as part of this study. In order to represent the worst-case scenario a 100% blockage at the structure has been modelled. Figure 2-7 shows the maximum flood extent during the 100% blockage at the structure during a 100-year with 29% climate change flood event. This shows that the flood extent is larger during this event where flows build up behind the inlet before eventually flowing overland to the downstream culvert extent where the Nun Brook becomes open channel.

Figure 2-8 shows the peak water levels associated with this residual event.

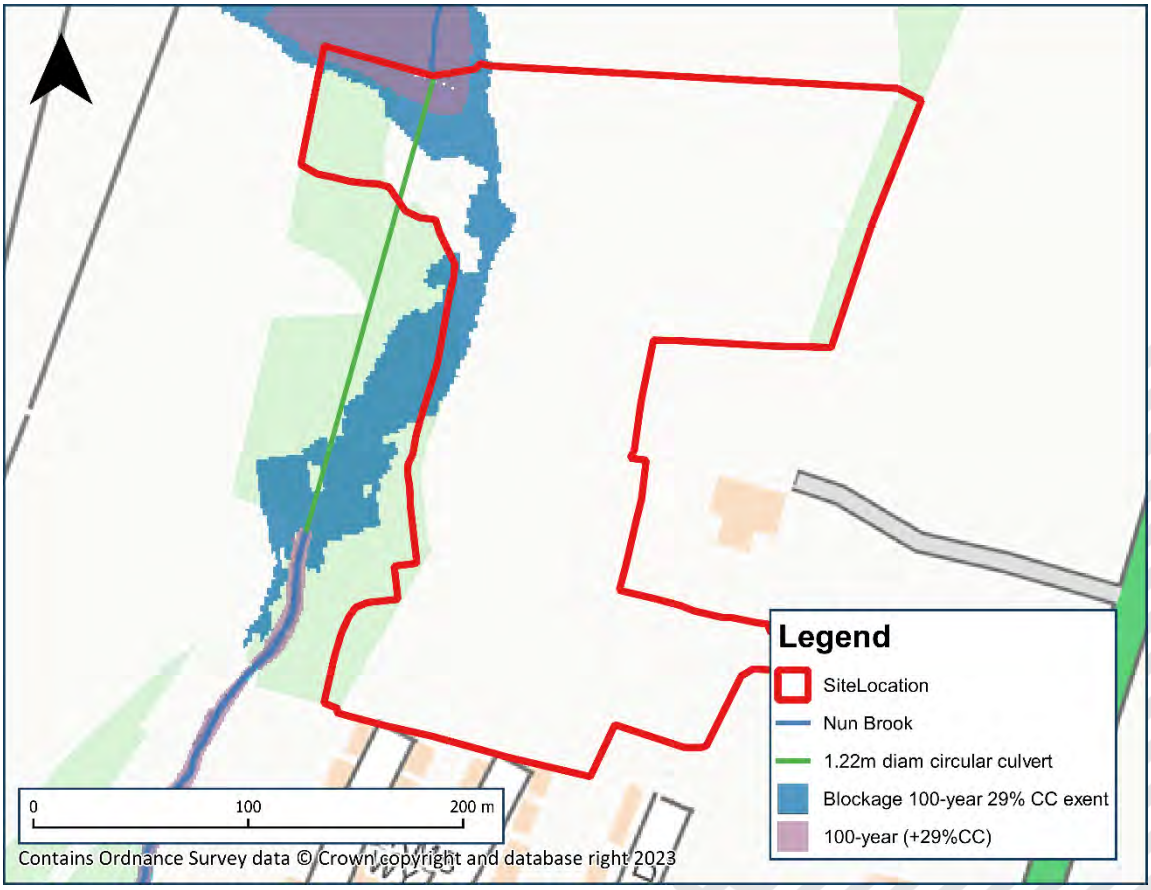


Figure 2-7: Blockage extent

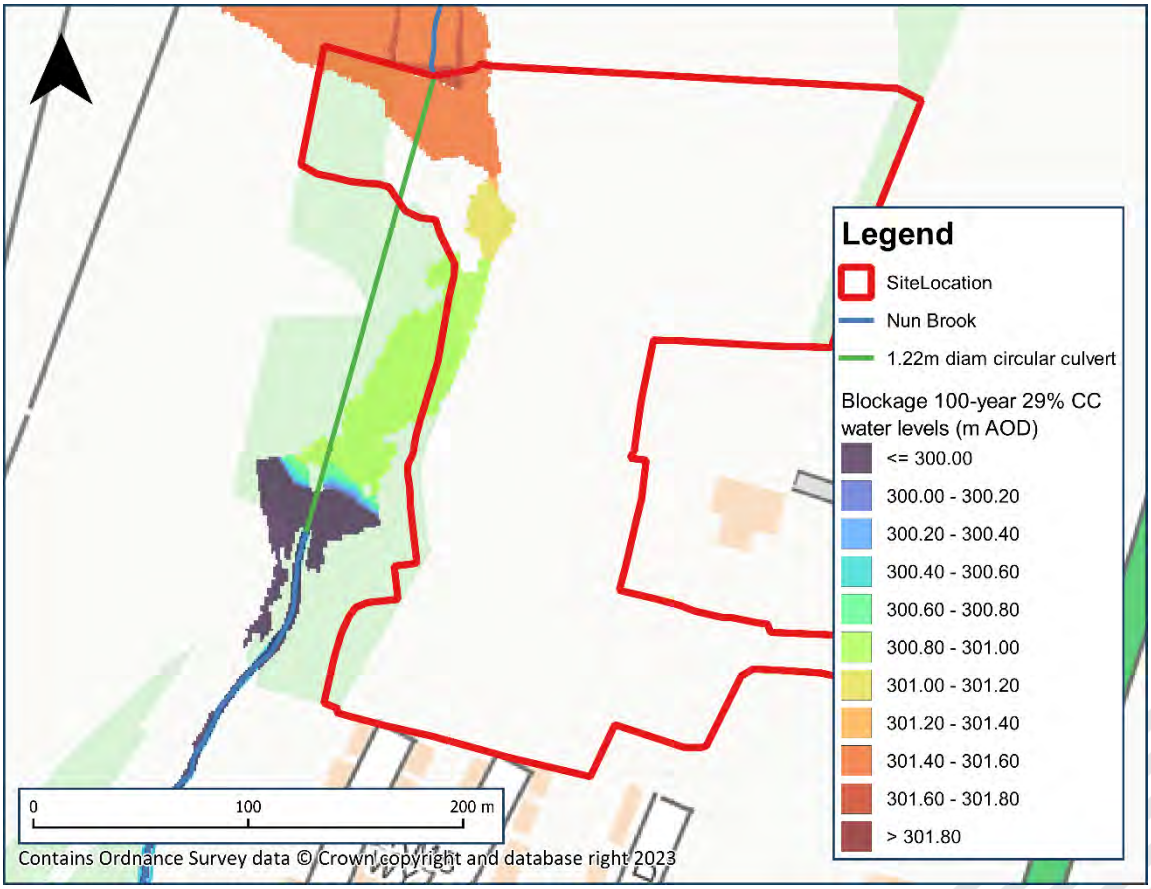


Figure 2-8: Blockage water levels

Figure 2-8 shows that during the 100-year with 29% climate change flood event with a 100% culvert blockage, the modelled peak water level is 301.78m AOD in the north-western area of the site. This is a 1.88m increase in peak water level compared to the baseline scenario.

3 On-site Surface Water Discharge Hydraulic Modelling

3.1 Modelling Approach

In order to assess the impact of the surface water drainage scheme proposed as part of the development, an assessment of the pre- and post- on-site surface water flows was completed using the baseline modelling described in Section 3.

3.2 Revised baseline reflecting current greenfield runoff flows

The existing greenfield run-off rates have been calculated as part of the proposed drainage strategy produced for the site by JPP Consulting. Appendix I of their report states that the peak greenfield runoff rate for the site for the 100-year rainfall event is 116.2 l/s. For the revised baseline scenario, this has been converted into m^3/s and read into the model as a lateral constant flow downstream of the 1.22m diameter culvert, inline with the ground levels within the site. In order to account for climate change, this inflow has been increased by 40%.

Applying the greenfield runoff from the site directly as a point inflow is a conservative approach as the existing model hydrology will account for the site runoff. Also, in reality, the flow would exhibit a hydrograph shape and would not be a constant. However, it was considered necessary to apply this to the baseline as the proposed drainage strategy discharge is to be applied to the post developed model scenario in a similar way.

The revised baseline model scenario was then run for the 100-year 29% climate change event.

3.3 Post-developed model reflecting the proposed on-site surface water outfall

The principal of the proposed drainage strategy for the development is for the whole site to drain to the watercourse, upstream of the 1.22m culvert via an attenuation basin. Discharge from the site into the watercourse will be restricted to 45.2l/s during the 100-year plus climate change (40%) rainfall event. In order to represent the impact of the proposed surface water discharge within the site, this has been modelled in a post-development model scenario.

During the post-development scenario, the proposed peak discharge (45.2l/s) has been applied as a constant flow upstream of the culvert as a lateral inflow to the watercourse. Note that this is conservative as in reality the flow would exhibit a flattened peak hydrography shape. The hydrology from the remaining model remains as per the baseline modelling but the greenfield runoff rate inflow applied to the revised baseline was excluded.

The post developed model scenario was then run for the 100-year 29% climate change event.

3.4 On-site Surface Water Discharge Hydraulic Modelling - Revised Baseline and Post-developed results

The results from the revised baseline modelling and post-development modelling were compared. The impact of the post-developed surface water drainage strategy on downstream flood extents is shown in Figure 3-1 below.

This shows that, with the proposed drainage strategy in place, there is a slight reduction in the flood extent downstream of the site as a greater proportion of the flow is held upstream of the 1.22m culvert. Figure 3-2 below shows the impact on flood depths during the 100-year with climate change event. It shows that there is a reduction in the flood depths downstream within the north-eastern area of Buxton. There is an increase in flood depths upstream of the site of up to 0.05m, however, the extent is unchanged.

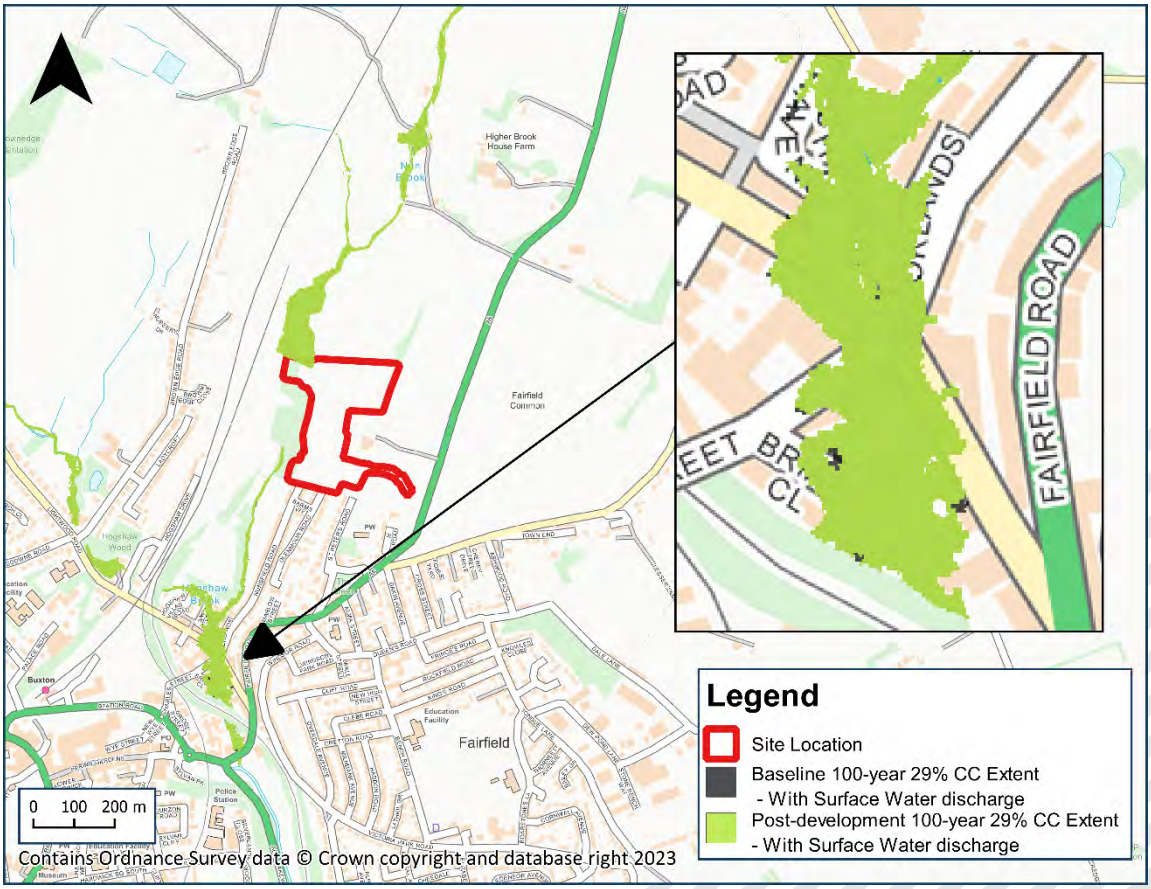


Figure 3-1: Impact on flood extents from surface water discharge amendment

JBA Project Code	2023s1142
Contract	Hydraulic Modelling at Hogshaw Farm
Client	Barratt Homes Manchester
Date	January 2024
Author	Ella Albrighton BSc
Reviewer / Sign-off	Amy Evans BSc MCIWEM C.WEM
Subject	Hydraulic Modelling at Hogshaw Farm, Buxton

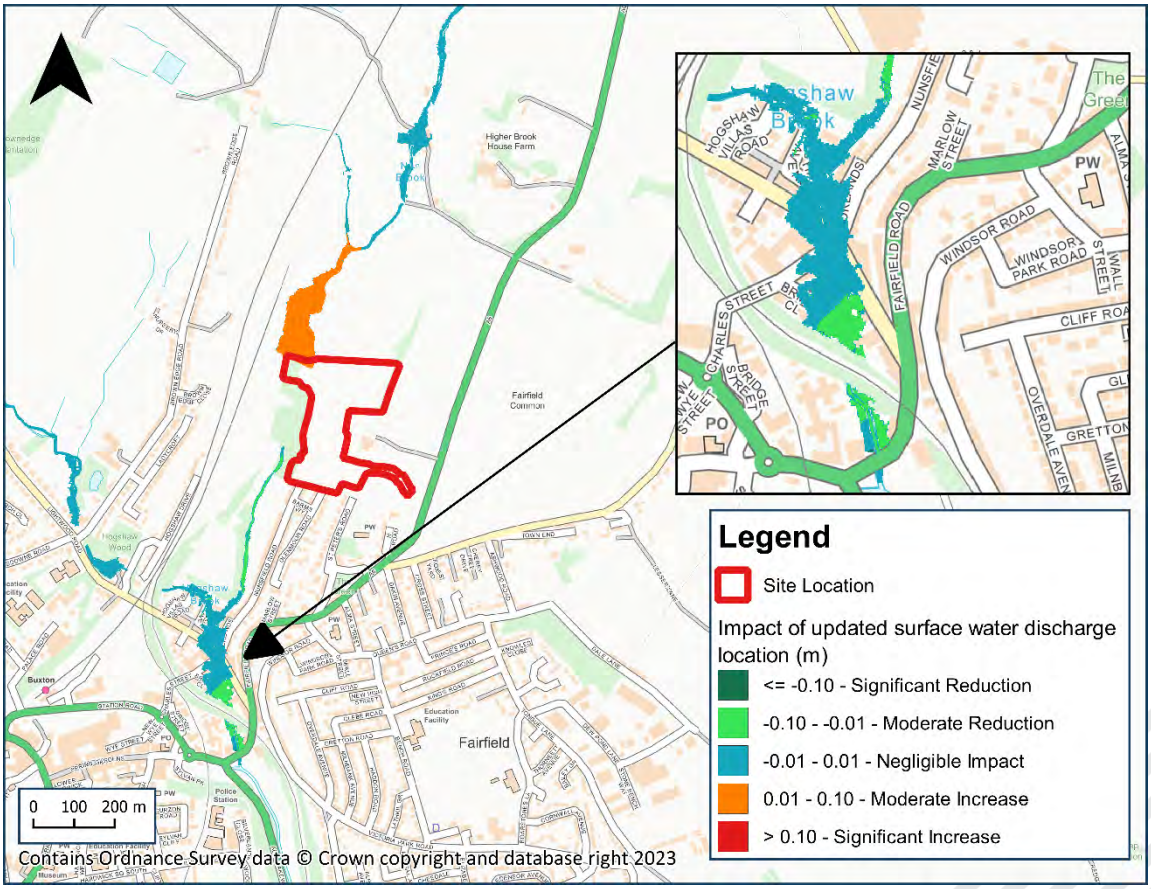


Figure 3-2: Impact on flood depths from surface water discharge amendment

4 Conclusion

- JBA Consulting were commissioned by JPP Consulting Ltd on behalf of Barratt Homes Manchester to undertake a fluvial hydraulic modelling study in order to support their planning application for a proposed development at their site at Hogshaw Farm, Buxton.
- The Nun Brook flows in a southerly direction through the north-western part of the site. The watercourse is culverted during this reach.
- A license to re-use the 1D-2D ESTRY-TUFLOW 2022 Hogshaw and Nun Brook hydraulic model was obtained from the Environment Agency for use in this study. The hydrology inflows, calculated in 2022 as part of the original modelling, were retained as these still reflect best practises.
- New topographic survey data representing the current ground levels within the site was integrated within the model.
- The updated and refined model was run with TUFLOW version 2023-03-AA-iDP-w64 for the 30-year, 100-year, 100-year with climate change (29%) and 1000-year fluvial flood events.
- Baseline model results show:
    - only the north-western area of the site is included with the maximum flood extent during all of the modelled flood extents. Model results show when 29% climate change is applied to the 100-year event, there is no impact on flood extents within the site. Upstream of the site, there is a slight increase in flood extent.
    - Within the site, the maximum flood depths can be found along the north-eastern area of the site upstream of the 1.22m diameter culvert. The maximum flood depth in this area is 4.02m.
    - During the baseline 100-year with 29% climate change event, the peak water levels is 299.90m AOD within the site.
    - The north-eastern areas of the site during the baseline 100-year with 29% climate change event the site is partially within the 'danger for all' hazard category.
- To represent the worst-case scenario, a 100% blockage at the 1.22m diameter culvert has been modelled for the 100-year with 29% climate change event. The blockage model results show that:
    - The flood extent is larger during this event where flows build up behind the culvert inlet before eventually flowing overland to the downstream culvert extent where the Nun Brook becomes open channel.
    - Within the site, during a 100% culvert blockage scenario, the peak water level will be 301.78m AOD in the north-western part of the site.
- In order to assess the impact of the surface water drainage scheme proposed as part of the development, an assessment of the pre- and post- on-site surface water flows was completed.
    - The existing greenfield run-off rates have been calculated as part of the drainage strategy produced for the site. A revised baseline model scenario was

set up which includes a lateral flow into the model to represent the greenfield 1 in 100 year plus climate change peak runoff (116.2 l/s). A review of ground levels within the site shows that the majority of this greenfield flow would enter the Nun Brook downstream of the 1.22m diameter culvert and therefore, this is where the lateral inflow has been applied for the revised baseline model scenario.

- During the post-development scenario, the proposed drainage strategy was represented by applying a lateral inflow at the proposed attenuated rate of 45.2l/s. In line with the proposed strategy, the lateral inflow in the post-developed model was applied upstream of the 1.22m.
- The pre- and post- on-site surface water modelling result show:
  - With the proposed drainage strategy in place, there is a slight reduction in the flood extent downstream of the site.
  - There is a reduction in the flood depths downstream within the north-eastern area of Buxton. There is an increase in flood depths upstream of the site of up to 0.05m however, the extent is unchanged.

Report on Drainage Strategy to Accompany Planning Application for Hogshaw Farm, off Fairfield Road, Buxton

by

Barratt Manchester

Revision	Date	Prepared By	Revision Notes
-	23.02.24	CD	
A	08.07.24	CD	Updated to suit latest planning layout

Contents

1. Introduction
2. Site Details
3. Pre-Development Greenfield Run Off
4. Soakaway Testing
5. Post-Development Surface Water Allowable Discharge Rates
6. Design Parameters
7. Summary of Drainage Design
8. Urban Creep
9. Design for Exceedance
10. Maintenance
11. Defect Reporting
12. Response Times

Drawings

1. Topographical Survey – SurveyEng Ltd; BH.TS.12 Rev C; March 2021
2. Preliminary Drainage Layout – H8797-BAH-XX-XX-DR-CE-300001 P07

Appendices

A. Flood Risk Assessment – JPP Consulting Ltd; R-FRA-11024R-01; July 2024
B. Ground Investigation Report – Soiltechnics; STQ4642M-G01 Rev 03; April 2023

1. Introduction

The following document has been prepared to assist the designer's preparation and the readers understanding of the drainage theory in one reference document.

2. Site Details

Development Name	Hogshaw Farm, Buxton
Site Address	Fairfield, Buxton, SK17 7HN
Longitude, Latitude (or OS Grid Ref)	406582; 374317
Site Description	3 No. open grassed fields separated by an existing dry stone walls footpath and hedgerow. Currently pasture lane.
Site Area (Ha)	4.20 Ha
Site Area used for calculating Greenfield Run-Off Rates (Ha)	3.72 Ha
Existing Impermeable Area (Ha)	0Ha
Is the Site Steeply Sloping (Y/N), If "Yes" Typical Gradient.	Yes, average gradient 1 in 8

Table 1

3. Pre-Development Greenfield Runoff Rates

Return Period	**Greenfield Rate (L/s)**
1 in 1 Year	37.5
Qbar	45.2
1 in 30 Year	88.6
1 in 100 Year	116.2

Table 2

4. Soakaway Testing

A site specific site investigation was carried out by Soilltechnics dated April 2023. A copy of the site investigation is presented in Appendix B.

Ground conditions are typically 0.30m of topsoil overlaying weathered Limestone and Shale bedrock.

Hydraulic conductivity tests were performed within selected boreholes as part of the ground investigation report undertaken by Soiltechnics. The infiltration testing has provided good permeability between 2.94 x 10^{-6} m/s to 3.12 x 10^{-6} m/s. However, due to the following reasons, infiltration disposal may not be the best option:

- Existing air voids within the strata could collapse with increased water causing compaction and depressions
- Steep slopes could become unstable with increased water
- Variations in strata across the site will affect the infiltration capacity across the development
- The lowest area of the development is located within made ground and therefore soakaways wouldn't be acceptable

For these reasons, it is decided that surface water will discharge to the existing Nun Brook watercourse on the western boundary.

5. Post-Development Surface Water Allowable Discharge Rates

Discharge rates have been limited to existing greenfield runoff rates of Qbar for all storm return periods. Refer to the Phase specific FRA, and Table 2 above for details of the pre-development greenfield runoff rates.

	1 in 1 Year	**1 in 30 Year**	**1 in 100 Year**
Developable Area (Ha)	**Allowable Discharge Rate L/s**	**Allowable Discharge Rate L/s**	**Allowable Discharge Rate L/s**
3.72	37.5	45.2	45.2

Table 3

6. Design Parameters

Preliminary Drainage Layout Drg No	H8797-BAH-XX-XX-DR-CE-300001 P07
Lowest FFL	302.325
Maximum TWL for Design	300.50 – Flow control manhole cover level
Climate Change Allowance	40%
Discharge Location Minimum Level	294.26
Point of Connection	Existing watercourse north west of site
Point of Connection Approved By DCC (Y/N)	No – Submission not made yet

Table 4

7. Summary of Preliminary Drainage

The drainage will be designed in accordance with the site specific FRA

The drainage will be designed to comply with DEFRA's non-statutory technical standards for sustainable drainage systems dated March 2015. Compliance to such is demonstrated within Section 15.

The surface water network is to drain into the existing watercourse situated west of the site boundary, running north to south. Discharge rates will be limited to existing greenfield runoff rates, all storm events have been restricted to Qbar.

Attenuation storage is provided in the form of SuDS in public open spaces. The attenuation storage is sized to provide attenuation for all flows up to an including the 1 in 100 year storm event plus a 40% allowance for climate change.

8. Urban Creep

An additional 10% will be added to the residential areas within the Surface Water Network design to represent Urban Creep.

9. Design for Exceedance

All surface water drainage models will be modelled for storm events greater than the 1 in 100 year event to determine the impact of flooding. Any exceedance flooding will be designed to be managed within the site where reasonably practicable.

The surface water drainage will be design so that all properties are unlikely to flood during these flood events.

10. Maintenance

All surface water (coloured blue) and the detention basin on the attached plan, H8797-BAH-XX-XX-DR-CE-300001, will be put forward for adoption under a Section 104 Agreement. Prior to issue of the Vesting Declaration, the drainage shown on the included plan will be maintainable by Barratt Manchester at the expense of Barratt Manchester.

All areas of public open space will be transferred to the management company for adoption and maintenance, excluding the detention basin. The management and maintenance will be funded by the purchasers/owners of the development by way of an annual fee levied on the owner. In order to ensure the long term operation, the maintenance contract will stipulate regular maintenance in accordance with the management plan.

All highways gullies, and highway drains on the attached plan will be put forward for adoption under a Section 38 Agreement with Derbyshire County Council. After issue of the highway final certificate, the highways and highway drains, gullies and gully pipes on the attached plan H8797-BAH-XX-XX-DR-CE-300001, will be maintainable by the Local Highway Authority at public expense. Prior to the issue of the final certificate by DCC, the roads and drainage will be maintainable by Barratt Manchester at the expense of Barratt Manchester.

All foul drainage on the attached plan H8797-BAH-XX-XX-DR-CE-300001 (coloured brown) will be put forward for adoption under a S104 agreement. Prior to issue of the Vesting Declaration, the drainage shown on the included plan will be maintainable by Barratt Manchester and at the expense of Barratt Manchester.

A draft inspection & maintenance schedule for elements of the SuDS/drainage infrastructure is shown in Table 5.

Drainage Element	**Maintenance Requirement**	**Frequency**
Surface Water Pipes and Manholes (prior to adoption)	Inspect. Remove excess silt & debris, Clear Blockage	Inspect Annually. CCTV if required. Silt & debris removed as necessary.
Catchpits	Inspect. Remove excess silt & debris, Clear Blockage	Inspected every 3 months. Silt & debris removed as necessary.
Ditches/Swales	Inspect. Remove excess vegetation. Clear blockages, silt & debris.	Inspected every 1 Month. Blockages, silt & debris removed as necessary.
Flow Controls	Inspect. Remove excess silt & debris, clear blockage. Test functionality of Bypass doors.	Inspect Annually Silt & debris removed as necessary. Flow control repaired, maintained as necessary.
Overflow Ponds (and POS)	Inspect. Remove excess vegetation. Clear blockages, silt & debris.	Inspected monthly, or after significant storm events. Blockages, silt & debris removed as necessary.

Table 5

11. Defect Reporting

Prior to adoption of the highway drains, foul drains, surface water drains, SuDS and culverts, defects may be reported to Barratt Manchester by the local authority, local residents or members of the public.

All defects can be reported to Barratt Manchester Customer Care line using the following details:

Email: manchester@newhomecare.co.uk

Phone: 0161 872 0161 Option 3

Phone (Out-of-Hours): 0345 601 6084

The customer care line's normal working hours are Monday to Friday 9:00 to 17:30, excluding bank holidays. The out-of-hours line is a 24-hour call service.

After adoption, the following numbers may be useful:

Derbyshire County Council Highways
https://www.derbyshire.gov.uk/transport-roads/roads-traffic/report-a-road-fault/report-a-road-fault.aspx
Tel: 01629 533190 (Mon-Fri 8:00 to 18:00, Sat 09:30 to 16:00 exc. Bank Holidays)

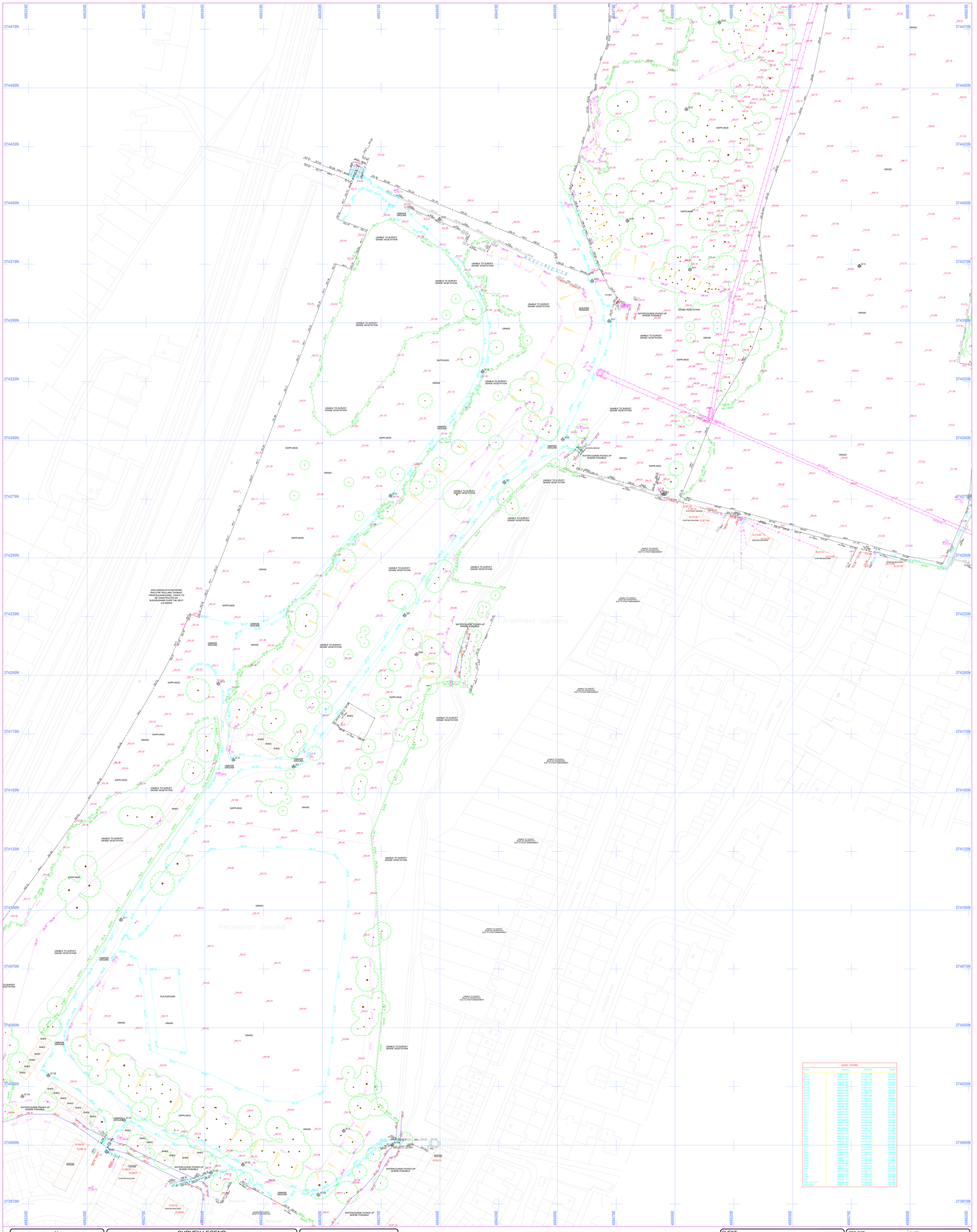
Environment Agency
Tel: 0800 80 70 60 (24 Hours)

12. Response Times

All non-urgent defects will be repaired within 10 weeks of being reported.

All urgent defects will be made safe within 48 hours, or sooner if practicable. Any works to 'Make Safe' may be a temporary measure in order to protect the public, and allow sufficient time to procure the permanent remedial works. This may include temporary 'fencing off' of the hazard until permanent remedial works can be completed.

Drawings
Topographical Survey



SURVEY STATIONS			
Name	Easting	Northing	Height
SE1	406859.665	374327.588	322.569
SE1A	406512.151	374164.057	297.944
SE1B	406222.352	374020.795	290.945
SE1BB	406313.430	374029.703	290.490
SE1BC	406295.662	374010.787	289.372
SE1BD	406316.350	373997.257	289.501
SE1BE	406316.206	373991.782	290.400
SE1BF	406307.613	373988.525	289.555
SE1BG	406348.304	373978.868	289.203
SE1BH	406379.753	374000.011	289.992
SE1C	406264.306	374066.952	296.505
SE1D	406359.098	374056.134	293.215
SE1E	406305.728	374196.456	302.202
SE1F	406378.981	374216.405	301.622
SE1G	406418.181	374129.336	301.626
SE1H	406578.433	374174.216	311.508
SE1I	406721.619	374566.998	321.153
SE2	406749.395	374561.510	321.558
SE20	406452.238	374300.398	293.464
SE21	406471.982	374292.734	294.365
SE22	406389.840	374194.173	301.364
SE23	406464.760	374367.855	294.827
SE3	406825.541	374222.136	323.056
SE4	406752.641	374308.805	313.544
SE40	406479.784	374193.502	300.805
SE41	406508.328	374172.667	300.000
SE42	406504.852	374440.935	301.581
SE43	406513.970	374477.839	302.823
SE5	406679.351	374311.710	318.343
SE5A	406679.048	374259.673	316.318
SE5B	406680.559	374329.391	319.455
SE5C	406823.177	374367.466	317.564
SE5D	406689.322	374346.548	321.991
SE5E	406726.494	374358.144	322.477
SE5F	406717.370	374370.470	322.591
SE6	406495.120	374277.097	300.548
SE7	406427.355	374283.179	295.072
SE8	406384.952	374215.520	297.580
SE9A	406390.027	374208.921	296.989
SE9	406331.771	374161.165	297.553
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STN_5002	406871.735	374144.880	324.769

N
W E
S

SURVEY ORIENTATED TO OS GRID (OSGB36-15)

SURVEY NOTES

ALL LEVELS ARE RELATED TO O.S DATUM (OSGB36-15) ESTABLISHED AT SE1 USING THE LEICA SMARTNET GPS NETWORK

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SURVEY LEGEND

FEATURES	BOUNDARY ANNOTATIONS			
TOP OF BANK	BARB WIRE FENCE	BW.F	SECURITY FENCE	SEC.F
BOTTOM OF BANK	CHAIN LINK FENCE	CL.F	TIMBER FENCE	T.F
SURVEY STATION	CONC POST AND PANEL	CP&P.F	BRICK WALL	B.W
TREE	CONC POST TIMB PANEL	CP&TP.F	BLOCK WALL	BL.W
HEDGE	ELECTRIC FENCE	EL.F	CONCRETE WALL	C.W
TREE CANOPY	HERAS FENCE	HER.F	GABIEN WALL	G.W
BUSHES	IRON RAIL FENCE	IR.F	MISCELLANEOUS WALL	MISC.W
VEGETATION	KNEE RAIL FENCE	KR.F	RETAINING WALL	R.W
	MISCELLANEOUS FENCE	MISC.F	RETAINING LOG WALL	RL.W
	POST AND WIRE FENCE	PAW.F	STONE WALL	S.W
	RANCH STYLE FENCE	RS.F		

LEVEL PREFIX ANNOTATIONS

ASL	ARCH SPRING LEVEL	IL	INVERT LEVEL		
BL	BED LEVEL	PL	PARAPET LEVEL	TRH	TREE HEIGHT
BD	BACK DROP	RL	ROOF/RIDGE LEVEL	THR	THRESHOLD LEVEL
CL	COVER LEVEL	SL	SOFFIT LEVEL	WL	WATER LEVEL
DH	TOP OF DOOR	TOF	TOP OF FENCE	WS	WINDOW SILL
DTC	DEPTH TO CROWN	TOP	TOP OF PIPE	WSF	WINDOW SOFFIT
FFL	FINISHED FLOOR LEVEL	TOW	TOP OF WALL		

GEOTECHNICAL INFORMATION

TRIAL HOLE / PIT	TH
BORE HOLE	BH
WINDOW SAMPLE	WS
MONITORING POINT	MP

SURVEY ANNOTATIONS

AV	AIR VALVE	OHC	OVERHEAD CABLES
B	BOLLARD	PB	POST BOX
BS	BUS STOP	PM	PARKING METER
BT	BRITISH TELECOM IC	PS	POST
CPS	CONCRETE PAVING SLABS	PYL	ELECTRICITY PYLON
CP	CATCH PIT	RE	RODDING EYE
DR	DRAIN	RS	ROAD SIGN
EB	ELECTRIC CONTROL BOX	RWP	RAIN WATER PIPE
EL	ELECTRICAL IC	ST	STOP TAP
EP	ELECTRICITY POLE	SM	SERVICE MARKER
ER	EARTH ROD	SP	SIGN POST
FH	FIRE HYDRANT	SV	STOP VALVE / SLUICE VALVE
FP	FLAG POLE	SVP	SOIL VENT PIPE
G	GULLY	TB	TELEPHONE BOX
GH	GREENHOUSE	TL	TRAFFIC LIGHTS
GP	GATE POST	TM	TELEPHONE MAST
GV	GAS VALVE	TP	TELEGRAPH POLE
IC	INSPECTION COVER	TPS	TACTILE PAVING SLABS
JB	JUNCTION BOX	VP	VENT PIPE
JKW	JAPANESE KNOT WEED	WM	WATER METER
KO	KERB OUTLET	WO	WASH OUT
LH	LAMP HOLE	UTL	UNABLE TO LIFT
LP	LAMP POST/LIGHT COLUMN	UTS	UNABLE TO SURVEY
MH	MANHOLE		
MP	MONITOR POINT		
NP	NAME PLATE		

CLIENT
BARRATT HOMES

PROJECT ENGINEER AS | DATE 10.12.2018
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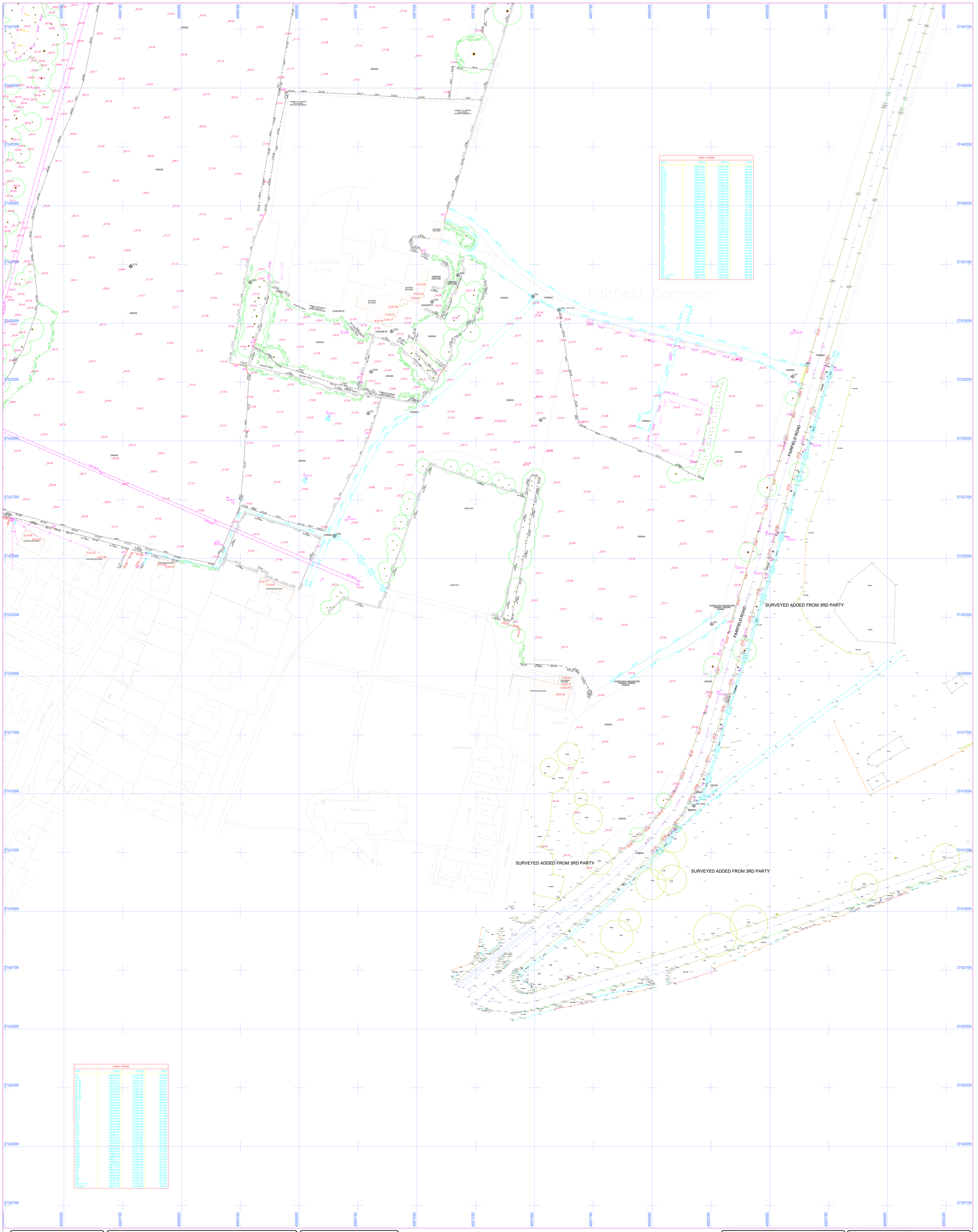
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BUXTON, FAIRFIELD

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SURVEY ADDED FROM 3RD PARTY	B	28-03-19	BM	-
ADDITIONAL TOPO SURVEY ADDED	A	11.03.19	BM	-

DRAWING DETAIL
TOPOGRAPHICAL LAND SURVEY
SHEET 1 OF 2

DRAWING NUMBER BH.TS.12 | REVISION C

SurveyEng Ltd
Land Surveyors & Engineers
14 GREEN MILL
WESTHOUGHTON
BOLTON
LANCS
BL5 3GE
TEL/FAX: 0800 772 3040
MOB: 07850069993
info@surveyeng.co.uk



SURVEY STATIONS

Name	Easting	Northing	Height
SE1	406859.665	374327.388	322.569
SE10	406312.151	374164.051	297.844
SE10A	406222.357	374020.795	290.945
SE10B	406233.422	374029.703	290.490
SE10C	406265.662	374010.767	289.312
SE10D	406258.255	373997.251	289.501
SE10E	406316.206	373991.782	290.405
SE10F	406302.612	373988.325	288.557
SE10G	406348.304	373978.868	289.201
SE10H	406379.732	374000.331	288.992
SE11	406364.306	374395.902	296.505
SE12	406359.098	374396.134	293.215
SE13	406305.728	374196.456	302.202
SE14	406278.981	374276.406	301.602
SE15	406418.181	374339.338	301.826
SE16	406378.433	374374.216	311.068
SE17	406721.819	374566.998	321.153
SE2	406749.395	374361.510	323.258
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SE41	406058.328	374372.687	302.000
SE42	406304.852	374440.925	301.581
SE43	406518.935	374477.839	302.822
SE5	406679.351	374311.710	318.363
SE5A	406665.048	374259.673	319.218
SE5B	406680.559	374329.391	319.455
SE5C	406629.177	374367.466	317.664
SE5D	406689.322	374346.568	321.991
SE5E	406706.494	374359.144	322.677
SE5F	406717.370	374375.470	322.591
SE6	406495.120	374277.097	300.548
SE7	406427.355	374282.179	295.072
SE8	406384.850	374225.520	297.590
SE8A	406390.027	374208.921	296.989
SE9	406337.771	374161.165	297.583
STN_ 11111111	406760.398	374355.633	323.306
STN_5002	406817.735	374144.880	324.769

N

W E

S

SURVEY ORIENTATED TO OS GRID (OSGB36-15)

SURVEY NOTES

ALL LEVELS ARE RELATED TO O.S DATUM (OSGB36-15)
ESTABLISHED AT SE1 USING THE LEICA SMARTNET GPS NETWORK

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SURVEY LEGEND

FEATURES

TOP OF BANK
BOTTOM OF BANK
SURVEY STATION
TREE
HEDGE
TREE CANOPY
BUSHES
VEGETATION

BOUNDARY ANNOTATIONS

BARB WIRE FENCE — BW.F
CHAIN LINK FENCE — CL.F
CONC POST AND PANEL — CP&P.F
CONC POST TIMB PANEL — CP&TP.F
ELECTRIC FENCE — EL.F
HERAS FENCE — HER.F
IRON RAIL FENCE — IR.F
KNEE RAIL FENCE — KR.F
MISCELLANEOUS FENCE — MISC.F
POST AND WIRE FENCE — P&W.F
RANCH STYLE FENCE — RS.F
SECURITY FENCE — SEC.F
TIMBER FENCE — T.F
BRICK WALL — B.W
BLOCK WALL — BL.W
CONCRETE WALL — C.W
GABIEN WALL — G.W
MISCELLANEOUS WALL — MISC.W
RETAINING WALL — R.W
RETAINING LOG WALL — RL.W
STONE WALL — S.W

LEVEL PREFIX ANNOTATIONS

ASL	ARCH SPRING LEVEL	IL	INVERT LEVEL		
BL	BED LEVEL	PL	PARAPET LEVEL	TRH	TREE HEIGHT
BD	BACK DROP	RL	ROOF/RIDGE LEVEL	THR	THRESHOLD LEVEL
CL	COVER LEVEL	SL	SOFFIT LEVEL	WL	WATER LEVEL
DH	TOP OF DOOR	TOF	TOP OF FENCE	WS	WINDOW SILL
DTC	DEPTH TO CROWN	TOP	TOP OF PIPE	WSF	WINDOW SOFFIT
FFL	FINISHED FLOOR LEVEL	TOW	TOP OF WALL		

GEOTECHNICAL INFORMATION

TRIAL HOLE / PIT — TH
BORE HOLE — BH
WINDOW SAMPLE — WS
MONITORING POINT — MP

SURVEY ANNOTATIONS

AV	AIR VALVE	OHC	OVERHEAD CABLES
B	BOLLARD	PB	POST BOX
BS	BUS STOP	PM	PARKING METER
BT	BRITISH TELECOM IC	PS	POST
CPS	CONCRETE PAVING SLABS	PYL	ELECTRICITY PYLON
CP	CATCH PIT	RE	RODDING EYE
DR	DRAIN	RS	ROAD SIGN
EB	ELECTRIC CONTROL BOX	RWP	RAIN WATER PIPE
EL	ELECTRICAL IC	ST	STOP TAP
EP	ELECTRICITY POLE	SM	SERVICE MARKER
ER	EARTH ROD	SP	SIGN POST
FH	FIRE HYDRANT	SV	STOP VALVE / SLUICE VALVE
FP	FLAG POLE	SVP	SOIL VENT PIPE
G	GULLY	TB	TELEPHONE BOX
GH	GREENHOUSE	TL	TRAFFIC LIGHTS
GP	GATE POST	TM	TELEPHONE MAST
GV	GAS VALVE	TP	TELEGRAPH POLE
IC	INSPECTION COVER	TPS	TACTILE PAVING SLABS
JB	JUNCTION BOX	VP	VENT PIPE
JKW	JAPANESE KNOT WEED	WM	WATER METER
KO	KERB OUTLET	WO	WASH OUT
LH	LAMP HOLE	UTL	UNABLE TO LIFT
LP	LAMP POST/LIGHT COLUMN	UTS	UNABLE TO SURVEY
MH	MANHOLE		
MP	MONITOR POINT		
NP	NAME PLATE		

CLIENT
BARRATT HOMES

PROJECT ENGINEER: AS
DRAWN: BM
DATE: 10.12.2018
SCALE: 1:500@A0

PROJECT TITLE
BUXTON, FAIRFIELD

DRAWING DETAIL
TOPOGRAPHICAL LAND SURVEY
SHEET 2 OF 2

DRAWING NUMBER: BH.TS.12
REVISION: C

DESCRIPTION	REV	DATE	DRWN	APPR
TOPO SURVEY UPDATED	C	26.03.21	BM	-
SURVEY ADDED FROM 3RD PARTY	B	28-03-19	BM	-
ADDITIONAL TOPO SURVEY ADDED	A	11.03.19	BM	-

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Drawings
Preliminary Drainage Layout

Warning to House Purchasers

Buyers are warned that this is a working drawing and the contents of this drawing may be subject to change during the build process. The layout, form, content, and dimensions specified are included for general guidance only. Finishes or features shown may alter in respect of individual properties. Whilst we make every effort to ensure our drawings are up to date there may from time to time be an unavoidable delay in updating these due to changes in regulations and/or site conditions. Prospective purchasers should not rely on these drawings without first confirming their accuracy with us. The contents of this drawing do not constitute a contract, part of any contract or warranty unless specifically incorporated into the contract. They should not be relied upon for the purposes of entering into a contract to purchase any property.

ENGINEERING LAYOUT NOTES

1. All adoptable drainage works have been designed and are to be constructed in accordance with "Sewerage Sector Guidance Appendix C – Design and Construction Guide (C.T. and United Utilities Guidelines. Where specification conflicts, UU guidelines shall take precedence.
2. All clay pipe work shall be extra strength clayware to BS 295 and BSEN 295 (SW only).
3. All precast concrete pipework shall be to Class 120 in accordance with BS08911–Part 1, BS EN 1916 and bear the BS Kitemark.
4. All adoptable drainage to be bedded in Class S granular surround unless otherwise stated on the longsections.
5. All concrete manhole and soakaways rings, and concrete cover slabs to be manufactured to BS EN 1917 and BS08111-Part 3.
6. Rising mains to be black polyethylene pipes complying to BS EN 13244-2. Polyethylene fittings, including fusion joints, and electro-fusion fittings shall comply with BS EN 13244-2.
7. All levels relate to Ordnance Datum. Contractor to ensure that this drawing is read in conjunction with the site specific topographical survey provided by Barratt Manchester and the benchmark information provided.
8. This drawing is to be read in accordance with all other relevant drawings.
9. The contractor shall be responsible for ensuring that any existing invert levels indicated on the drawings are correct before work commences.
10. All proposed connections to the sewer shall be 150ø unless stated otherwise.
11. All private house drainage shall be 100ø and all drag-out connections shall be 150ø at a minimum gradient of 1:80 unless otherwise stated, and laid in accordance with Part H of the Building Regulations.
12. Runoff from private surfaces shall not discharge across the highway. Gullies or channels shall be provided as appropriate to prevent this.
13. Pram crossings shall be provided at the inner tangent points of all junctions.
14. Pipes shall be protected from concentrated loading by construction traffic during the construction period when insufficient cover to the pipe may make them vulnerable to damage.
15. Insitu CBR tests of the road formation levels are to be carried out to determine the depth of pavement construction required. This is to be approved by Derbyshire County Council prior to construction of the road pavements.
16. Groundworker to ensure that plot drainage be within the curtilage of the plot they serve where possible and inspection covers kept within hardstanding where possible.
17. Contractor to provide Severn Trent Water with sufficient notice prior to commencement of sewer works on their inspections telephone number.
18. Contractor to obtain all necessary highway opening notices from Derbyshire County Council, obtain approval to work on United Utilities Sewerage System, obtain approval to method statement from the Environment Agency and/or the Local Lead Flood Authority for any works affecting a watercourse.

ENGINEERING KEY

- S104 Adoptable Surface Water Sewer & Manhole
- Private Surface Water Drag-Out and Invert (10.25)
- S38 Adoptable Surface Water Sewer & Manhole
- S38 Adoptable Road Gully
- S104 Adoptable Foul Water Sewer & Manhole
- Private Foul Drag-Out and Invert 10.25
- Proposed Adoptable Foul Water Rising Main
- Proposed S104 Sewer Easement
- Proposed Adoptable Foul Water Pumpstation

Revision	Description	Date	Design By
P07	Updated design to suit planning layout revision Rev. 3	01.07.24	CD
P06	Updated design to suit planning layout revision Rev. 2	27.06.24	CD
P05	Reverted to pumped solution for the whole site.	14.02.24	BJM
P04	Updated design to suit planning layout revision N.	09.02.24	BJM

Project: Hogshaw Farm, Buxton
Description: Preliminary Drainage Layout

Design By	Date	Scale at A0	Revision
CD	Feb 2024	1:500	P07

Project	Originator	Functional	Spatial Form	Discipline	Number
H8797 - BAH -		XX	- XX - DR -	CE -	300001

BARRATT HOMES

Do not scale from this drawing. Work to given dimensions only. Any discrepancies are to be reported to Originator.
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Detention Basin
Low Flow Bed Level: 298.8m
Main Channel Level: 299.2m
Top Water Level: 300.45m
Top of Bank: 300.55m
Storage Volume: 1300m3

S44 – Flow Control
Head=1.95m; Flow=45.2l/s
Emergency drain down penstock included in manhole

Road 1
Road 2a
Road 2b
Road 3
Road 4
Road 5
Road 6

GOLF COURSE
ROMAN ROAD (course of)
Nunsfield Farm
Fairfield Common
Allotment Gardens
NunBrook
BARMS WAY
Potential Future Link Road
PLAY AREA (LAP) Refer to drawing 2402.41929
ARM 1
ARM 2
ARM 4
AS ABOVE HOLES
TENT OF WORKS

Appendix A
Flood Risk Assessment

- Infrastructure Design
- Structural Engineering
- Development Planning
- Professional Advice
- Geotechnical & Environmental
- Surveying

jpp



Proposed Residential Development
Hogshaw Farm
Buxton
Derbyshire

Flood Risk Assessment and Drainage Strategy

Revision F: July 2024
R-FRA-11024R-01-F

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Proposed Residential Development
Hogshaw Farm
Buxton
Derbyshire

Flood Risk Assessment and Drainage Strategy

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Report Reference	R-FRA-11024R-01-F
Date	Revision F: July 2024

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Revision	Date	Description	Prepared	Reviewed
0	23rd January 2019	Initial Report	Ram Sarpal	Warren Allsopp
A	31st March 2023	DRAFT – revised to suit latest development proposals.	Izzy How	Katherine Rose
A	26th April 2023	Revised to suit latest development proposals.	Katherine Rose	Katherine Rose
B	24th May 2023	Revised following client comments	Katherine Rose	Katherine Rose
C	6th June 2023	Appendices updated	Katherine Rose	Katherine Rose
D	16th February 2024	Revised following consultation comments, and to include latest drainage strategy information and JBA modelling data.	Josh Beverly	Katherine Rose
E	23rd February 2024	Revised following client comments.	Josh Beverly	Katherine Rose
F	12th July 2024	Revised to suit latest site layout.	Josh Beverly	Katherine Rose

Contents

1.0 Introduction 1

1.1 Background 1
1.2 Objectives 1
1.3 Reference documents 2
1.4 Report history 2

2.0 Description and history of the site and development proposals 3

2.1 Location and description of the site 3
2.2 History of the site 3
2.3 Proposed development 3
2.4 Site topography 4
2.5 Existing drainage infrastructure 4
2.6 Geology of the site and ground investigation data 4
2.7 Development proposals and flood risk vulnerability 5

3.0 Flood risk 6

3.1 Fluvial / Tidal flooding 6
3.2 Flooding from surface water 8
3.3 Flooding from groundwater 9
3.4 Flooding from sewers 9
3.5 Flooding from reservoirs, canals and other artificial sources 9
3.6 Historic flooding 10
3.7 Flood risk vulnerability and flood zone compatibility 11
3.8 Flood compensation 11
3.9 Access and egress 11

4.0 Additional flood modelling 12

4.1 Introduction 12
4.2 Baseline modelling 12
4.3 On-site surface water discharge hydraulic modelling 12
4.4 Mitigation 13

5.0 Management of surface water 14

5.1 Current conditions 14
5.2 Surface water drainage outfalls 14
5.3 Surface water drainage strategy 15
5.4 SUDS assessment 16
5.5 Water quality 17
5.6 Surface water drainage design and management 18
5.7 Existing run-off rates 18
5.8 Attenuation requirements 19
5.9 Overland flows 20

6.0 Foul water drainage strategy 21

7.0 Maintenance 22
7.1 Surface water drainage maintenance 22
7.2 Foul water drainage maintenance 24
8.0 Summary and conclusions 25

Appendices

Appendix A ..... A
Planning Layout ..... A
Barratt Homes drawing no. H8797-BAH-XX-XX-DR-UD-203001-P03 ..... A
Appendix B ..... B
Topographical Land Survey ..... B
Survey Eng Ltd drawing no BH.TS.12-C ..... B
Appendix C C
Severn Trent Water Asset Plan C
Appendix D ..... D
Environment Agency Product 4 Data ..... D
Appendix E ..... E
Extract of Ground Investigation ..... E
Soiltechnics report ref. STQ4642M-G01 ..... E
Appendix F ..... F
Areas Susceptible to Groundwater Flooding (High Peak Borough) ..... F
DCC Level 1 SFRA: Map 5.6 ..... F
Appendix G ..... G
Historic Flood Incidence by Source and Floodzones (High Peak Borough) ..... G
DCC Level 1 SFRA: Map 3.6 ..... G
Appendix H ..... H
Preliminary Drainage Layout ..... H
Barratt Homes drawing no. H8797-BAH-XX-XX-DR-CE-300001-P07 ..... H
Appendix I I
Greenfield Calculations I
Appendix J ..... J
Drained Area Plan ..... J
JPP Consulting drawing no. 11024-FRA05B ..... J
Appendix K ..... K
Attenuation Calculations ..... K

Appendix L ..... **L**
Overland Flows L
JPP Consulting drawing no. 11024-FRA06B L
Appendix M ..... **M**
Severn Trent Water Pre-Development Enquiry ..... M
Appendix N ..... **N**
Hydraulic Modelling Report ..... N
JBA Technical Note 2023s1142 ..... N

Figures

Figure 1.1 Site Location Plan 1
Figure 2.1 Aerial imagery dated 1999 3
Figure 3.1 Flood Map for Planning (Rivers and Sea) 6
Figure 3.2 Risk of Flooding from Surface Water 8
Figure 3.3 Risk of Flooding from Reservoirs 10

Tables

Table 2.1 Flood Risk Vulnerability Classification 5
Table 3.1 Flood Zone Definitions 7
Table 3.2 Flood Risk Vulnerability and Flood Zone Compatibility 11
Table 5.1 SUDS Assessment 16
Table 5.2 Pollution Hazard Indices for Different Land Use Classifications 17
Table 5.3 Indicative SuDS Mitigation Indices for Discharges to Surface Waters 17
Table 5.4 Peak Rainfall Allowance: Derwent Derbyshire Management Catchment 18
Table 5.5 Greenfield Run-off Rates 19
Table 7.1 Maintenance Areas – Surface Water 22
Table 7.2 Operation and Maintenance: Detention Basins 23
Table 7.3 Maintenance Areas – Foul Water 24

1.0 Introduction

1.1 Background

1.1.1 This report is a Flood Risk Assessment and Drainage Strategy which has been prepared by JPP Consulting Limited on behalf of Barratt Homes for a proposed residential development. The benefit of this report is to our instructing Client.

1.1.2 The proposed Residential development is located at Hogshaw Farm off Nunsfield Road, Buxton, as shown in Figure 1.1 below. Buxton is located to the south-west of Sheffield and east of Macclesfield. The National Grid Reference for the site is E406520 N374340. The proposed development has a total development area of 5.605ha (56,050m^2).



Figure 1.1 Site Location Plan
Source: Open Street Maps, obtained 29th March 2023

1.2 Objectives

1.2.1 The objective of this report is to advise interested parties regarding the potential risk of flooding and the management of surface water run-off arising from the proposals.

1.2.2 This report has been prepared to support a reserved matters planning application.

1.3 Reference documents

1.3.1 This report has been prepared with reference to the following publications:-

- Ministry of Housing, Communities and Local Government (March 2012, updated December 2023), National Planning Policy Framework
- Ministry of Housing, Communities and Local Government (March 2014, updated August 2022), Planning Practice Guidance 'Flood Risk and Coastal Change'
- Department for Environment, Food and Rural Affairs (March 2015), Non-statutory technical standards for sustainable drainage systems
- Environment Agency (September 2013), Climate Change Allowances for Planners: Guidance to support the National Planning Policy Framework
- Environment Agency (October 2013), Delivering benefits through evidence: Rainfall runoff management for developments
- HM Government (2010), The Building Regulations (2010), Drainage and Waste Disposal, Approved Document H, The NBS, Newcastle Upon Tyne
- Wilson, Bray, Cooper (2004), Sustainable drainage systems: Hydraulic, structural and water quality advise, C609, CIRIA, London
- Woods-Ballard et al (2015), The SUDS Manual, C753, CIRIA, London
- CIRIA Report C624 Development and flood risk
- National SUDS Working Group (2004), Interim Code of Practice for Sustainable Drainage Systems,
- Institute of Hydrology (1999), Flood Estimation Handbook, Institute of Hydrology, Wallingford
- BS EN 752:2008 Drain and sewer systems outside buildings. Hydraulic design and environmental considerations
- BS 8533:2011 Assessing and managing flood risk in development – Code of Practice
- CIRIA Report C635 Designing for exceedance in urban drainage – good practice
- Derbyshire County Council & Derby City Council Strategic Flood Risk Assessment Level 1: For Minerals and Waste Local Development Framework (August 2012)

1.4 Report history

1.4.1 This report had previously been revised (Revision E) further to the receipt of further client comments based on prior drainage strategy proposals as provided by Barratt Homes, and the inclusion of details of the fluvial hydraulic modelling study undertaken by JBA Consulting Ltd.

1.4.2 This report has been revised (Revision F) following the receipt of a new site layout and drainage strategy as provided by Barratt Homes.

1.4.3 Changes to the report associated with Revision F are marked by a vertical line in the right-hand column.

2.0 Description and history of the site and development proposals

2.1 Location and description of the site

2.1.1 The proposed residential development is located at Hogshaw Farm, off Nunsfield Road, Buxton, as shown in Figure 1.1 above. The site is bound by agricultural land to the north, a golf course and the A6 to the east, dwellings to the south, and woodland, Nun Brook and a railway line to the west.

2.2 History of the site

2.2.1 The site currently comprises an area of open land associated with Hogshaw Farm, as shown on the topographical survey enclosed in **Appendix B**. There is an area of woodland along the site's western boundary.

2.2.2 Aerial imagery dating back to 1999 shows that the site was comparable to the present day during this time, see Figure 2.1 below.



Figure 2.1 Aerial imagery dated 1999
Obtained: Google Earth Pro 29th March 2023

2.3 Proposed development

2.3.1 The proposed development will comprise 99 residential dwellings. The proposed development layout is shown on the plan enclosed in **Appendix A.**

2.4 Site topography

2.4.1 The topographical survey indicates that site levels fall from east (at approximately 323.0m) towards west (lowest point of approximately 296.0m). The topographical survey is shown on the plan enclosed in **Appendix B**.

2.5 Existing drainage infrastructure

2.5.1 Severn Trent Water's asset plan is enclosed in **Appendix C.** The asset plan identifies a surface water sewer and a foul water sewer, both located in Barms Way to the south. Both sewers then flow south along Nunsfield Road, with the foul sewer transitioning to a combined water sewer. The surface water and foul water sewers are both 150mm diameter, and the combined water sewer is a 225mm diameter pipe.

2.5.2 The topographical survey, as enclosed in **Appendix B**, identifies a number of inspection covers within the southern part of the site.

2.5.3 Nun Brook is located to the west of the site. As shown on the dataset provided by the Environment Agency (see **Appendix D**), a section of this watercourse is culverted.

2.6 Geology of the site and ground investigation data

2.6.1 Inspection of the geological maps show that there are no records of superficial deposits at the site. A narrow band on Alluvium (comprising clay, silt, sand and gravel) is shown along Nun Brook to the west of the site.

2.6.2 The bedrock geology which underlies the majority of the site is Eyam Limestone Formation. A small area along the western part of the site is underlain by Bowland Shale Formation, comprising Mudstone, Siltstone and Sandstone.

2.6.3 A Ground Investigation has been undertaken by Soiltechnics, see report extract enclosed in **Appendix E**. The GI included site visits in January and February 2019, which included:

- Twenty exploratory trials pits (TP01-TP20)
- Twenty-eight exploratory boreholes (DTS01-DTS13 and DTS15-DTS29)
- Infiltration testing in three borehole locations (DTS06, 13 and 19)

2.6.4 The proposed residential development is covered by Zone 3 of the GI, whilst the proposed access route falls within Zone 4 and the open space in the north-western corner within Zone 1. Zone 2 of the GI falls beyond the current site boundary. The encountered ground conditions are briefly summarised as follows:

- Topsoil: Zones 3 and 4
- Made Ground: Zone 1, 2 and 4
- Weathered Bee Low Limestone Formation: Zone 4
- Weathered Eyam Limestone Formation: Zone 3
- Weathered Bowland Shale Formation: Zone 2 and 3
- Bowland Shale Formation Bedrock: Zone 3

2.6.5 Groundwater inflows were encountered in many of the exploratory excavations, as set out in Table 6.4.1 of the Ground Investigation report (see extract in **Appendix E**). In short, groundwater was encountered at depths between 1.3m and 4.2m bgl.

2.6.6 Infiltration test results are summarised as follows:

- Weathered Bee Low Limestone (DTS06, Zone 4, access): 3.81 x 10^{-6} m/s
- Weathered Eyam Limestone (DTS13, Zone 3, residential): between 2.67 x 10^{-4} and 4.72 x 10^{-5} m/s
- Weathered Bowland Shale (DTS19, Zone 3, residential): between 2.94 x 10^{-6} and 3.12 x 10^{-6} m/s

2.6.7 The GI report states:

> *"Testing completed to date should be considered preliminary only and we recommend further, more intensive, on site testing is carried out targeting the part of the investigation allowing detailed design of infiltration systems to be progressed if such systems are to be adopted".*

2.6.8 Additional investigations are being undertaken in the north-western area of the site, to allow an assessment of risks associated with ground conditions.

2.7 Development proposals and flood risk vulnerability

2.7.1 With reference to Table 2 of the Flood Risk and Coastal Change Planning Practice Guidance (PPG) to the National Planning Policy Framework (NPPF), the proposed residential development would be classed as More Vulnerable development.

2.7.2 An extract from Table 2 of the PPG for Flood Risk and Coastal Change is replicated below in Table 2.1 with the proposed development type highlighted.

Flood Risk Vulnerability Classification	
Vulnerability	**Development Types**
More Vulnerable	Hospitals.
	Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.
	Buildings used for **dwelling houses**, student halls of residence, drinking establishments, nightclubs and hotels.
	Non-residential uses for health services, nurseries and educational establishments.
	Landfill and site used for waste management facilities for hazardous waste.
	Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.
Source: Planning Practice Guidance - 2014	

Table 2.1 Flood Risk Vulnerability Classification

3.0 Flood risk

3.1 Fluvial / Tidal flooding

3.1.1 An extract of the Environment Agency's Flood Map for Planning (Rivers and Sea) is provided below in Figure 3.1. The flood map was extracted from the GOV.UK website on 29th March 2023. The approximate application site boundary is shown in red. The map indicates that the majority of the development site is located within Flood Zone 1 (Low Probability).



Figure 3.1 Flood Map for Planning (Rivers and Sea)
Source: GOV.UK website – March 2023

3.1.2 We note that there are areas of Flood Zone 2 (Medium Probability) and Flood Zone 3 (High Probability) to the north-west and south-west of the site. These areas encroach into the site boundary in the north-western corner of the site. These areas are associated with Nun Brook. The topographical survey confirms that ground levels in this area are lower than those of the developable area of the site.

3.1.3 Product 4 flood level data has been obtained from the Environment Agency, as enclosed in **Appendix D**. This identified that the site is located within Flood Zone 1 and at a low risk of fluvial flooding.

3.1.4 Additional flood risk information is set out in Chapter 4.0, following a fluvial hydraulic modelling study undertaken by JBA Consulting Ltd.

3.1.5 Table 3.1 below is a copy of Table 1 from Planning Practice Guidance for *'Flood Risk and Coastal Change'* to the National Planning Policy Framework which defines Flood Zones. The proposed development, which is located within Flood Zone 1, is defined as having a less than 1 in 1,000 annual probability of river or sea flooding in any year.

Flood Zone Definitions	
Flood Zone	**Definition**
Zone 1: Low Probability	**Land having a less than 1 in 1,000 annual probability of river or sea flooding.**
Zone 2: Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or Land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.
Zone 3a: High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding.
Zone 3b: The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency.
Source: Planning Practice Guidance - 2014	

Table 3.1 Flood Zone Definitions

3.2 Flooding from surface water

3.2.1 An extract of the Environment Agency map 'Risk of Flooding from Surface Water' is provided below in Figure 3.2. The approximate application site boundary is shown in red. The site is shown to be located in an area of very low (less than 1 in 1000) risk of surface water flooding in a given year.

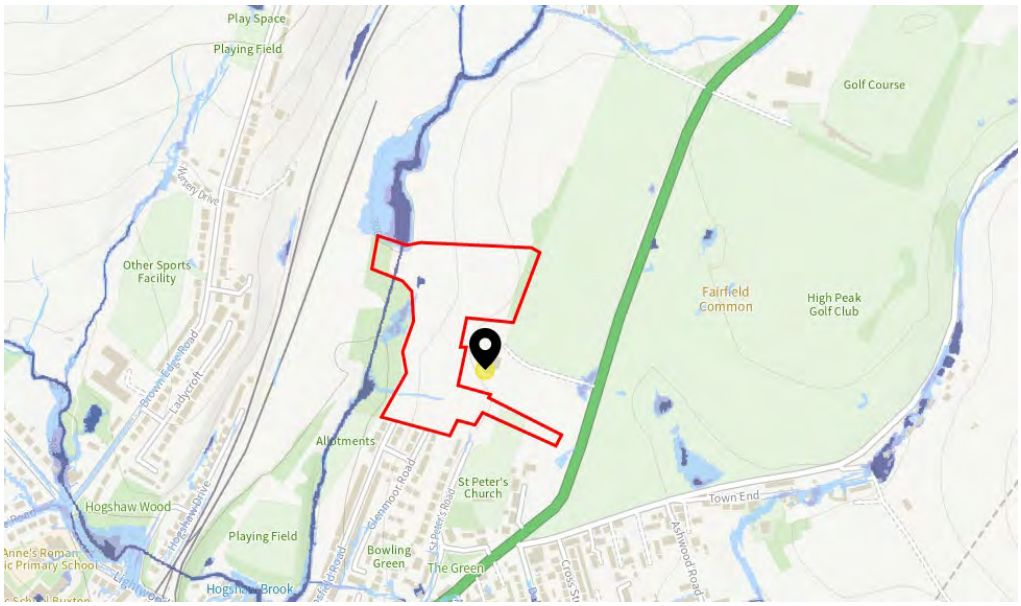


Figure 3.2 Risk of Flooding from Surface Water
Source: GOV.UK website – March 2023

3.2.2 We note that there are areas of medium and high surface water flood risk to the west of the site, associated with Nun Brook. The topographical survey confirms that ground levels in this area are lower than those of the developable area of the site.

3.2.3 It should be noted that this map is generated using a broad methodology applied at the national scale. The model utilises generalised information on infiltration, sewerage infrastructure, rainfall events and catchment topography to route rainfall over a ground surface model. As such, the analysis does not take account of site-scale factors / characteristics that may exert an influence upon surface water flood depths and extents. The map therefore only provides a guide regarding the areas that may be vulnerable to this source of flooding.

3.3 Flooding from groundwater

3.3.1 Information from the Derbyshire County Council (DCC) Level 1 Strategic Flood Risk Assessment (SFRA) has been reviewed with regards to groundwater flooding. The Areas Susceptible to Ground Water Flooding Map for the High Peak Borough is enclosed within **Appendix F**. This is a *"strategic scale map showing groundwater flood areas in a 1 kilometre square grid. It identifies at a broad scale areas susceptible to flooding from groundwater on the basis of geological and hydrogeological conditions. It does not show the likelihood of groundwater flooding occurring and therefore is a hazard not risk based dataset. It does not take account of areas where groundwater is likely to pond or flow, but simply considers where groundwater might emerge".*

3.3.2 The map shows that the 1Km grid square where the site is located is within the '<25%' category.

3.3.3 As part of the Ground Investigation, groundwater inflows were encountered in many of the exploratory excavations, as set out in Table 6.4.1 of the Ground Investigation report (see extract in **Appendix E**). In short, groundwater was encountered at depths between 1.3m and 4.2m bgl.

3.3.4 The information available at the time of preparing this report suggests that groundwater emergence at the surface is unlikely, and therefore the risk of flooding is considered to be low.

3.4 Flooding from sewers

3.4.1 Severn Trent Water's asset plans identify that there are no adopted sewers within the site boundary, as shown on the plan enclosed in **Appendix C.**

3.4.2 The DCC Level 1 SFRA has been reviewed with regards sewer flooding. The Historic Flood Incidence by Source and Floodzones map for the High Peak Borough is enclosed within **Appendix G**. No sewer flooding are incidents are shown within the site boundary. A single sewer flooding incident is identified within Buxton, south-east from the site. The scale of the mapping is not sufficient to refine the location of this incident.

3.4.3 We do not have any records of sewer flooding within the vicinity of the proposed development.

3.4.4 We therefore do not consider the risk of flooding from sewers to be a significant risk to the proposed development.

3.5 Flooding from reservoirs, canals and other artificial sources

3.5.1 We are not aware of any canals or artificial water sources that may result in flooding of this site.

3.5.2 The EA provides maps (https://flood-warning-information.service.gov.uk/long-term-flood-risk/) showing the area that may be affected by flooding as a result of a breach of a large, raised reservoir (i.e. capable of storing over 25,000 cubic metres of water above the natural level of any part of the surrounding land).

3.5.3 An extract of the Environment Agency map 'Risk of Flooding from Reservoirs' is provided below in Figure 3.3. It can be seen that the proposed development site, shown in red, is not at a risk of flooding from reservoirs.



Figure 3.3 Risk of Flooding from Reservoirs
Source: GOV.UK website – 29th March 2023

3.5.4 It can therefore be concluded that the risk of flooding from reservoirs and other artificial sources is low.

3.6 Historic flooding

3.6.1 The DCC Level 1 SFRA has been reviewed with regards to historical flooding. The Historic Flood Incidence by Source and Floodzones map for the High Peak Borough is enclosed within **Appendix G**. This map includes details of historic flooding from the following sources:

- Artificial
- Fluvial
- Groundwater
- Multiple
- Other
- Sewers
- Surface Water
- Unknown

3.6.2 No flood events from the above sources are shown within the site boundary.

3.6.3 The Environment Agency are not aware of any historic flood incidents at the site, as set out within **Appendix D**.

3.7 Flood risk vulnerability and flood zone compatibility

3.7.1 Based on the above assessment of the site being located within Flood Zone 1 and classified as a More Vulnerable development, and with reference to Table 3.2 below (Planning Practice Guidance for 'Flood Risk and Coastal Change' to the National Planning Policy Framework, Table 3), the proposed development of this site would be considered "appropriate". A copy of Table 3 is presented below highlighting the above. Neither a Sequential Test nor an Exception Test will be required.

Table 3 – Flood Risk Vulnerability and Flood Zone Compatibility

Flood Risk Vulnerability Classification	Essential Infrastructure	Water Compatibility	Highly Vulnerable	More Vulnerable	Less Vulnerable
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	✓	Exception test required	✓	✓
Zone 3a	Exception test required	✓	X	Exception test required	✓
Zone 3b	Exception test required	✓	X	X	X
✓ = Development is appropriate			X = Development should not be permitted		

Source: Planning Practice Guidance - 2014

Table 3.2 Flood Risk Vulnerability and Flood Zone Compatibility

3.8 Flood compensation

3.8.1 Flood compensation measures will not be required for this site as it is located within Flood Zone 1.

3.8.2 The results of the fluvial hydraulic modelling study, discussed further in Chapter 4.0 below, identify the flood extents upstream of the culvert, to the north-west of the site. Based on these results, the proposed detention basin is considered to be outside of the modelled flood extent, such that flood compensation requirements are not triggered as a result of the detention basin location.

3.9 Access and egress

3.9.1 Access and egress to and from this site in the event of flooding will be via the proposed development's access road, which will allow residents of the development to move to higher ground.

4.0 Additional flood modelling

4.1 Introduction

4.1.1 As set out in Section 3.1 above, the flood maps available online identify the site to be located in Flood Zone 1. However, areas of Flood Zone 2 and 3 are identified to the north-west and south-west of the site, associated with the watercourse in this location. As such, a fluvial hydraulic modelling study has been undertaken. This has been undertaken by JBA Consulting, full details of which are set out in their report enclosed in **Appendix N**.

4.2 Baseline modelling

4.2.1 Baseline modelling has been undertaken for the following scenarios:

- 1 in 30 year
- 1 in 100 year
- 1 in 100 year + 29% climate change
- 1 in 1000 year

4.2.2 For the four scenarios set out above, the modelled flood extents are shown in to the north-western area of the site.

4.2.3 The modelled flood depths associated with the baseline 1 in 100 year plus 29% climate change scenario are shown to be deepest immediately upstream of the culverted watercourse. The maximum flood depth is identified to be 4.02m, within the area of low elevation surrounding the channel.

4.2.4 Blockage analysis has been undertaken for a worst-case scenario of a 100% blockage of the culvert during the 1 in 100 year plus 29% climate change event. This blockage results in a 1.88m increase in peak water level to the north-west, and Figure 2-7 of the JBA report identifies the route of water across the site.

4.3 On-site surface water discharge hydraulic modelling

4.3.1 The baseline model was updated to account for the calculated existing greenfield run-off rates from the site, which were then increased by 40% as an allowance for climate change.

4.3.2 The surface water drainage strategy proposes a flow restriction of 45.2 l/s, based on the existing Q_{bar} run-off rate from the site, see additional details in Section 5.7 below. This rate of 45.2 l/s has been used as a static value within the hydraulic modelling, based on the maximum run-off rate from the site. The 45.2 l/s flow restriction offers an overestimation of post-development flows, as smaller storm events will result in lower run-off rates from the site. The modelling results therefore present a worst-case scenario.

4.3.3 The results from the revised baseline modelling and post-development modelling were compared to understand the impact of the proposed development. With the proposed surface water drainage strategy in place, there is a slight reduction identified in the flood extent downstream of the site, in the proximity of the Lightwood Road area. There is also a reduction in flood depth identified here too. This betterment downstream is due to a greater proportion of the flow being held upstream of the 1.22m culvert. As a result, there is an increase in flood depths upstream of the site of up to 0.05m, however, the extent is unchanged.

4.3.4 As noted within the JBA report, *"the majority of the pre-development greenfield surface water discharge would enter Nun Brook downstream of the 1.22m diameter culvert"*. Therefore, the post-development scenario not only reduces greenfield discharge rates from the site, but also moves the surface water discharge point upstream of the culvert. This therefore allows the discharge from the site to be controlled, and, in turn, provides a betterment of alleviating downstream flooding.

4.4 Mitigation

4.4.1 The fluvial hydraulic modelling study undertaken by JBA Consulting Ltd identifies a slight reduction in the existing flood extent identified downstream of the site, and also a reduction in these flood depths. As the proposals are shown to offer flood alleviation downstream of the site, no mitigation strategy is considered to be required.

4.4.2 We would note that the positive results of the proposed drainage strategy are intentional, and developed in order to reduce an existing flooding issue identified within the vicinity of the site.

5.0 Management of surface water

5.1 Current conditions

5.1.1 The site is currently open with no existing development, and is therefore considered a greenfield site with no existing drainage. Therefore, greenfield run-off calculations shall be used to derive the allowable run off rate from the site.

5.2 Surface water drainage outfalls

5.2.1 It is a requirement of The Building Regulations (2010), Drainage and Waste Disposal, Approved Document H, to dispose of surface water collected by a development in accordance with the following, listed in order of priority:-

1. Infiltration systems where ground condition permit
2. To watercourses
3. To sewers

5.2.2 Each of these is considered separately below:

5.2.3 Infiltration systems

5.2.3.1 The geology of the site is described in Section 2.6 above. For a worst-case assessment, it is assumed that infiltration techniques are not viable for the management of surface water at the site.

5.2.3.2 We acknowledge the presence of Made Ground at the site, and the risk that infiltration techniques would pose with regards to the mobilisation of leachates. As such, infiltration techniques will not be considered further due to the risk associated with mobilising leachates to the watercourse.

5.2.3.3 On the basis that infiltration techniques are not viable at the site, the proposed detention basin will be designed accordingly, such as with a clay liner.

5.2.4 Watercourses / Main River

5.2.4.1 Nun Brook is located along the site's western boundary. Surface water from the proposed development will drain to this watercourse.

5.2.5 Sewers

5.2.5.1 Draining the site to an existing watercourse is a viable option, therefore the use of surface water sewers will not be considered further.

5.3 Surface water drainage strategy

5.3.1 Surface water discharge rates will be restricted to greenfield equivalent run-off rates to ensure that the rate of surface water run-off from the site does not increase as a result of the proposed development.

5.3.2 The proposed drainage strategy will comprise a piped network with attenuation provided in an online detention basin. Due to the risk of mobilising contaminants to the watercourse, the proposed basin will be lined accordingly, such as with clay.

5.3.3 The location of the proposed detention basin is considered appropriate. It is located in the lowest area of the site and in close proximity to the proposed outfall location upstream of the culvert. With the steeply sloping nature of the site in general, the flatter ground levels in this north-western area help minimise the earthworks required to achieve the detention basin.

5.3.4 The culverted Nun Brook is circa 8m below the ground level to which it runs through. The ground above the Nun Brook culvert is a former landfill site, that is covered by dense bushes and trees. The proposed location of the attenuation basin has been chosen to minimise the impact on existing trees, vegetation and biodiversity. The topographical survey, as enclosed in **Appendix B**, shows that other locations within this land are more severely impacted by trees and vegetation. The proposed location of the basin will offer ease of access and maintenance, as the surrounding dense vegetation will be cleared during the works. This includes the reduction in ground level from circa 8m to circa 6m, and thus improving access for possible future dig-downs.

5.3.5 The proposed flow control, to facilitate surface water being attenuated within the attenuation basin, will be fitted with a bypass. This will therefore allow the basin to be emptied through the bypass and into the adjacent floodplain, should the culvert need a dig-down repair during a storm event. The area of the basin above the culvert will be covered by a management company who will work to keep the area maintained, clear and future proof from self-seeded trees and dense vegetation, therefore maintaining an ease of access.

5.3.6 The basin has been designed such that normal flows up the a 1 in 30 year scenario remain within the lower basin level; the higher basin level is only likely to flood during storm events greater than a 1 in 30 year scenario. A dry weather channel is included to keep the area as dry as possible during common rainfall.

5.3.7 An indicative surface water layout plan is enclosed in **Appendix H.** The drawing shows that surface water attenuation can be accommodated on the site and the method of discharge on the basis that infiltration techniques are not viable. The detailed design parameters of the drainage are described below.

5.4 SUDS assessment

5.4.1 We have considered the suitability of SUDS for use on the development site. The review is set out in below Table 5.1.

SUDS Assessment		
SUDS Technique	**Suitability**	**Justification**
Rain Water Harvesting	Maybe	To be considered at detailed design stage.
Green Roofs	No	Green roofs are generally only viable on flat roofs. The proposed dwellings are to have pitched roofs.
Infiltration	Maybe	Subject to site investigation
Filter Strips / Filter Drains	Maybe	Subject to site investigation
Swales	Maybe	To be considered at detailed design stage, where levels allow.
Bioretention Systems	No	Attenuation will be provided in the form of a detention basin.
Trees	Yes	Most existing trees will remain on the site, plus new trees and landscaping areas will be planted.
Pervious Pavements	No	Treatment of surface water will be achieved by the low-flow channel and micro-pool within the online detention basin.
Attenuation Tanks	No	Surface water will be attenuated above ground within a detention basin.
Detention Basin	Yes	Surface water attenuation to be provided above-ground within an online detention basin, to include micro-pool and low flow channel.
Ponds and Wetlands	No	Attenuation will be provided above-ground using detention basins.
Trapped Drainage	No	Treatment of surface water will be achieved by the low-flow channel and micro-pool within the online detention basin.

Table 5.1 SUDS Assessment

5.4.2 With reference to the Environmental Health consultation response, the inclusion of reed beds has been considered within the wider site. This is not considered viable due to the steeply sloping nature of the site. The proposed detention basin is to be online in nature, with a low flow channel and micro-pool which will offer water quality benefits, as discussed further in Section 5.5 below. The inclusion of planting, such as reeds, will be considered within the design of the detention basin.

5.5 Water quality

5.5.1 Chapter 26 of The SuDS Manual 2015 (CIRIA 753) provides guidance on the methods that should be used to design SuDS to meet the water quality design criteria and good practice design standards. Based on the simple index approach, the pollution hazard indices for different land use classifications are listed in Table 26.2, Chapter 26 of the SuDS Manual. Table 5.2 below summarises the pollution hazard indices that are applicable for residential land use development.

Pollution Hazard Indices for Different Land Use Classifications				
Land Use	**Pollution Hazard Level**	**Total Suspended Solids (TSS)**	**Metals**	**Hydro-carbons**
Residential Roofs	Very low	0.2	0.2	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg school, offices) ie <300 traffic movements/day	Low	0.5	0.4	0.4
Source: Table 26.2 of The SuDS Manual				

Table 5.2 Pollution Hazard Indices for Different Land Use Classifications

5.5.2 Surface water run-off from the development will pass through an online detention basin. Additional SUDS measures, such as filter drains and swales, will be considered as part of the detailed drainage design.

5.5.3 Table 26.3 of The SuDS Manual shows the mitigation indices for a range of SuDS components for discharges to surface waters. A copy of this is provided in Table 5.3 below.

Indicative SuDS Mitigation Indices for Discharges to Surface Waters			
Type of SuDS Component	**Mitigation Indices**		
	TSS	**Metals**	**Hydro-carbons**
Filter strip	0.4	0.4	0.5
Filter drain	0.4	0.4	0.4
Swale	0.5	0.6	0.6
Bioretention system	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond	0.7	0.7	0.5
Wetland	0.8	0.8	0.8
Source: Table 26.3 of The SuDS Manual			

Table 5.3 Indicative SuDS Mitigation Indices for Discharges to Surface Waters

5.5.4 As set out in The SuDS Manual, where two or more components are utilised, *"a factor of 0.5 is used to account for the reduced performance of the secondary or tertiary components"*. This will therefore need to be considered where multiple SUDS components are proposed.

5.5.5 As the detention basin will be online and include a low flow channel and micropool, it is considered to be a pond for this the purpose of this water quality assessment. Based on the information and assessment set out above, the online detention basin is considered to provide sufficient water treatment for the development proposals.

5.5.6 Additional SuDS features will be considered at detailed design stage, which would offer further water quality benefits.

5.6 Surface water drainage design and management

5.6.1 Proposals are to design the surface water drainage system to accommodate storms up to the 1 in 100 year event plus an allowance of 40% for climate change. The design life of a residential development is considered to be greater than 60 years. Table 5.4 below is a copy of Table 2 from the Environment Agency's guidance 'Flood risk assessments: climate change allowances' to support the National Planning Policy Framework, which defines the climate change allowances. This information is provided for the Derwent Derbyshire Management Catchment in which the proposed development is located within.

Peak Rainfall Intensity Allowance in Small and Urban Catchments			
Allowance	**Epoch**	**Central Allowance**	**Upper End Allowance**
3.3%	2050s	20%	35%
	2070s	25%	35%
1%	2050s	20%	40%
	2070s	30%	40%
Source: https://environment.data.gov.uk/hydrology/climate-change-allowances/rainfall			

Table 5.4 Peak Rainfall Allowance: Derwent Derbyshire Management Catchment

5.7 Existing run-off rates

5.7.1 To reflect the changes in the near surface geology across the site the greenfield run-off rates have been calculated. The method used to calculate the greenfield run off rates is the ICP SUDS and the calculations are enclosed in **Appendix I**.

5.7.2 The greenfield run-off rates, for the application site, are:

Greenfield Run-off Rates			
Return Period	**Existing Discharge Rate (l/s)**	**Proposed Discharge Rate (l/s)**	**Betterment**
Qbar Total Site Area	45.2	45.2	0%
1 in 1 Year	37.5	37.5	0%
1 in 30 Year	88.6	45.2	49%
1 in 100 Year	116.2	45.2	61%
1 in 100 Year + Climate Change	-	45.2	

Table 5.5 Greenfield Run-off Rates

5.7.3 Surface water run-off from the proposed development will be limited to the greenfield equivalent rate of 45.2 l/s via a vortex flow control device.

5.7.4 With reference to the results of the fluvial hydraulic modelling study, as discussed in Chapter 4.0, restricting flows to the greenfield equivalent rate of 45.2 l/s is considered to be appropriate.

5.8 Attenuation requirements

5.8.1 Surface water will discharge into the watercourse located to the west of the site and will be attenuated to the greenfield run-off rate of 45.2 l/s. To achieve this, surface water will be attenuated via an online detention basin in the north-west corner of the site to accommodate a 1 in 100 year event plus an allowance of 40% for climate change.

5.8.2 The proposed drained area of the development is 1.883 ha, as shown on the plan enclosed in **Appendix J**. An allowance of 10% has been applied for urban creep. Therefore, the drainage calculation have been prepared based on a total drained area of 1.940 ha.

5.8.3 Based on the proposed drained area and allowable discharge rate of 45.2 l/s, the storage requirement for the 1 in 100 year plus climate change event has been calculated utilising the following parameters. Calculations are enclosed in **Appendix K**.

Rainfall profile	= Flood Estimation Handbook
Return period	= 100 year
Durations	= 60 to 10080 minutes
Climate change	= 40%
Drained area	= 1.940 ha
Limiting flow to watercourse	= 45.2 l/s
Control	= Vortex flow control
Total storage required	= 1,084m^3

5.8.4 The indicative surface water drainage layout incorporating the attenuation is shown on the plan enclosed in **Appendix H.**

5.9 Overland flows

5.9.1 Proposals are to design the surface water drainage to accommodate the 1 in 100 year storm event taking into account the predicted future effects of climate. Clearly there is a risk of this storm event being exceeded, albeit this risk is considered very low. In such an event the proposed drainage systems will become overwhelmed and overland flows could occur. Overland flows will be directed to follow the path that overland flows currently follow.

5.9.2 Predicted overland flows are shown on the plan enclosed in **Appendix L**.

6.0 Foul water drainage strategy

6.1 Severn Trent Water's asset plan is enclosed in **Appendix C.** The asset plan identifies a foul water sewer located in Barms Way to the south. This is a 150mm diameter sewer, which then flows south along Nunsfield Road, where is transitions to a 225mm diameter combined water sewer.

6.2 The intention is for foul water to discharge to Severn Trent Water's sewer network at manhole 5203, located at the junction of Barms Way and Nunsfield Road. A pre-development enquiry has been undertaken with Severn Trent Water (STW) with regards to this connection, see response enclosed in **Appendix M**. STW have confirmed that a gravity connection to this sewer *"at a new or existing manhole (5203)"* would be acceptable, subject to a formal Section 106 approval.

7.0 Maintenance

7.1 Surface water drainage maintenance

7.1.1 The drainage system will be designed to minimise maintenance requirements, however, a full maintenance scheme will be established for those elements not being offered for adoption. The various areas will be maintained as set out in Table 7.1 below.

Maintenance Areas – Surface Water	
Aspect	**Maintainer**
Private Drains	Home owner
SUDS – Private	Home owner
SUDS – Communal	Management Company
Adopted Sewers	Severn Trent Water

Table 7.1 Maintenance Areas – Surface Water

7.1.2 Additional maintenance information is set out below for the various components of the surface water drainage strategy.

7.1.3 Hydrobrake

7.1.3.1 A hydrobrake will be utilised to restrict surface water flows.

7.1.3.2 Responsibility for the maintenance of the hydrobrake is with the management company, in line with the manufacturer's specifications.

7.1.4 Detention basins

7.1.4.1 Surface water attenuation will be provided within an online detention basin with low flow channel and micropool. The operation and maintenance requirements for detention basins are outlined in Table 7.2 below.

Operation and Maintenance: Detention Basins		
Maintenance schedule	**Required action**	**Typical Frequency**
Regular maintenance	Remove litter and debris	Monthly
	Cut the grass – for spillways and access routes	Monthly (during growing season), or as required
	Cut grass – meadow grass in and around basin	Half yearly (spring – before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation, establish appropriate silt removal frequencies	Monthly (for first year), then annually or as required
	Check any penstocks and other mechanical devices	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually
Occasional Maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial actions	Repair erosion or other damage reseeding or re-turfing	As required
	Realignment of rip-rap	As required.
	Repair/rehabilitation of inlets, outlets and overflows	As required.
	Relevel uneven surfaces and reinstate design levels	As required
Source: Table 22.1 from Source: The SuDs Manual - 2015		

Table 7.2 Operation and Maintenance: Detention Basins

7.1.4.2 Responsibility for the maintenance of detention basins is as follows:

- Management company – shared detention basins.

7.2 Foul water drainage maintenance

7.2.1 The drainage system will be designed to minimise maintenance requirements, however, a full maintenance scheme will be established for those elements not being offered for adoption. The various areas will be maintained as set out in Table 7.3 below.

Maintenance Areas – Foul Water	
Aspect	**Maintainer**
Private Drains	Home owner
Adopted Sewers	Severn Trent Water

Table 7.3 Maintenance Areas – Foul Water

8.0 Summary and conclusions

8.1 The proposed Residential development is located at Hogshaw Farm, off Nunsfield Road, Buxton. The site is bound by agricultural land to the north, a golf course and dwellings to the east, Hogshaw Brook and dwellings to the south and a railway line to the west.

8.2 The proposed development will comprise 99 residential dwellings.

8.3 The development is located within Flood Zone 1 and at low risk of flooding from rivers and sea. The site is shown to be at low risk of flooding from surface water, groundwater, sewers and reservoirs.

8.4 A fluvial hydraulic modelling study has been undertaken by JBA Consulting Ltd. The results of which identify a slight reduction in the existing flood extent identified downstream of the site, and also a reduction in these flood depths. The proposals are therefore shown to offer flood alleviation downstream of the site, achieving a betterment on the existing scenario.

8.5 The proposed surface water drainage strategy will comprise a piped network with attenuation provided in an online detention basin, with an outfall to Nun Brook restricted to the greenfield run-off rate of 45.2 l/s. A total volume of 1,084m^3 of attenuation will be provided, sufficient to accommodate storms up to and including the 1 in 100 + 40% climate change event.

8.6 The intention is for foul water to discharge to Severn Trent Water's sewer network at the junction of Barms Way and Nunsfield Road. A pre-development enquiry has been undertaken with Severn Trent Water (STW) with regards to this connection. STW have confirmed that a gravity connection to this sewer *"at a new or existing manhole (5203)"* would be acceptable, subject to a formal Section 106 approval.

8.7 National, Regional and Local planning policy requires that:

- Development is directed to sites at the lowest probability of flooding;
- Development accommodates the potential impacts of climate change;
- Development should not be permitted if it would be at an unacceptable risk of flooding or create an unacceptable risk elsewhere; and
- New development should facilitate safe access and exit during flood conditions.

8.8 The proposals for a residential development at Hogshaw Farm, off Nunsfield Road, Buxton are therefore fully compliant with policy in respect of development and flood risk, such that flood risk considerations do not constitute a barrier to the granting of planning consent.

Appendix A

Planning Layout

Barratt Homes drawing no. H8797-BAH-XX-XX-DR-UD-203001-P03

SCHEDULE OF ACCOMMODATION

Barratt Type	House Type	Sqft	No	Total Sqft
Private Units				
Rowan - End	2 Bed Terraced House	866	10	8660
Rowan - Mid	2 Bed Terraced House	866	1	866
Oakmoor - End	3 Bed Bed Semi / Mews House Duel Aspect End Unit	1049	1	1049
Birchmoor - End	3 Bed Terraced House	1025	3	3075
Rathlin	3 Bed Detached House	990	11	10890
Matlock - End	3 Bed Semi / Mews House	970	23	22310
Hopton	3 Bed Detached / Semi Detached Dual Aspect House	1017	9	9153
Hopton - End	3 Bed Detached / Semi Detached Dual Aspect House	1017	1	1017
Knightwood - End	4 Bed Townhouse	1122	18	20196
Ashtead	4 Bed Dual Aspect Detached House	1265	4	5060
Wallasea	4 Bedroom Int. Garage Detached House	1206	11	13266
Haweswater	4 Bedroom Int. Garage Detached House	1495	7	10465
Total number of units and square footage			**99**	**106007**
Gross Site Area in Acres				**10.39**
Open Space & Undevelopable Area in Acres				**3.18**
Net Site Area in Acres				**7.21**
Density (Units per Acre)				**14**
Density (Units per Hectare)				**34**
Square Foot / Acre				**14,703**

Legend:

- Proposed dwelling and house type code.
- Proposed garage to be built.
- Grass, refer to detailed landscaping plans for details.
- Wall (Refer to BTL01/BTD01&02 for details)
- Timber gates to be erected to rear gardens. (as indicated on site layout).
- Existing trees to be retained & protected during works.
- Trees to be removed, refer to 1795_ARB_AIA & 1795_ARB_AMS for details.
- Root Protection Zone
- Indicates a tree with a TPO.
- Water main easement, 5m wide as confirmed by Ward Hadaway.
- AS OPP — Dwelling handing - as / opposite see the construction dwg.
- Refuse collection area
- EV — Car charging point, refer to EVCP info pack for specs & positioning details.
- PROW.
- GRP Chimney
- Indicative Landscaping, refer to UG_1795_Lan_SI_01-05 for details.

North

AGRICULTURAL LAND

PUMPING STATION

SUDS

LOCAL WILDLIFE AREA

GOLF COURSE

Nunsfield Farm

Fairfield Commc

Potential Future Link Road

ENTRANCE STATEMENT

SUBSTATION

TEMP SALES PARKING

PLAY AREA (LAP) Refer to drawing 2402.4/929

Buxton FP 2

Buxton FP 1

Buxton FP 77

Nestle Water Main 5m

Existing connection to remain open

Existing connection to remain open

BARMS WAY

GLENMOOR ROAD

Sub Sta

The Devonshire Cooch House

324.3m

Northlands

St Peter's Church

Links View

NORTH ROAD

ARM 4

ARM 3

B.O.A.T

Revision	Description	Date	Design By
03	Flipped plot 16, pulled 16&17 south 1m, revised multi use footpath position, various minor tweaks to suit ENG comments	28/06/24	GB
02	Layout updated to various internal comments.	18/06/24	GB

Project: HOGSHAW FARM

Description: PLANNING LAYOUT

Design By:	Date:	Scale at A0:	Revision:
GB	11/06/2024	1:500	3

Project	Originator	Functional	Spatial	Form	Discipline	Number
H8797	- BAH -	XX	- XX -	OR -	UD -	203001

BARRATT HOMES

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HOGSHAW FARM BUXTON

Appendix C
Severn Trent Water Asset Plan



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Scale: 1:1250 | Date: 28/03/23 | Wastewater Plan A2

Data updated: 14/03/23 | Map Centre: 406645,374389 | Our Ref: 1121913 - 1 | Powered by digdat

Public Foul Gravity/Lateral Drain		Highway Drain		Manhole Foul	
Public Combined Gravity/Lateral Drain		Overflow Pipe		Manhole Surface	
Public Surface Water Gravity/Lateral Drain		Disposal Pipe		Abandoned Pipe	
Pressure Foul		Culverted Water Course		Chamber	
Pressure Combined		Pumping Station			
Pressure Surface Water		Fitting			

Section 104 sewers are shown in green

Private sewers are shown in magenta

nathan.reed@jppuk.net

11024 Buxton

SEVERN TRENT

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Appendix D
Environment Agency Product 4 Data

Detailed River Network Map, centred on Nunsfield Farm, Buxton [EMD299476]

Environment Agency

Legend

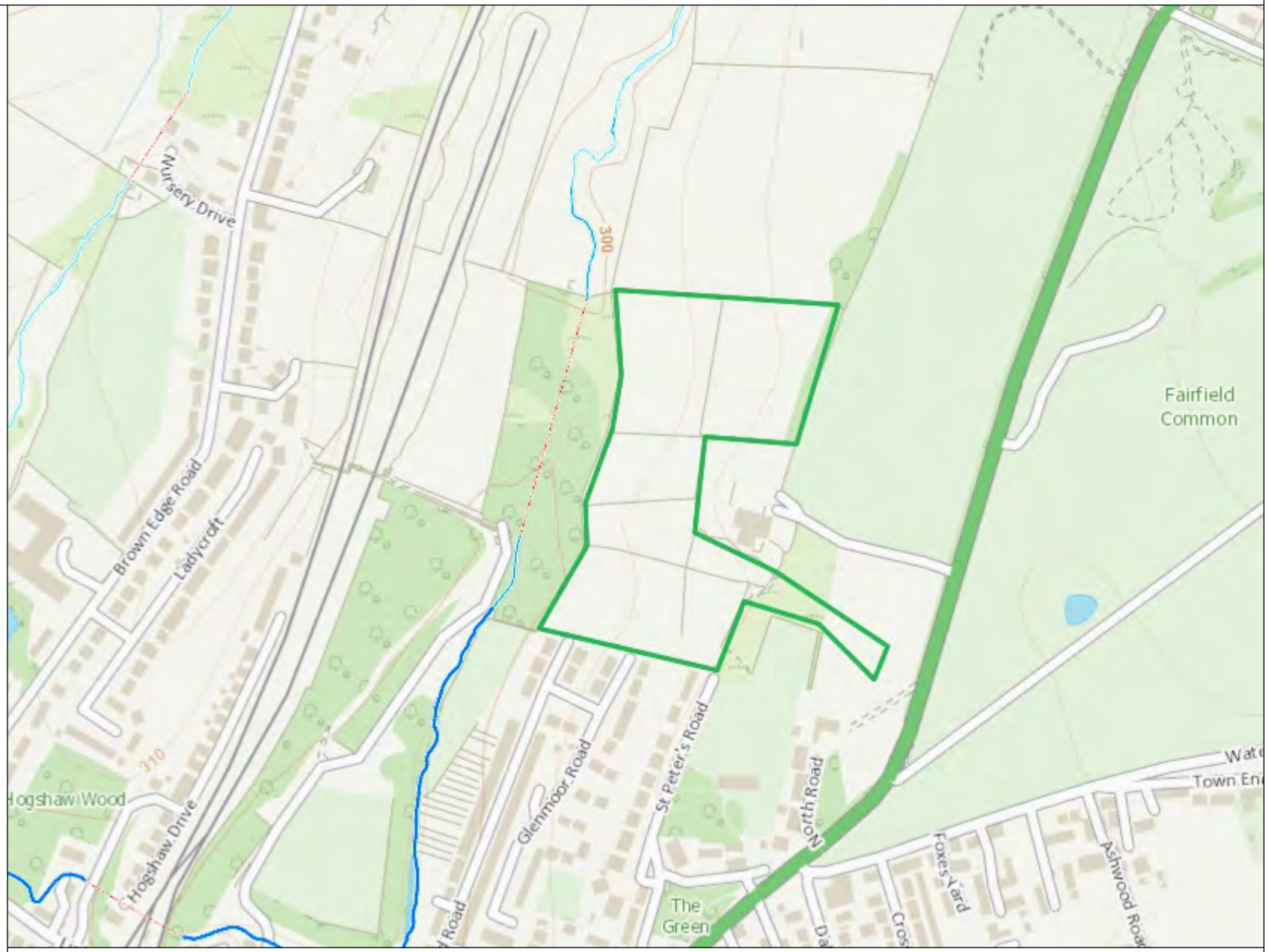
Detailed River Network

- Primary River
- Secondary River
- Tertiary River
- Lake / Reservoir
- Canal
- Canal Tunnel
- Extended Culvert
- Multiple Channel Culvert
- Underground River (potential sewer)
- Underground River (inferred)
- Underground River (local knowledge)
- Undefined

Offline Drainage features

Detailed River Network

- Primary River
- Secondary River
- Tertiary River
- Lake / Reservoir
- Canal
- Canal Tunnel
- Extended Culvert
- Multiple Channel Culvert
- Underground River (potential sewer)
- Underground River (inferred)
- Underground River (local knowledge)
- Undefined



1: 5,000

0 125

Metres

N W E S

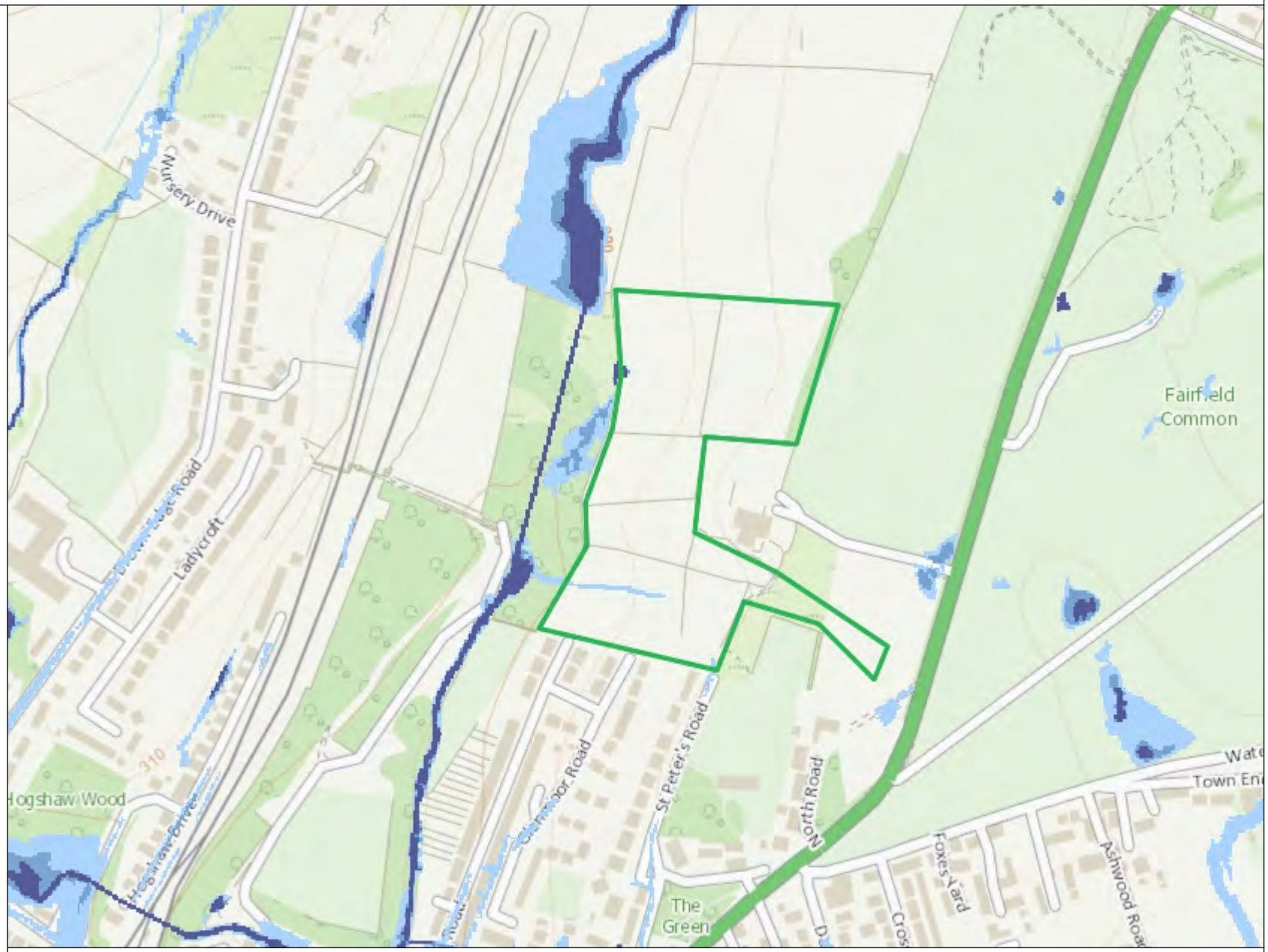
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Surface Water Flood Map, centred on Nunsfield Farm, Buxton [EMD299476]

Environment Agency

Legend

- Flood Extent 1 in 30
- Flood Extent 1 in 100
- Flood Extent 1 in 1000



1: 5,000

0 125

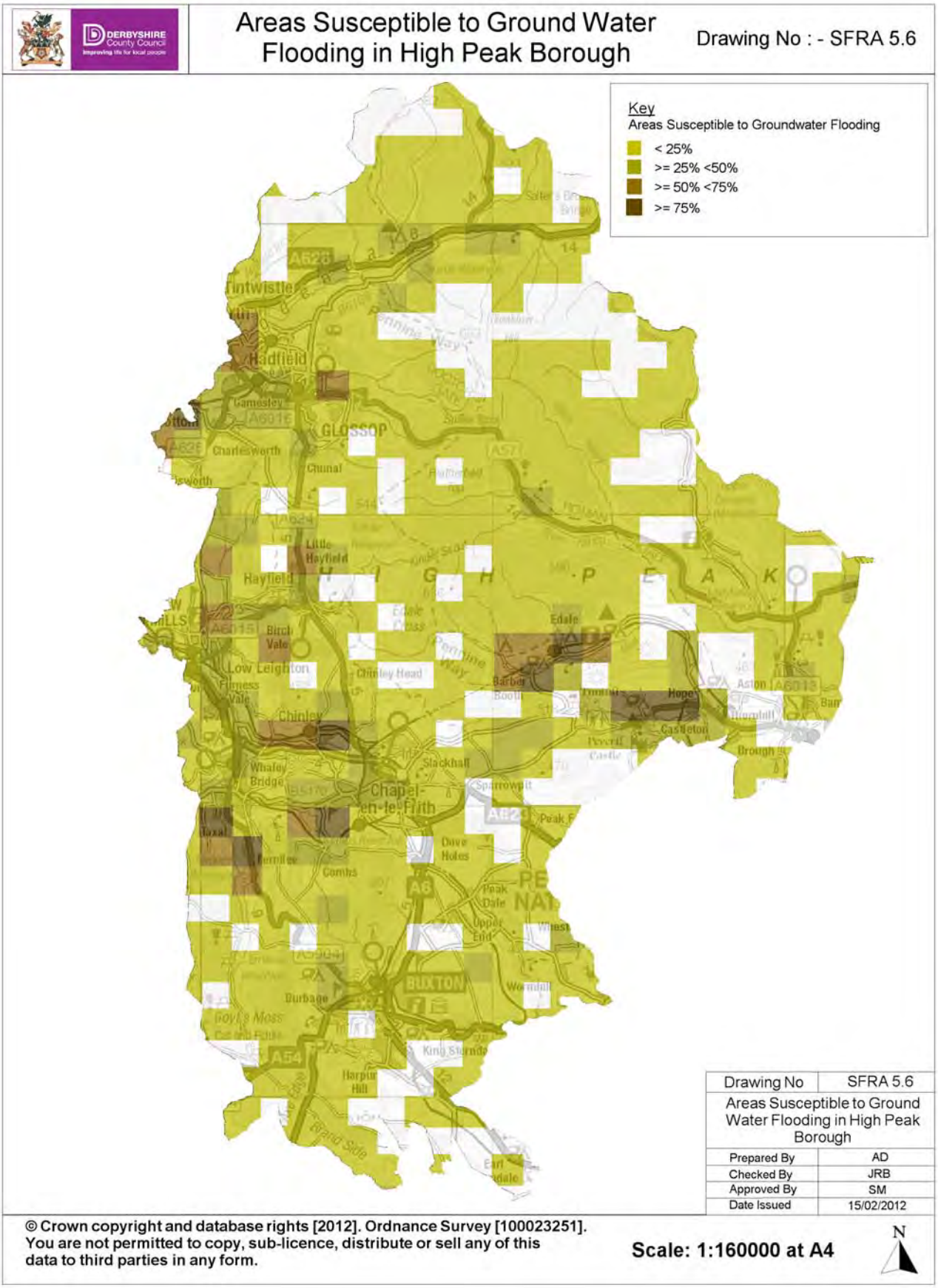
Metres

N W E S

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Appendix F

Areas Susceptible to Groundwater Flooding (High Peak Borough)
DCC Level 1 SFRA: Map 5.6

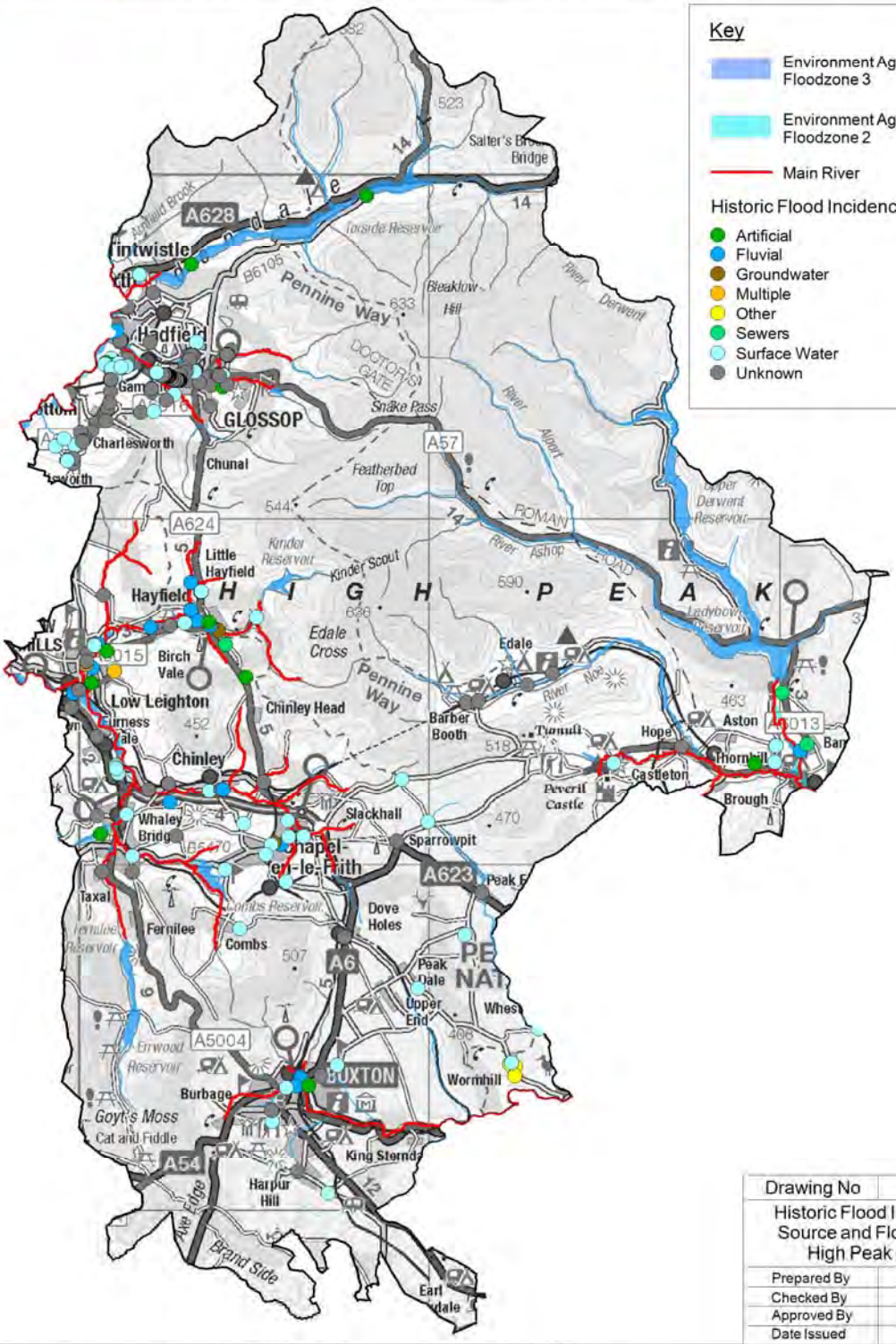

Areas Susceptible to Ground Water Flooding in High Peak Borough
Drawing No : - SFRA 5.6
Key
Areas Susceptible to Groundwater Flooding
< 25%
>= 25% <50%
>= 50% <75%
>= 75%
Hadfield
Glossop
Chinley
Whaley Bridge
Chapel-en-le-Frith
Buxton
Hayfield
Edale
Castleton
Hope
Drawing No
SFRA 5.6
Areas Susceptible to Ground Water Flooding in High Peak Borough
Prepared By
AD
Checked By
JRB
Approved By
SM
Date Issued
15/02/2012
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Scale: 1:160000 at A4
N

Appendix G

Historic Flood Incidence by Source and Floodzones (High Peak Borough)
DCC Level 1 SFRA: Map 3.6

Historic Flood Incidence by Source and Floodzones in High Peak Borough

Drawing No : - SFRA 3.6



Drawing No	SFRA 3.6
Historic Flood Incidence by Source and Floodzones in High Peak Borough	
Prepared By	AD
Checked By	JRB
Approved By	SM
Date Issued	02/08/2012

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Scale: 1:160000 at A4

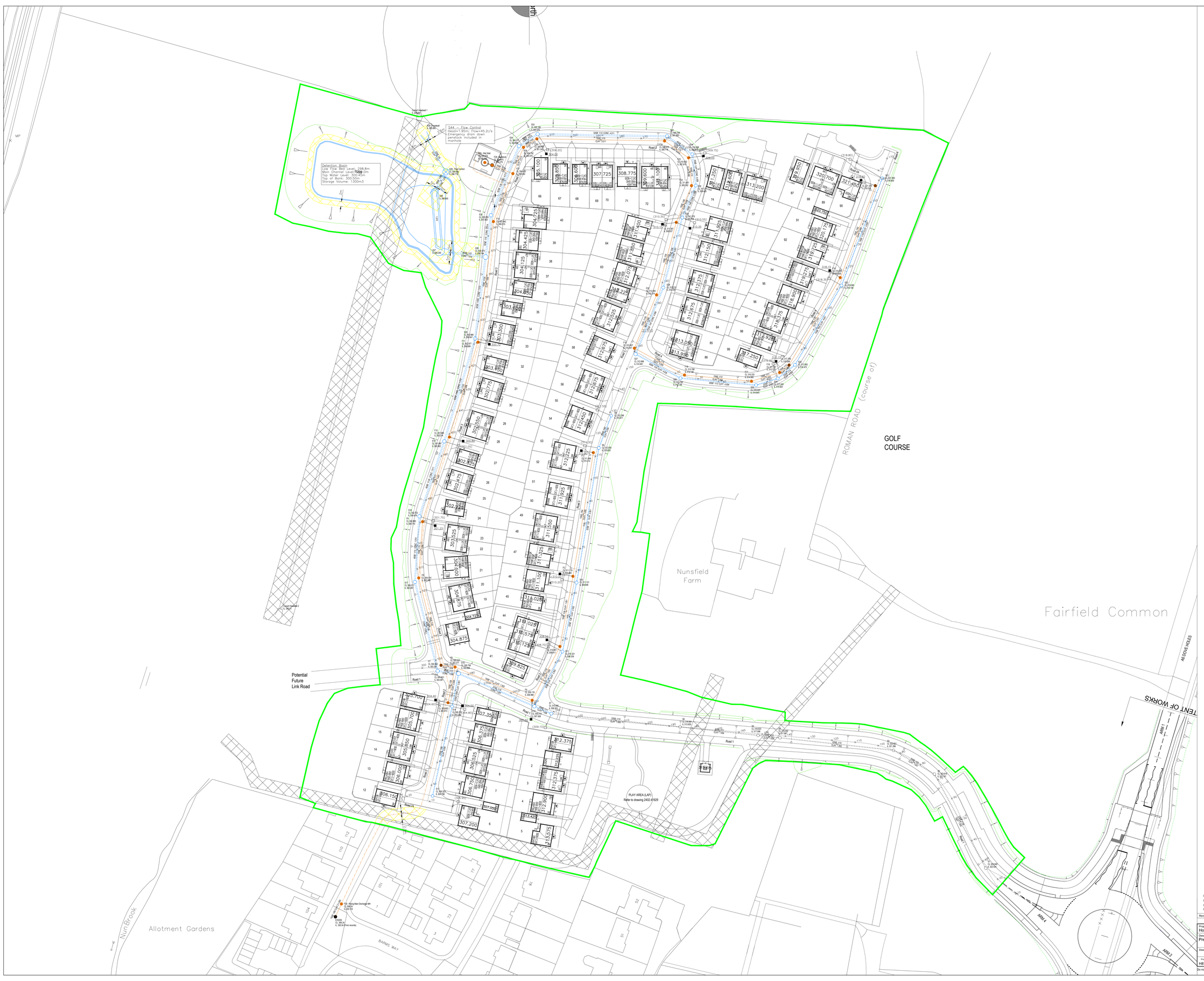
N

K
L

Appendix H

Preliminary Drainage Layout

Barratt Homes drawing no. H8797-BAH-XX-XX-DR-CE-300001-P07



Warning to House Purchasers

Buyers are warned that this is a working drawing and the contents of this drawing may be subject to change during the build process. The layout, form, content, and dimensions specified are included for general guidance only. Finishes or features shown may alter in respect of individual properties. Whilst we make every effort to ensure our drawings are up to date there may from time to time be an unavoidable delay in updating these due to changes in regulations and/or Planning Authority requirements. Please check with your Sales Advisor for the latest information on your property. The contents of this drawing do not constitute a contract, part of any contract or warranty unless specifically incorporated into the contract. They should not be relied upon for the purposes of entering into a contract to purchase any property.

ENGINEERING LAYOUT NOTES

1. All adoptable drainage works have been designed and are to be constructed in accordance with "Sewerage Sector Guidance Appendix C – Design and Construction Guide (C.T. and United Utilities Guidelines. Where specification conflicts, UU guidelines shall take precedence.
2. All clay pipe work shall be extra strength clayware to BS 295 and BSEN (SW only).
3. All precast concrete pipework shall be to Class 120 in accordance with BS08911–Part 1, BS EN 1916 and bear the BS Kitemark.
4. All adoptable drainage to be bedded in Class S granular surround unless otherwise stated on the longsections.
5. All concrete manhole and soakaways rings, and concrete cover slabs to be manufactured to BS EN 1917 and BS08111-Part 3.
6. Rising mains to be black polyethylene pipes complying to BS EN 13244-2. Polyethylene fittings, including fusion joints, and electro-fusion fittings shall comply with BS EN 13244-2.
7. All levels relate to Ordnance Datum. Contractor to ensure that this drawing is read in conjunction with the site specific topographical survey provided by Barratt Manchester and the benchmark information provided.
8. This drawing is to be read in accordance with all other relevant drawings.
9. The contractor shall be responsible for ensuring that any existing invert levels indicated on the drawings are correct before work commences.
10. All proposed connections to the sewer shall be 150ø unless stated otherwise.
11. All private house drainage shall be 100ø and all drag-out connections shall be 150ø at a minimum gradient of 1:80 unless otherwise stated, and laid in accordance with Part H of the Building Regulations.
12. Runoff from private surfaces shall not discharge across the highway. Gullies or channels shall be provided as appropriate to prevent this.
13. Pram crossings shall be provided at the inner tangent points of all junctions.
14. Pipes shall be protected from concentrated loading by construction traffic during the construction period when insufficient cover to the pipe may make them vulnerable to damage.
15. Insitu CBR tests of the road formation levels are to be carried out to determine the depth of pavement construction required. This is to be approved by Derbyshire County Council prior to construction of the road pavements.
16. Groundworker to ensure that plot drainage be within the curtilage of the plot they serve where possible and inspection covers kept within hardstanding where possible.
17. Contractor to provide Severn Trent Water with sufficient notice prior to commencement of sewer works on their inspections telephone number.
18. Contractor to obtain all necessary highway opening notices from Derbyshire County Council, obtain approval to work on United Utilities Sewerage System, obtain approval to method statement from the Environment Agency and/or the Local Lead Flood Authority for any works affecting a watercourse.

ENGINEERING KEY

- S104 Adoptable Surface Water Sewer & Manhole
- Private Surface Water Drag-Out and Invert (10.25)
- S38 Adoptable Surface Water Sewer & Manhole
- S38 Adoptable Road Gully
- S104 Adoptable Foul Water Sewer & Manhole
- Private Foul Drag-Out and Invert 10.25
- Proposed Adoptable Foul Water Rising Main
- Proposed S104 Sewer Easement
- Proposed Adoptable Foul Water Pumpstation

Revision	Description	Date	Design By
P07	Updated design to suit planning layout revision Rev. 3	01.07.24	CD
P06	Updated design to suit planning layout revision Rev. 2	27.06.24	CD
P05	Reverted to pumped solution for the whole site.	14.02.24	BJM
P04	Updated design to suit planning layout revision N.	09.02.24	BJM

Project: Hogshaw Farm, Buxton
Description: Preliminary Drainage Layout

Design By	Date	Scale at A0	Revision
CD	Feb 2024	1:500	P07

Project	Originator	Functional	Spatial Form	Discipline	Number
H8797 - BAH -		XX	- XX - DR -	CE -	300001

BARRATT HOMES

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Appendix I
Greenfield Calculations

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.500
Area (ha)	3.720	Urban	0.000
SAAR (mm)	1374	Region Number	Region 4

Results l/s

QBAR Rural	45.2
QBAR Urban	45.2
Q100 years	116.2
Q1 year	37.5
Q30 years	88.6
Q100 years	116.2

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Appendix J

Drained Area Plan

JPP Consulting drawing no. 11024-FRA05B

General notes

All dimensions are in metres unless otherwise stated.

All levels are in metres.

This drawing is to be read in conjunction with all relevant Engineers and Architect's drawings, Specifications, Reports and Engineering Details.

Do not scale from this drawing.

Based on Topographical Land Survey by SurveyEng Ltd, drawing number BH.TS.12 Rev C dated 26.03.2021.

Based on Planning Layout by Barratt Homes, drawing number H8797-BAH-XX-XX-DR-UD-203001-P03 dated 28.06.2024.

Drawing Key

Plot Areas = 5,665m^2

Driveway Areas = 3,904m^2

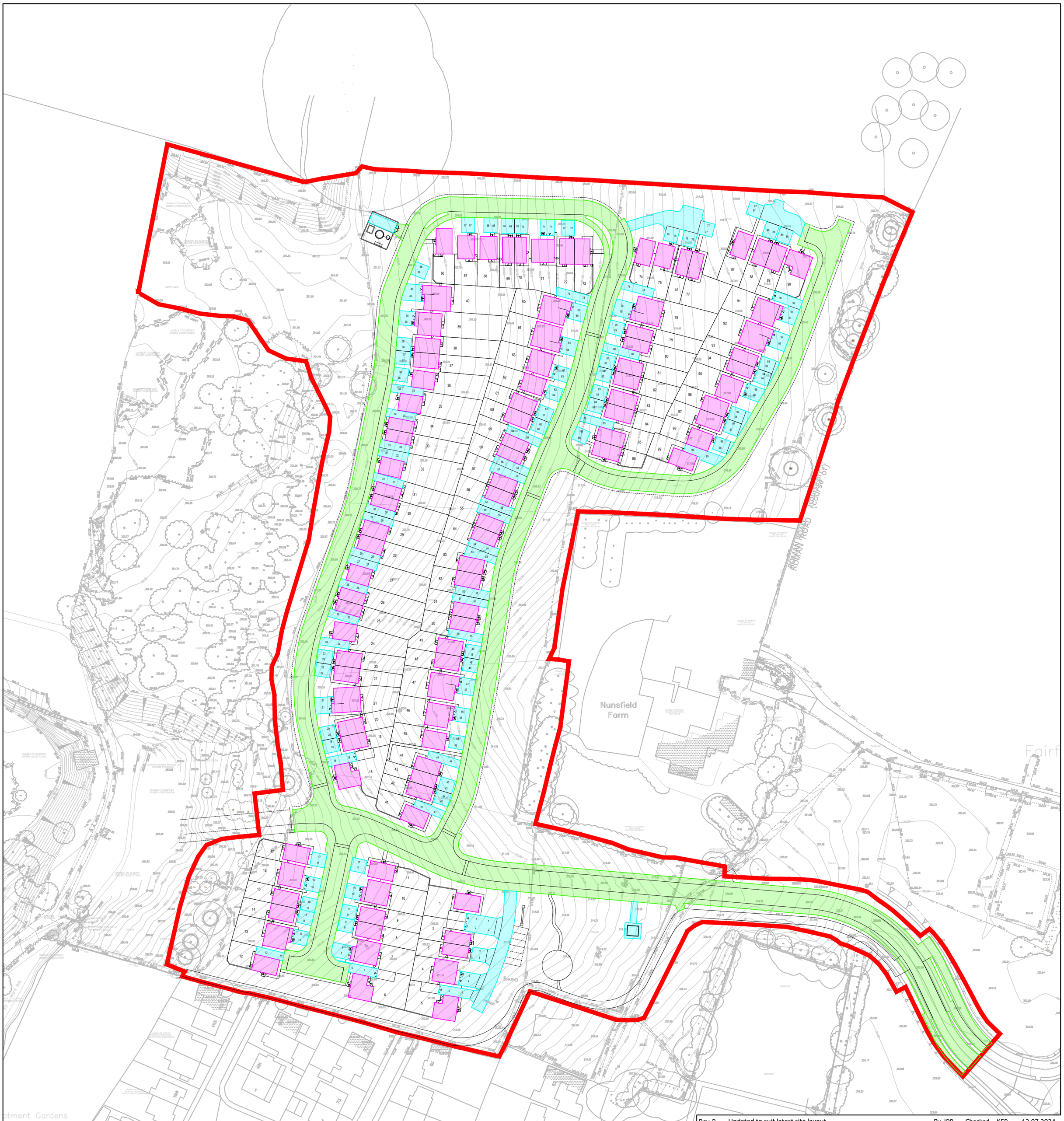
Road Areas = 9,260m^2

Total Area = 18,829m^2

10% Urban Creep to Plots = 567m^2

Total Drained Area including 10% Urban Creep = 19,396m^2

Site Boundary



Drawing is not to be used for construction until status is CONSTRUCTION

Rev B	Updated to suit latest site layout	By JPB	Checked	KER	12.07.2024
Rev A	Updated to suit latest site layout	By NCR	Checked	KER	31.01.2024

jpp
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- Structural Engineering
- Development Planning
- Professional Advice
- Geotechnical & Environmental
- Surveying

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Grand Union Works, Whilton Locks, Daventry
Northamptonshire, NN11 2NH
T: 01604 781811

Poole & Milton Keynes

E: mail@jppuk.net **W**: jppuk.net

Client	Barratt Homes
Project	Proposed Residential Develolpment Land at Hogshaw Farm, Nunsfield Road, Buxton
Title	Drained Area Plan

Scale at A2	Drawn by	Checked by	Date
1:1000	IH	KER	26.04.2023

Status	Project ref	Drawing no.	Revision
FOR PLANNING	11024	FRA05	B

Appendix K
Attenuation Calculations

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	98.525	0.525	45.1	568.6	O K
30 min Summer	98.627	0.627	45.1	680.2	O K
60 min Summer	98.736	0.736	45.1	797.8	O K
120 min Summer	98.831	0.831	45.1	900.9	O K
180 min Summer	98.863	0.863	45.1	935.1	O K
240 min Summer	98.878	0.878	45.1	952.0	O K
360 min Summer	98.888	0.888	45.1	962.5	O K
480 min Summer	98.881	0.881	45.1	955.4	O K
600 min Summer	98.866	0.866	45.1	938.4	O K
720 min Summer	98.845	0.845	45.1	915.8	O K
960 min Summer	98.790	0.790	45.1	856.5	O K
1440 min Summer	98.662	0.662	45.1	717.6	O K
2160 min Summer	98.502	0.502	45.1	544.2	O K
2880 min Summer	98.390	0.390	45.0	422.3	O K
4320 min Summer	98.270	0.270	42.7	292.4	O K
5760 min Summer	98.232	0.232	35.9	252.0	O K
7200 min Summer	98.209	0.209	31.0	226.8	O K
8640 min Summer	98.192	0.192	27.3	208.4	O K
10080 min Summer	98.179	0.179	24.5	194.4	O K
15 min Winter	98.590	0.590	45.1	639.5	O K
30 min Winter	98.708	0.708	45.1	767.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	164.198	0.0	582.3	18
30 min Summer	100.796	0.0	717.7	33
60 min Summer	61.875	0.0	892.8	62
120 min Summer	37.983	0.0	1097.5	120
180 min Summer	28.551	0.0	1238.2	166
240 min Summer	23.316	0.0	1348.8	196
360 min Summer	17.526	0.0	1521.4	260
480 min Summer	14.313	0.0	1657.1	330
600 min Summer	12.232	0.0	1770.5	400
720 min Summer	10.759	0.0	1868.9	470
960 min Summer	8.754	0.0	2027.5	608
1440 min Summer	6.545	0.0	2273.0	866
2160 min Summer	4.894	0.0	2558.3	1228
2880 min Summer	3.982	0.0	2774.5	1560
4320 min Summer	2.943	0.0	3070.9	2208
5760 min Summer	2.374	0.0	3313.1	2944
7200 min Summer	2.010	0.0	3505.4	3672
8640 min Summer	1.755	0.0	3669.9	4408
10080 min Summer	1.564	0.0	3811.9	5136
15 min Winter	164.198	0.0	653.7	18
30 min Winter	100.796	0.0	805.3	32

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	98.833	0.833	45.1	903.2	O K
120 min Winter	98.943	0.943	45.1	1022.7	O K
180 min Winter	98.984	0.984	45.1	1066.9	O K
240 min Winter	98.996	0.996	45.1	1079.4	O K
360 min Winter	99.000	1.000	45.2	1083.5	O K
480 min Winter	98.983	0.983	45.1	1065.3	O K
600 min Winter	98.954	0.954	45.1	1033.9	O K
720 min Winter	98.918	0.918	45.1	995.2	O K
960 min Winter	98.830	0.830	45.1	899.8	O K
1440 min Winter	98.621	0.621	45.1	673.3	O K
2160 min Winter	98.392	0.392	45.0	425.2	O K
2880 min Winter	98.276	0.276	43.4	299.5	O K
4320 min Winter	98.219	0.219	33.1	237.2	O K
5760 min Winter	98.190	0.190	26.9	206.5	O K
7200 min Winter	98.172	0.172	22.8	186.4	O K
8640 min Winter	98.159	0.159	20.0	171.9	O K
10080 min Winter	98.148	0.148	17.8	160.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	61.875	0.0	1000.7	62
120 min Winter	37.983	0.0	1230.0	118
180 min Winter	28.551	0.0	1387.6	172
240 min Winter	23.316	0.0	1511.4	222
360 min Winter	17.526	0.0	1704.9	278
480 min Winter	14.313	0.0	1856.8	356
600 min Winter	12.232	0.0	1983.8	434
720 min Winter	10.759	0.0	2094.0	508
960 min Winter	8.754	0.0	2271.7	656
1440 min Winter	6.545	0.0	2547.3	922
2160 min Winter	4.894	0.0	2865.9	1256
2880 min Winter	3.982	0.0	3108.3	1532
4320 min Winter	2.943	0.0	3441.2	2244
5760 min Winter	2.374	0.0	3711.0	2944
7200 min Winter	2.010	0.0	3926.7	3680
8640 min Winter	1.755	0.0	4111.3	4408
10080 min Winter	1.564	0.0	4271.4	5144

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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	406450 374300 SK 06450 74300
C (1km)	-0.025
D1 (1km)	0.411
D2 (1km)	0.398
D3 (1km)	0.369
E (1km)	0.301
F (1km)	2.404
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.940

Time (mins) From:	To:	Area (ha)
0	4	1.940

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Model Details

Storage is Online Cover Level (m) 100.000

Tank or Pond Structure

Invert Level (m) 98.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1084.0	1.000	1084.0	1.001	0.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0282-4520-1000-4520
Design Head (m)	1.000
Design Flow (l/s)	45.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	282
Invert Level (m)	98.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	45.2
Flush-Flo™	0.432	45.1
Kick-Flo®	0.774	40.0
Mean Flow over Head Range	-	36.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	8.8	1.200	49.3	3.000	76.8	7.000	116.1
0.200	29.0	1.400	53.1	3.500	82.8	7.500	120.1
0.300	43.9	1.600	56.7	4.000	88.4	8.000	124.0
0.400	45.0	1.800	60.0	4.500	93.6	8.500	127.7
0.500	44.8	2.000	63.1	5.000	98.5	9.000	131.3
0.600	44.0	2.200	66.1	5.500	103.2	9.500	134.8
0.800	40.6	2.400	69.0	6.000	107.7		
1.000	45.2	2.600	71.7	6.500	112.0		

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Appendix L
Overland Flows
JPP Consulting drawing no. 11024-FRA06B

General notes

All dimensions are in metres unless otherwise stated.

All levels are in metres.

This drawing is to be read in conjunction with all relevant Engineers and Architect's drawings, Specifications, Reports and Engineering Details.

Do not scale from this drawing.

Based on Topographical Land Survey by SurveyEng Ltd, drawing number BH.TS.12 Rev C dated 26.03.2021.

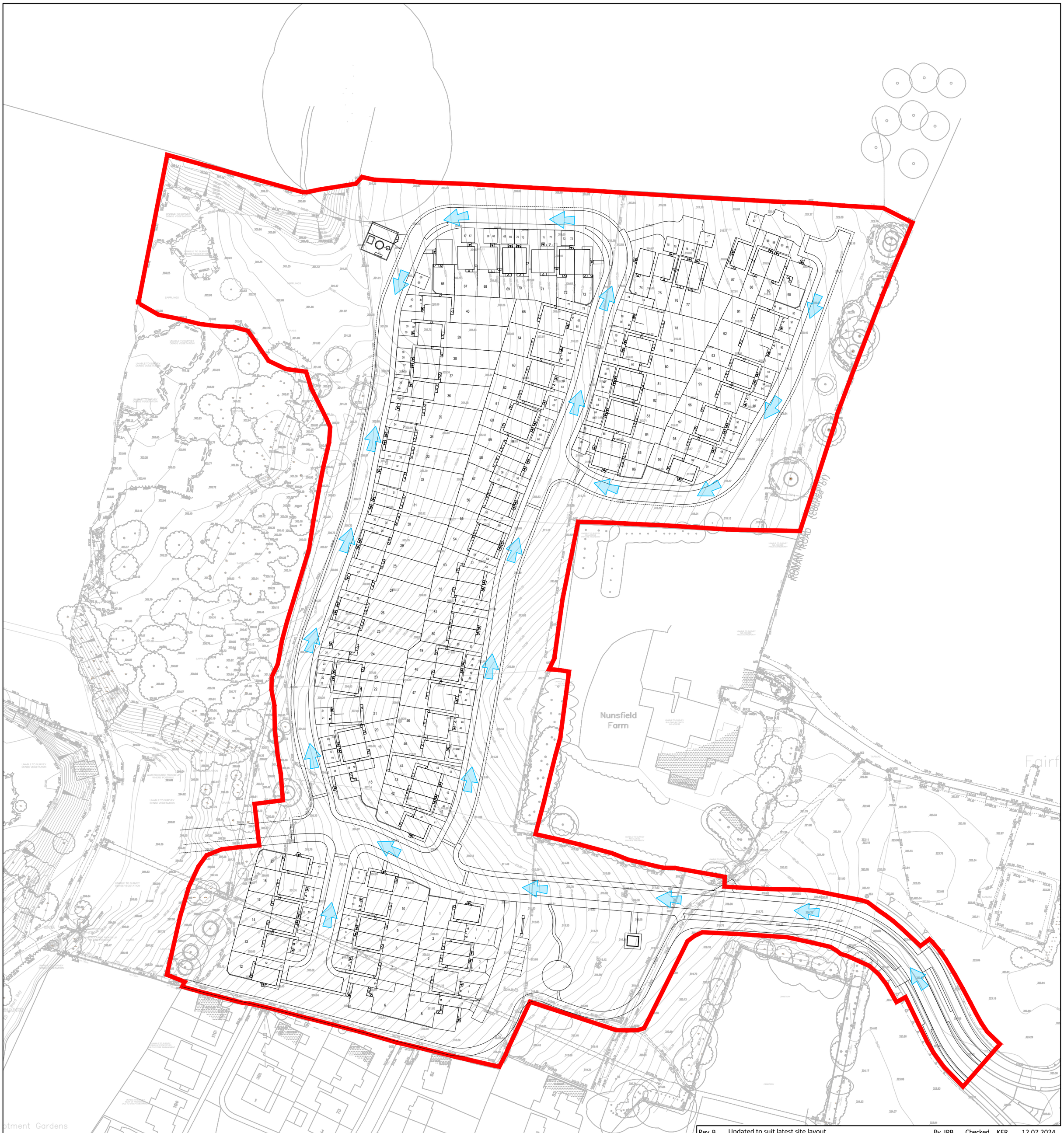
Based on Planning Layout by Barratt Homes, drawing number H8797-BAH-XX-XX-DR-UD-203001-P03 dated 28.06.2024.

Based on Drainage Layout by Barratt Homes, drawing number H8797-BAH-XX-XX-DR-CE-300001-P07 dated 01.07.2024.

Drawing Key

Predicted Overland Flows

Site Boundary



Drawing is not to be used for construction until status is CONSTRUCTION

Rev B	Updated to suit latest site layout	By	JPB	Checked	KER	12.07.2024
Rev A	Updated to suit latest site layout	By	JPB	Checked	KER	31.01.2024

jpp

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Northamptonshire, NN11 2NH
T: 01604 781811

Poole & Milton Keynes

E: mail@jppuk.net **W**: jppuk.net

Client	Barratt Homes
Project	Proposed Residential Develolpment Land at Hogshaw Farm, Nunsfield Road, Buxton
Title	Predicted Overland Flows

Scale at A2	1:1000	Drawn by	KER	Checked by	KER	Date	26.04.2023
Status **FOR PLANNING**		Project ref 11024		Drawing no. FRA06		Revision B	

Appendix M

Severn Trent Water Pre-Development Enquiry

WONDERFUL ON TAP

Severn Trent Water Ltd
Leicester Water Centre
Gorse Hill
Anstey
Leicester
LE7 7GU

Contact: Emma Nowak
Mob: 07970361864

Email:
Network.Solutions@SevernTrent.co.uk

Our ref: 1080322

JPP Consulting Ltd,
4 Ironstone Way,
Brixworth,
Northampton,
NN6 9UD.

FAO: Katherine Rose

20th April 2023

Dear Katherine,

Proposed Residential Development (116 Residential Dwellings) at: Land at Hogshaw Farm, Nunsfield Road, Buxton

X: 406585 / Y: 374410

I refer to your Development Enquiry Request submitted in respect of the above site. Please find enclosed the sewer records that are included in the fee together with the Supplementary Guidance Notes (SGN) referred to below.

Public Sewers in Site – Required Protection

There are no public sewers crossing the site.

Please Note: On 1st October 2011 many private sewers were transferred into the ownership of Severn Trent Water as public sewers, where two or more properties in separate ownership are served by those sewers. Most of these former private sewers will not be shown on the public sewer records, therefore a full site survey should be carried out prior to any layout design or construction works to identify where these sewers may be and to avoid later delays and possible added costs.

Foul Water Drainage

The most convenient point of connection for gravity foul flows from the site is at the 150mm public foul sewer southwest of the site at the junction of Barms Way & Nunsfield Road. A gravity connection for an additional 116 dwellings (1.8 l/s 2DWF) would be acceptable at this sewer at a new or existing manhole (5203) subject to formal 106 approval.

Please note that a gravity connection should be viable for the whole site, however should after investigations, a pumped

connection be required for any part of the site, please notify us as soon as possible further modelling may be required to understand the impact of increased flows in the foul network.

Surface Water Drainage

Under the terms of Section H of the Building Regulations 2000, the disposal of surface water by means of soakaways should be considered as the primary method. If this is not practical a connection to the watercourse southeast of the site would be acceptable subject to LLFA approval. In addition, other sustainable drainage methods should also be explored before a discharge to the public sewerage system is considered.

If these are found to be unsuitable, satisfactory evidence will need to be submitted. The evidence should be either percolation test results or by the submission of a statement from the SI consultant (extract or a supplementary letter).

The site drainage should be discussed with the Local Lead Flood Authority with a view to implement suitable SuDS techniques to land soakaways or other land drainage systems prior to any consideration of discharges to public sewers being accepted. Any discharge rate to a watercourse or drainage ditch will be determined by the LLFA.

Should soakaways / SuDs prove not to be viable, the Nun Brook runs west of the proposed development. A connection to the watercourse should be pursued but may require the crossing of third-party land. Please note, that if you cannot gain consent from the landowner, a S98 Sewer Requisition may be required. For your information, STW have the right to lay sewers through 3rd party land even unregistered land, however, STW do not have the right to discharge to a watercourse/ditch. In order to discharge to a watercourse we require a Deed Of Grant Of Easement (DOGOE) from the watercourse owner. Please liaise with the LLFA as statutory consultee in the planning process to agree flow rates at this location.

No impact on the public network.

WONDERFUL ON TAP

SEVERN TRENT

New Connections

For any new connections including the use, reuse and indirect to the public sewerage system, the developer will need to submit Section 106 application. Our Developer Services department are responsible for handling all such enquiries and applications. To contact them for an application form and associated guidance notes, please call 0800 707 6600, email new.connections@severntrent.co.uk or download from www.stwater.co.uk

Please quote the above reference number in any future correspondence (including e-mails) with STW Limited. Please send **all correspondence** to the network.solutions@severntrent.co.uk email inbox address, a response will be made within 15 days.

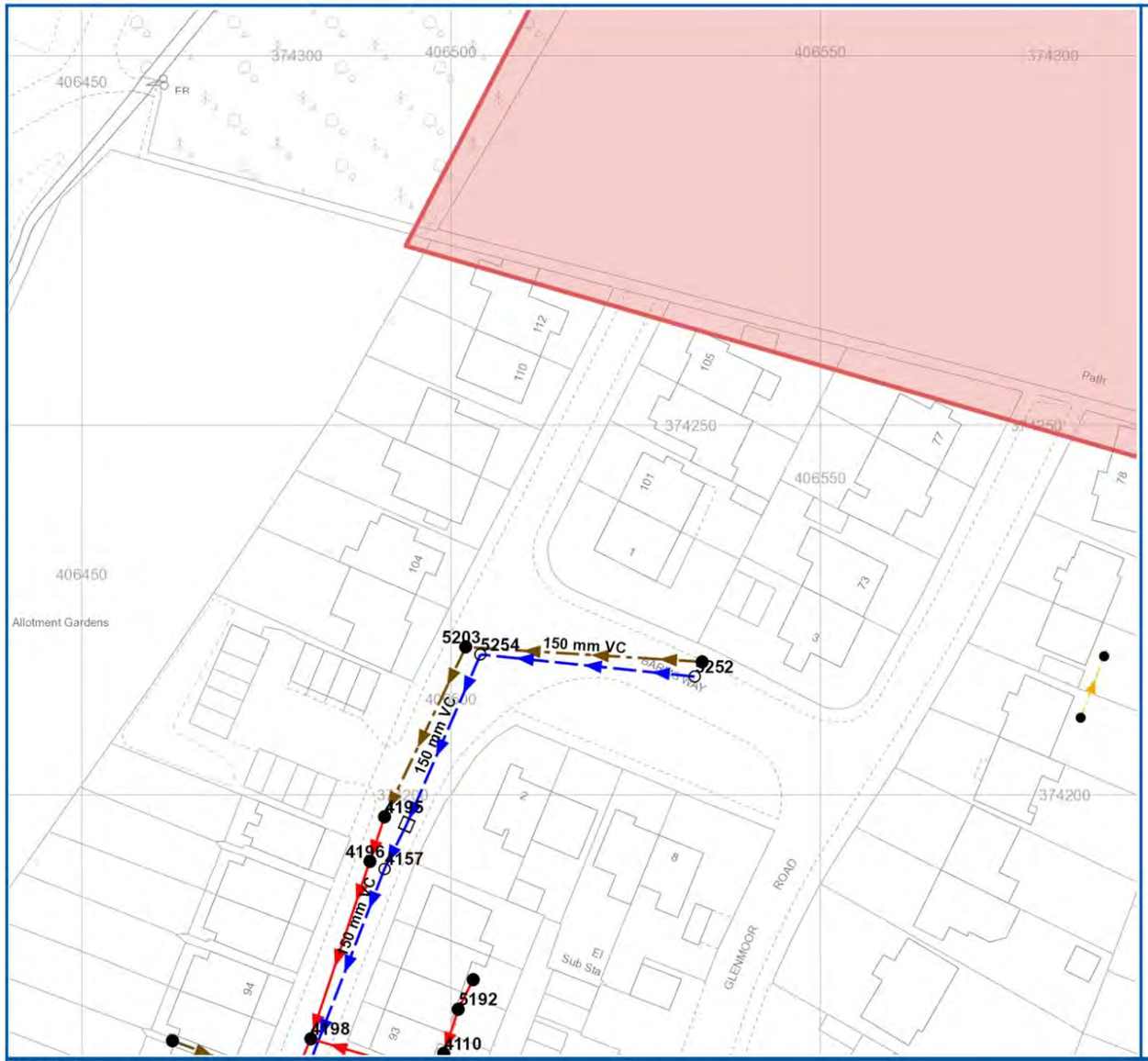
If you require a VAT receipt for the application fee please email MISCINCOME.NC@SEVERNTRENT.CO.UK quoting the above Reference Number.

Please note that Developer Enquiry responses are only valid for 6 months from the date of this letter.

Yours sincerely,

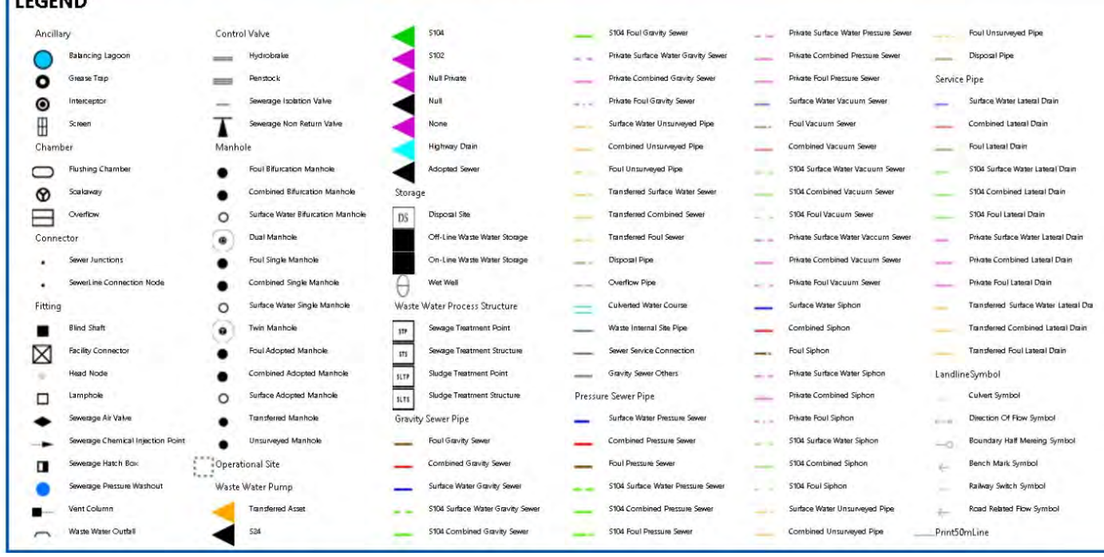


Emma Nowak.
Senior Evaluation Technician
Network Solutions
Developer Services



Reference	Cover Level	Invert Level Upstream	Invert Level Downstream	Purpose	Material	Pipe Shape	Max Size	Min Size	Gradient	Year Laid
SK06745203	306.1759	304.78	303.4	F	VC	C	150	<UNK>	18.48	31/12/1899 00:00:00
SK06745254	306.242	304.93	303.91	S	VC	C	150	<UNK>	24.59	31/12/1899 00:00:00
SK06744196	304.957	<UNK>	300.86	C	VC	C	<UNK>	<UNK>	0	31/12/1899 00:00:00
SK06745201	309.9079	308.58	304.79	F	VC	C	150	<UNK>	8.46	31/12/1899 00:00:00
SK06744195	305.1549	303.4	<UNK>	C	VC	C	150	<UNK>	0	31/12/1899 00:00:00
SK06745191	306.591	305.981	305.746	C	VC	C	100	<UNK>	18.63	31/12/1899 00:00:00
SK06744110	306.3659	305.206	<UNK>	C	VC	C	100	<UNK>	0	31/12/1899 00:00:00
SK06745252	309.9419	308.572	304.94	S	VC	C	150	<UNK>	8.03	31/12/1899 00:00:00
SK06745192	306.436	305.726	305.226	C	VC	C	100	<UNK>	12.64	31/12/1899 00:00:00
SK06744198	304.035	300.84	299.375	C	VC	C	225	<UNK>	33.86	31/12/1899 00:00:00
SK06744157	304.967	303.537	<UNK>	S	VC	C	150	<UNK>	0	31/12/1899 00:00:00
<UNK>	<UNK>	<UNK>	<UNK>	F	VC	<UNK>	<UNK>	<UNK>	<UNK>	05/07/2020 00:00:00
<UNK>	<UNK>	<UNK>	<UNK>	F	VC	<UNK>	<UNK>	<UNK>	<UNK>	14/04/2021 00:00:00

LEGEND



MATERIALS

- - NONE
- AC - ASBESTOS CEME
- BR - BRICK
- CC - CONCRETE BOX CULVERT
- CI - CAST IRON
- CO - CONCRETE
- CSB CONCRETE SEGMENTS (BOLTED)
- CSU - CONCRETE SEGMENTS (UNBOLTED)
- DI - DUCTILE IRON
- GRP - GLASS REINFORCED PLASTIC
- MAC - MASONRY IN REGULAR COURSES
- MAR - MASONRY RANDOMLY COURSED
- PE - POLYETHLENE
- PF - PITCH
- PP - POLYPROPYLENE
- PSC - PLASTIC STEEL COMPOSITE
- PVC - POLYVINYL CHLORIDE
- RPM - REINFORCED PLASTIC MATRIX
- SI - SPUN (GREY) IRON
- ST - STEEL
- U - UNKNOWN
- VC - VITRIFIED CLAY
- XXX - OTHER

CATEGORIES

- W - WEIR
- C - CASCADE
- DB - DAMBOARD
- SE - SIDE ENTRY
- FV - FLAP VALVE
- BD - BACK DROP
- S - SIPHON
- D - HIGHWAY DRAIN
- S104 - SECTION 104

SHAPE

- C - CIRCULAR
- E - EGG SHAPED
- O - OTHER
- R - RECTANGLE
- S - SQUARE
- T - TRAPEZOIDAL
- U - UNKNOWN

PURPOSE

- C - COMBINED
- E - FINAL EFFLUENT
- F - FOUL
- L - SLUDGE
- S - SURFACE WATER

Severn Trent Water Limited
Asset Data Management
PO Box 5344
Coventry
CV3 9FT
Telephone: 0345 601 6616

SEWER RECORD (Tabular)

O/S Map Scale: 1:750 **This map is centred upon:**

Date of Issue: 20-04-23 **X:** 406516.49 **Y:** 374235.53

Disclaimer Statement:

1 Do not scale off this Map.

2 This plan and any information supplied with it is furnished as a general guide, is only valid at the date of issue and no warranty as to its correctness is given or implied. In particular this plan and any information shown on it must not be relied upon in the event of any development or works (including but not limited to excavations) in the vicinity of SEVERN TRENT WATER assets or for the purposes of determining the suitability of a point of connection to the sewerage or distribution systems.

3 On 1 October 2011 most private sewers and private lateral drains in Severn Trent Water's sewerage area, which were connected to a public sewer as at 1 July 2011, transferred to the ownership of Severn Trent Water and became public sewers and public lateral drains. A further transfer takes place on 1 October 2012. Private pumping stations, which form part of these sewers or lateral drains, will transfer to ownership of Severn Trent Water on or before 1 October 2016. Severn Trent Water does not possess complete records of these assets. These assets may not be displayed on the map.

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Appendix N

Hydraulic Modelling Report
JBA Technical Note 2023s1142

JBA Project Code	2023s1142
Contract	Hydraulic Modelling at Hogshaw Farm
Client	Barratt Homes Manchester
Date	January 2024
Author	Ella Albrighton BSc
Reviewer / Sign-off	Amy Evans BSc MCIWEM C.WEM
Subject	Hydraulic Modelling at Hogshaw Farm, Buxton

1 Introduction

1.1 Terms of reference

JBA Consulting were commissioned by JPP Consulting Ltd on behalf of Barratt Homes Manchester to undertake a fluvial hydraulic modelling study in order to support their planning application for a proposed development at their site at Hogshaw Farm, Buxton.

The Nun Brook, which becomes an Environment Agency Main River downstream of the site, flows in a southerly direction through the north-western part of the site. The watercourse is culverted during this reach. The culvert has a diameter of 1.22m. The location of the site and the Nun Brook are included within Figure 1-1 below.

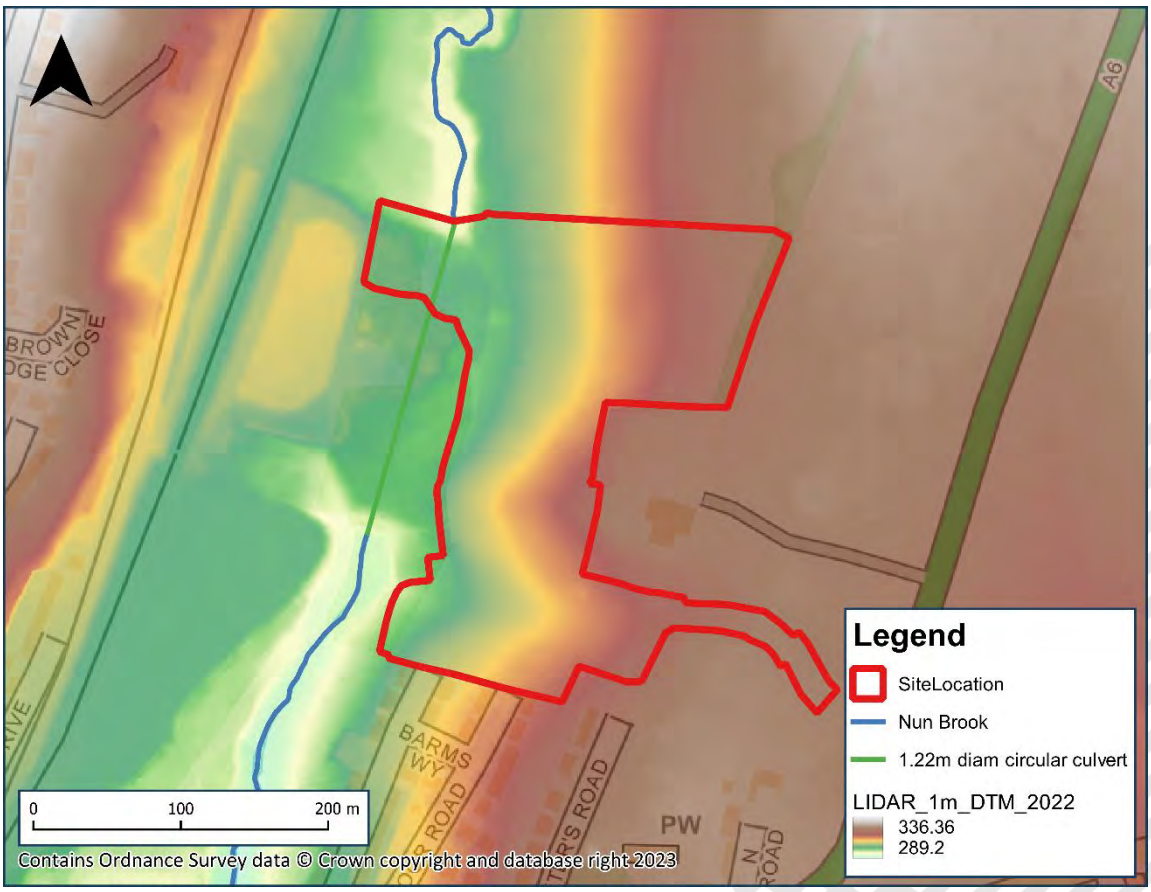


Figure 1-1 - Site Location

2 Baseline Hydraulic modelling

2.1 Modelling Approach

A license to re-use the 1D-2D ESTRY-TUFLOW 2022 Hogshaw and Nun Brook hydraulic model was obtained from the Environment Agency for use in this study. The hydrology inflows, calculated in 2022 as part of the original modelling, were retained as these still reflect best practises.

The extent of the existing model in relation to the site is shown within Figure 2-1 below.

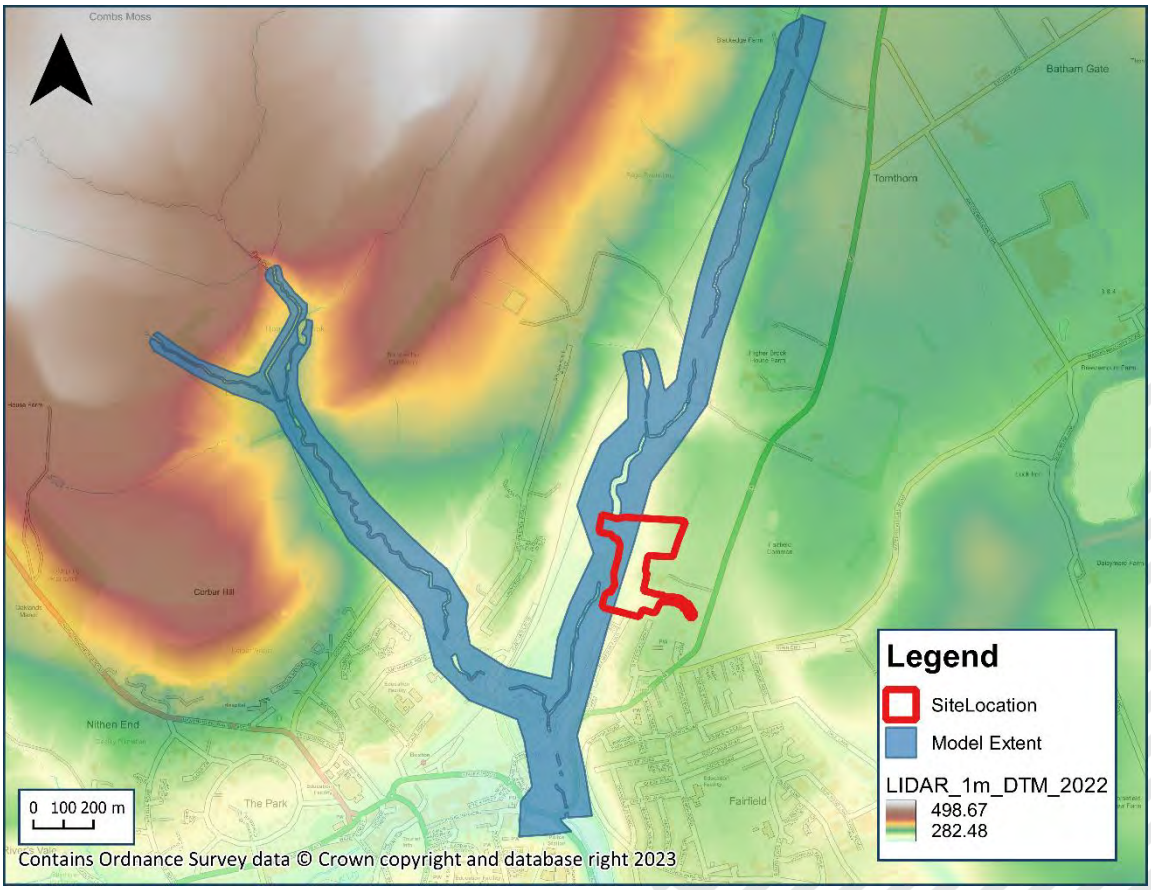


Figure 2-1: Existing model extent

New topographic survey data (included within Appendix A) representing the current ground levels within the site was integrated within the model.

The updated and refined baseline model was run with TUFLOW version 2023-03-AA-iDP-w64 for the 30-year, 100-year, 100-year with climate change (29%) and 1000-year fluvial flood events.

2.2 Baseline model results

2.2.1 Baseline flood extents

The baseline flood extents during the 30-year, 100-year and 1000-year events are shown in Figure 2-2 below. Figure 2-3 shows the impact of climate change on the 100-year flood extents.

This shows that only the north-western area of the site is included with the maximum flood extent during all of the modelled flood extents.

Figure 2-3 shows that, when 29% climate change is applied to the 100-year event, there is no impact on flood extents within the site. Upstream of the site, there is a slight increase in flood extent.

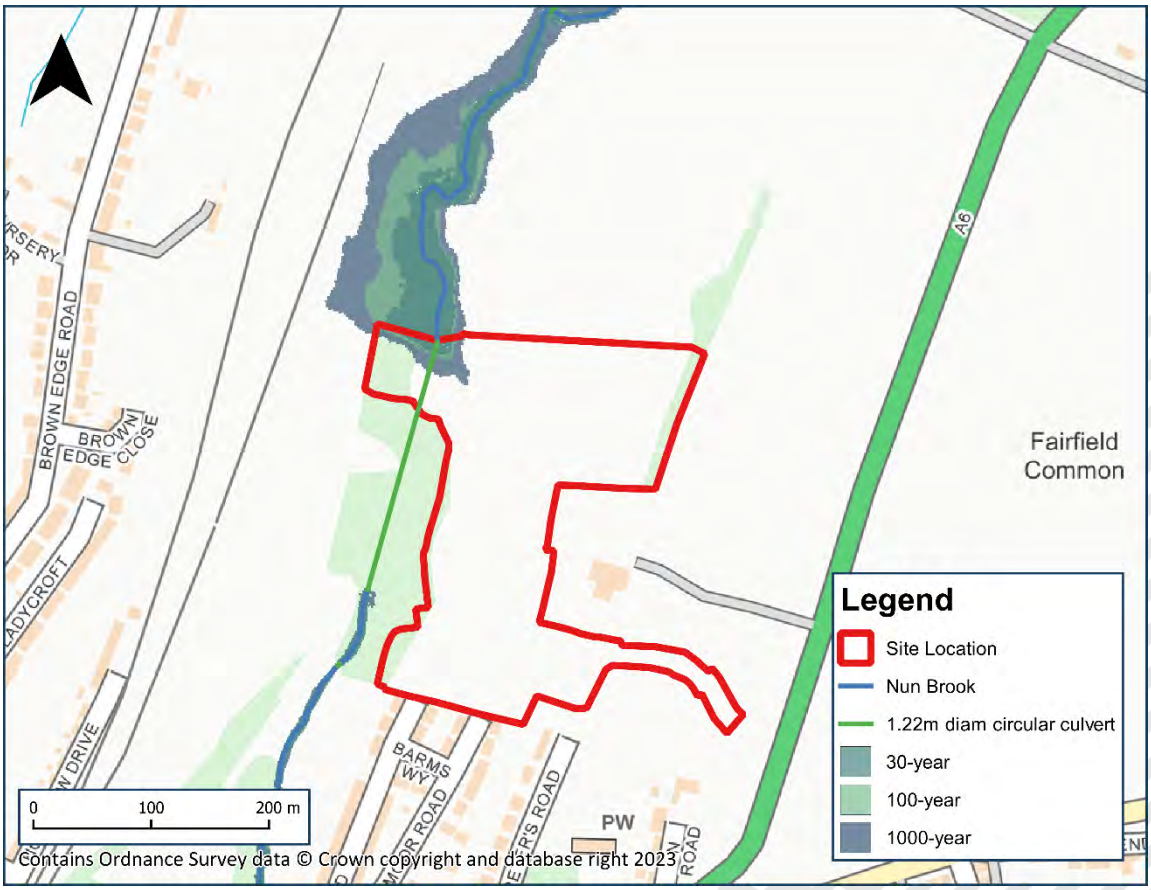


Figure 2-2: Baseline flood extents

JBA Project Code	2023s1142
Contract	Hydraulic Modelling at Hogshaw Farm
Client	Barratt Homes Manchester
Date	January 2024
Author	Ella Albrighton BSc
Reviewer / Sign-off	Amy Evans BSc MCIWEM C.WEM
Subject	Hydraulic Modelling at Hogshaw Farm, Buxton

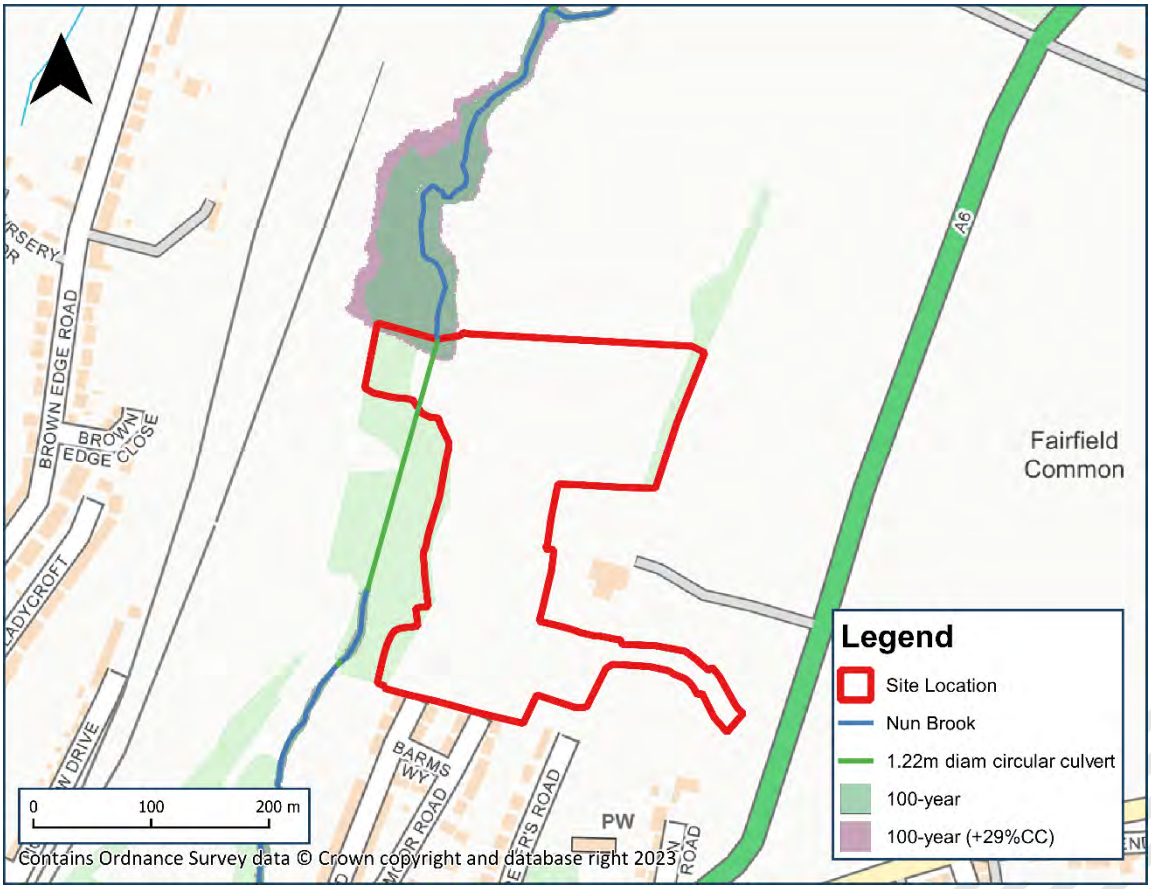


Figure 2-3: Baseline flood extent with climate change

2.2.2 Baseline flood depths

The flood depths within the site during the 100-year with 29% climate change flood event (i.e. the design event) are shown within Figure 2-4.

This shows that within the site, the maximum flood depths are upstream of the 1.22m diameter culvert inlet. The maximum flood depth in this area is 4.02m, within the area of low elevation surrounding the channel.

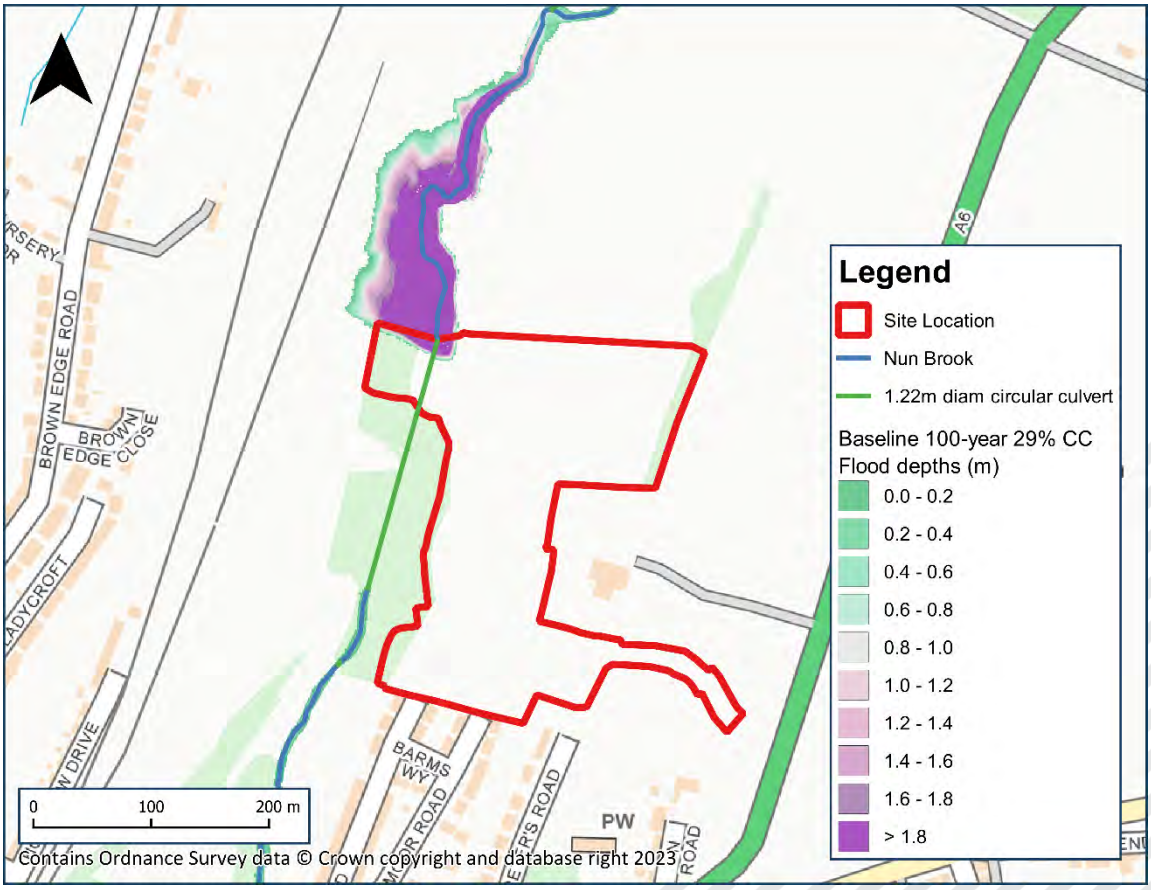


Figure 2-4: Baseline flood depths

2.2.3 Baseline water levels

The water levels during the baseline 100-year with 29% climate change are shown in Figure 2-5. During the baseline 100-year with 29% climate change event, the peak water level onsite and at the inlet of the culvert is 299.90m AOD.

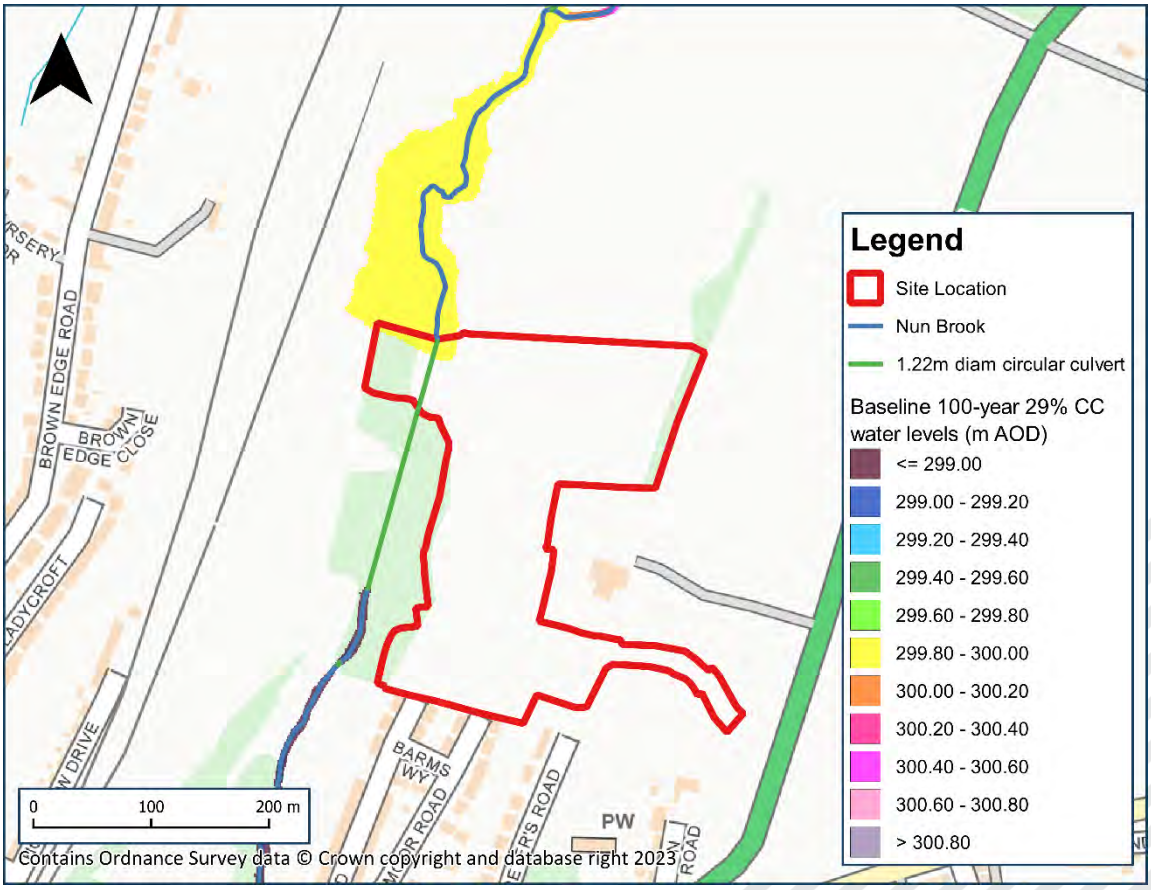


Figure 2-5: Baseline water levels

2.2.4 Baseline hazard to people

The fluvial hazard-to-people rating during a 100-year with 29% climate change flood scenario has been mapped using the formula as suggested in Defra's FD2321/TR2 "Flood Risk to People". The different hazard categories are shown in Table 2-1 and the hazard classification to the site during the 100-year with 29% climate change scenario is shown in Figure 2-6.

Table 2-1 Flood Risk to People Hazard to People

Flood hazard rating depth x (velocity+0.5) +DF	Level of Flood Hazard Description	Class label
<0.75	Low	Caution "Flood zone with shallow flowing water or deep standing water"
0.75 to 1.25	Moderate	Dangerous for some (i.e. Children) "Danger: flood zone with deep or fast flowing water"
1.25 to 2.00	Significant	Danger for most "Danger: flood zone with deep fast flowing water"
>2.00	Extreme	Dangerous for all "Extreme danger: flood zone with deep fast flowing water"
Using the hazard equation HR = d*(v+0.5) + DF Where d = depth of flooding (m) v = velocity of floodwaters (m/sec) DF = debris factor		

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Subject	Hydraulic Modelling at Hogshaw Farm, Buxton

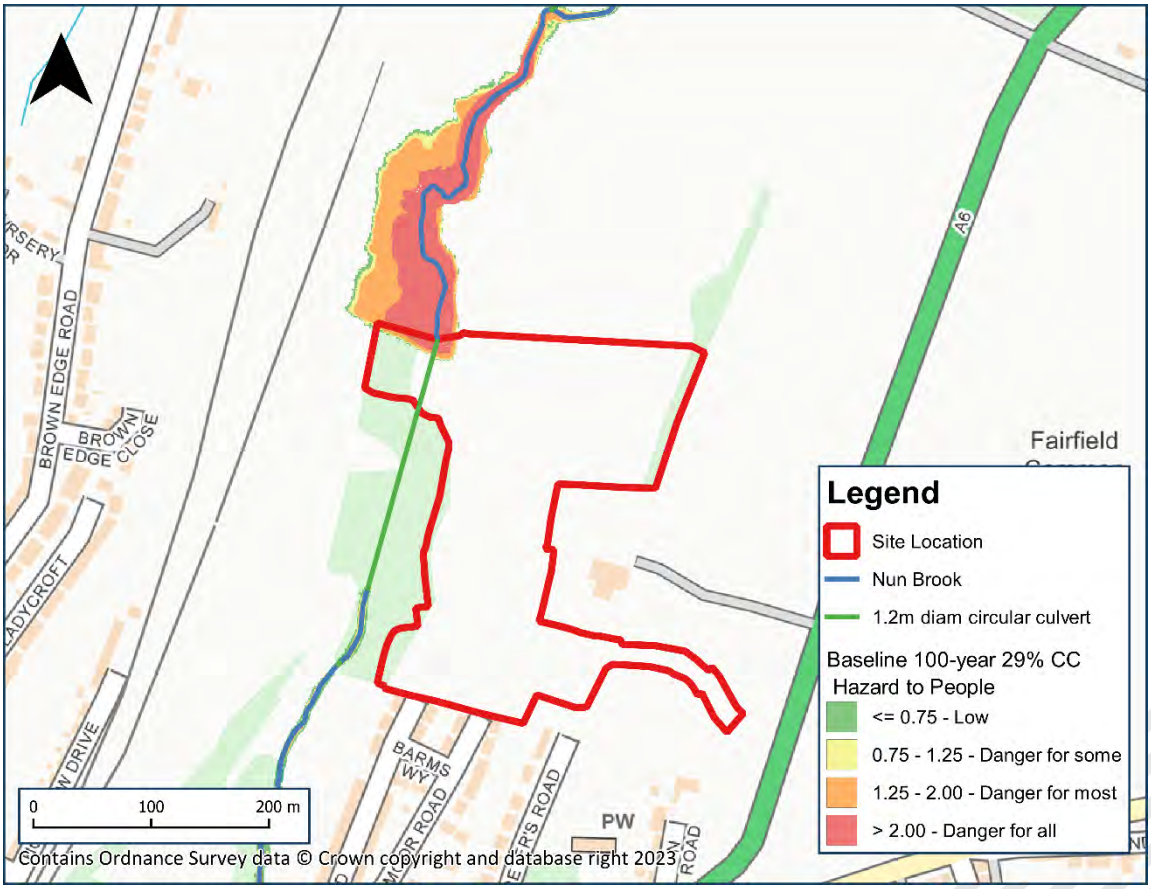


Figure 2-6: Baseline hazard to people

Figure 2-6 shows that during the baseline 100-year with 29% climate change event the north-western area of the site is partially within the 'danger for all' hazard category. However, this is primarily the channel and immediate floodplain of the Nun Brook.

2.3 Blockage analysis

The residual risk of a blockage at the inlet of the 1.22m diameter culvert has been considered as part of this study. In order to represent the worst-case scenario a 100% blockage at the structure has been modelled. Figure 2-7 shows the maximum flood extent during the 100% blockage at the structure during a 100-year with 29% climate change flood event. This shows that the flood extent is larger during this event where flows build up behind the inlet before eventually flowing overland to the downstream culvert extent where the Nun Brook becomes open channel.

Figure 2-8 shows the peak water levels associated with this residual event.

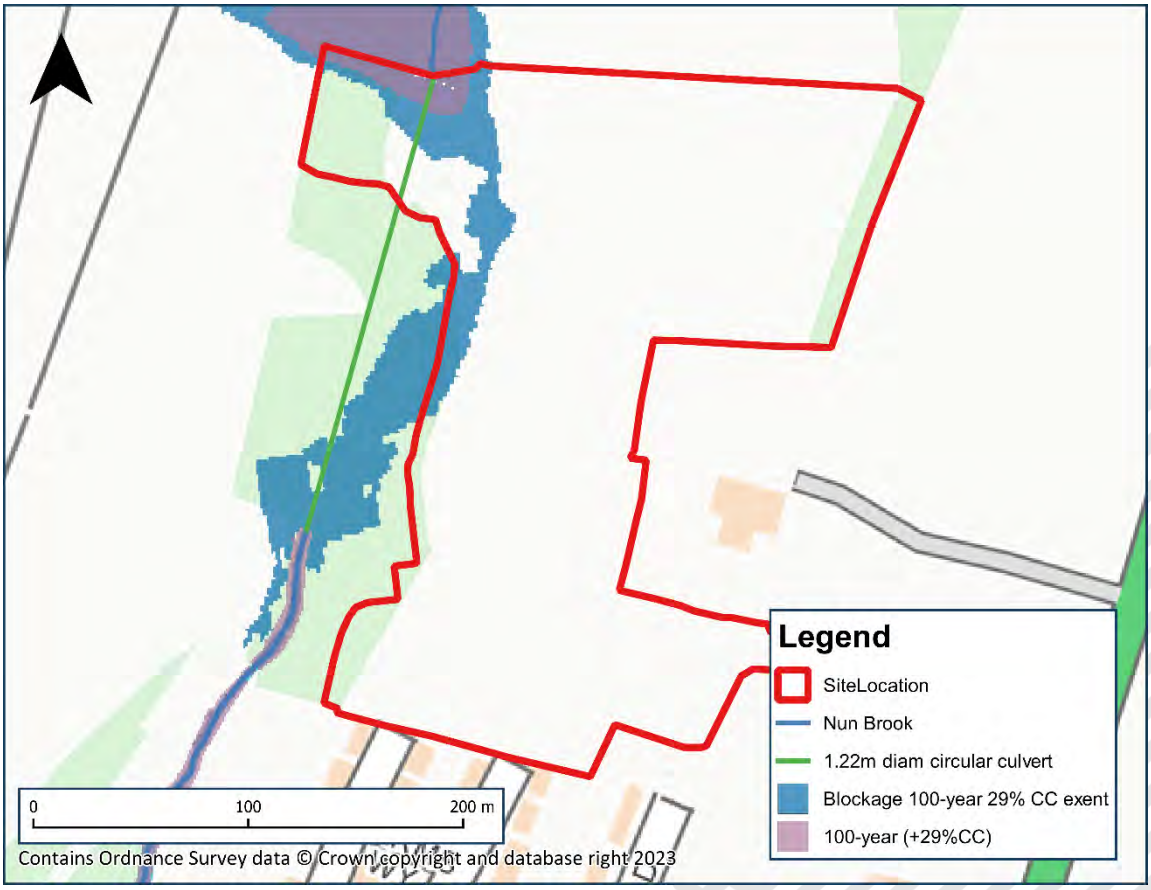


Figure 2-7: Blockage extent

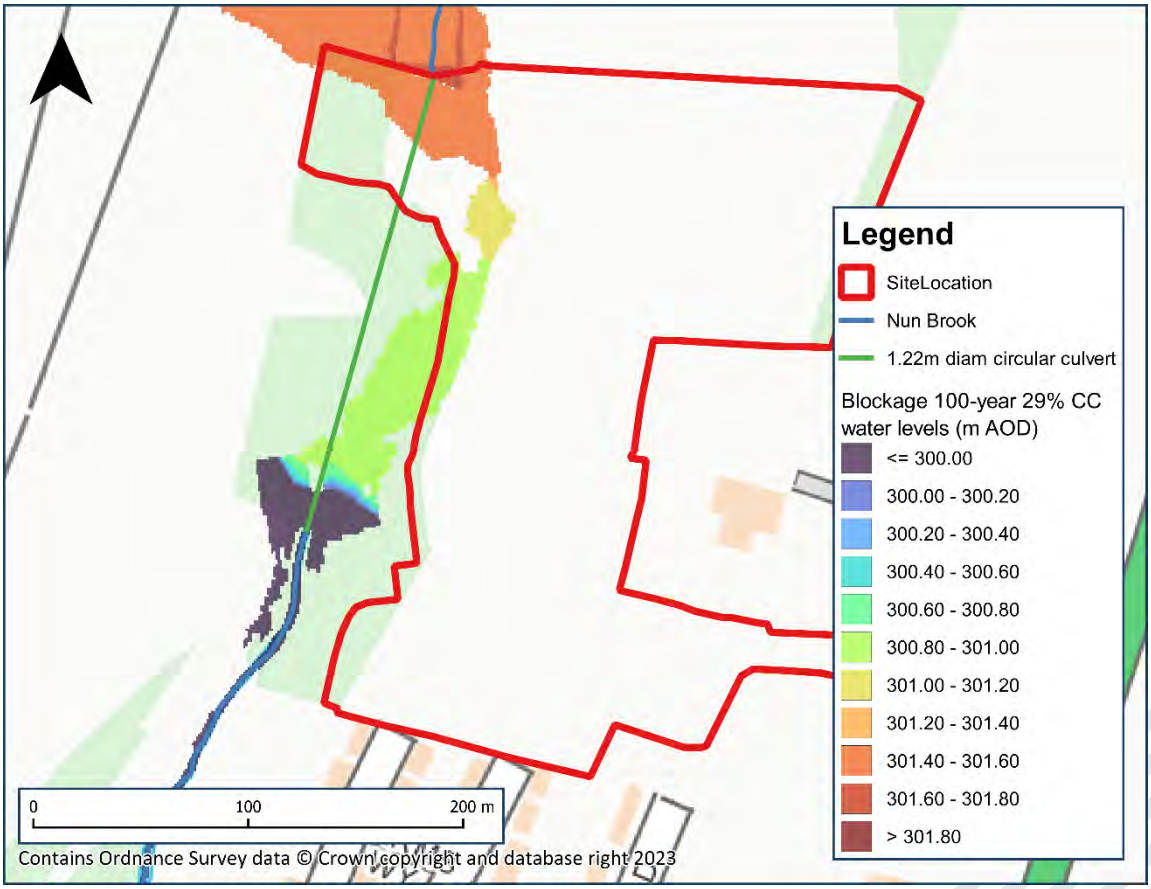


Figure 2-8: Blockage water levels

Figure 2-8 shows that during the 100-year with 29% climate change flood event with a 100% culvert blockage, the modelled peak water level is 301.78m AOD in the north-western area of the site. This is a 1.88m increase in peak water level compared to the baseline scenario.

3 On-site Surface Water Discharge Hydraulic Modelling

3.1 Modelling Approach

In order to assess the impact of the surface water drainage scheme proposed as part of the development, an assessment of the pre- and post- on-site surface water flows was completed using the baseline modelling described in Section 3.

3.2 Revised baseline reflecting current greenfield runoff flows

The existing greenfield run-off rates have been calculated as part of the proposed drainage strategy produced for the site by JPP Consulting. Appendix I of their report states that the peak greenfield runoff rate for the site for the 100-year rainfall event is 116.2 l/s. For the revised baseline scenario, this has been converted into m^3/s and read into the model as a lateral constant flow downstream of the 1.22m diameter culvert, inline with the ground levels within the site. In order to account for climate change, this inflow has been increased by 40%.

Applying the greenfield runoff from the site directly as a point inflow is a conservative approach as the existing model hydrology will account for the site runoff. Also, in reality, the flow would exhibit a hydrograph shape and would not be a constant. However, it was considered necessary to apply this to the baseline as the proposed drainage strategy discharge is to be applied to the post developed model scenario in a similar way.

The revised baseline model scenario was then run for the 100-year 29% climate change event.

3.3 Post-developed model reflecting the proposed on-site surface water outfall

The principal of the proposed drainage strategy for the development is for the whole site to drain to the watercourse, upstream of the 1.22m culvert via an attenuation basin. Discharge from the site into the watercourse will be restricted to 45.2l/s during the 100-year plus climate change (40%) rainfall event. In order to represent the impact of the proposed surface water discharge within the site, this has been modelled in a post-development model scenario.

During the post-development scenario, the proposed peak discharge (45.2l/s) has been applied as a constant flow upstream of the culvert as a lateral inflow to the watercourse. Note that this is conservative as in reality the flow would exhibit a flattened peak hydrography shape. The hydrology from the remaining model remains as per the baseline modelling but the greenfield runoff rate inflow applied to the revised baseline was excluded.

The post developed model scenario was then run for the 100-year 29% climate change event.

3.4 On-site Surface Water Discharge Hydraulic Modelling - Revised Baseline and Post-developed results

The results from the revised baseline modelling and post-development modelling were compared. The impact of the post-developed surface water drainage strategy on downstream flood extents is shown in Figure 3-1 below.

This shows that, with the proposed drainage strategy in place, there is a slight reduction in the flood extent downstream of the site as a greater proportion of the flow is held upstream of the 1.22m culvert. Figure 3-2 below shows the impact on flood depths during the 100-year with climate change event. It shows that there is a reduction in the flood depths downstream within the north-eastern area of Buxton. There is an increase in flood depths upstream of the site of up to 0.05m, however, the extent is unchanged.

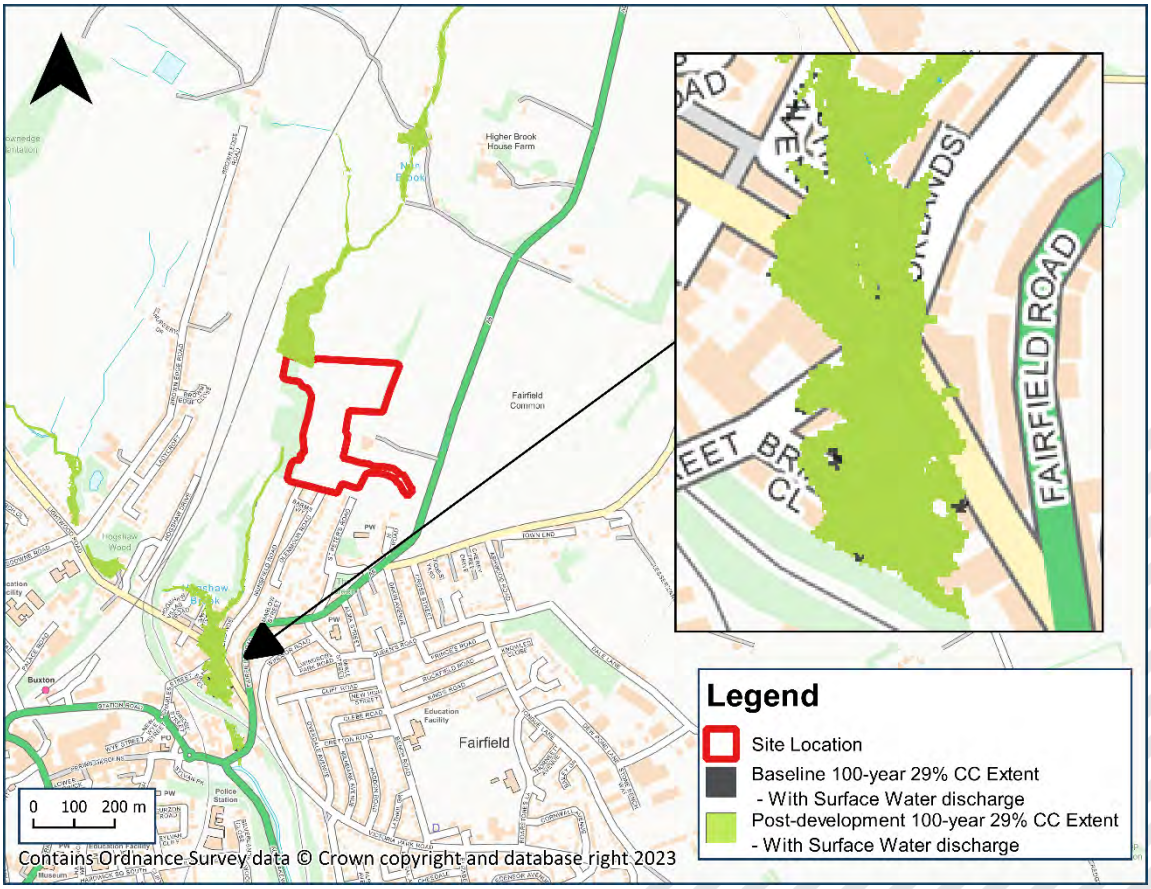


Figure 3-1: Impact on flood extents from surface water discharge amendment

JBA Project Code	2023s1142
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Client	Barratt Homes Manchester
Date	January 2024
Author	Ella Albrighton BSc
Reviewer / Sign-off	Amy Evans BSc MCIWEM C.WEM
Subject	Hydraulic Modelling at Hogshaw Farm, Buxton

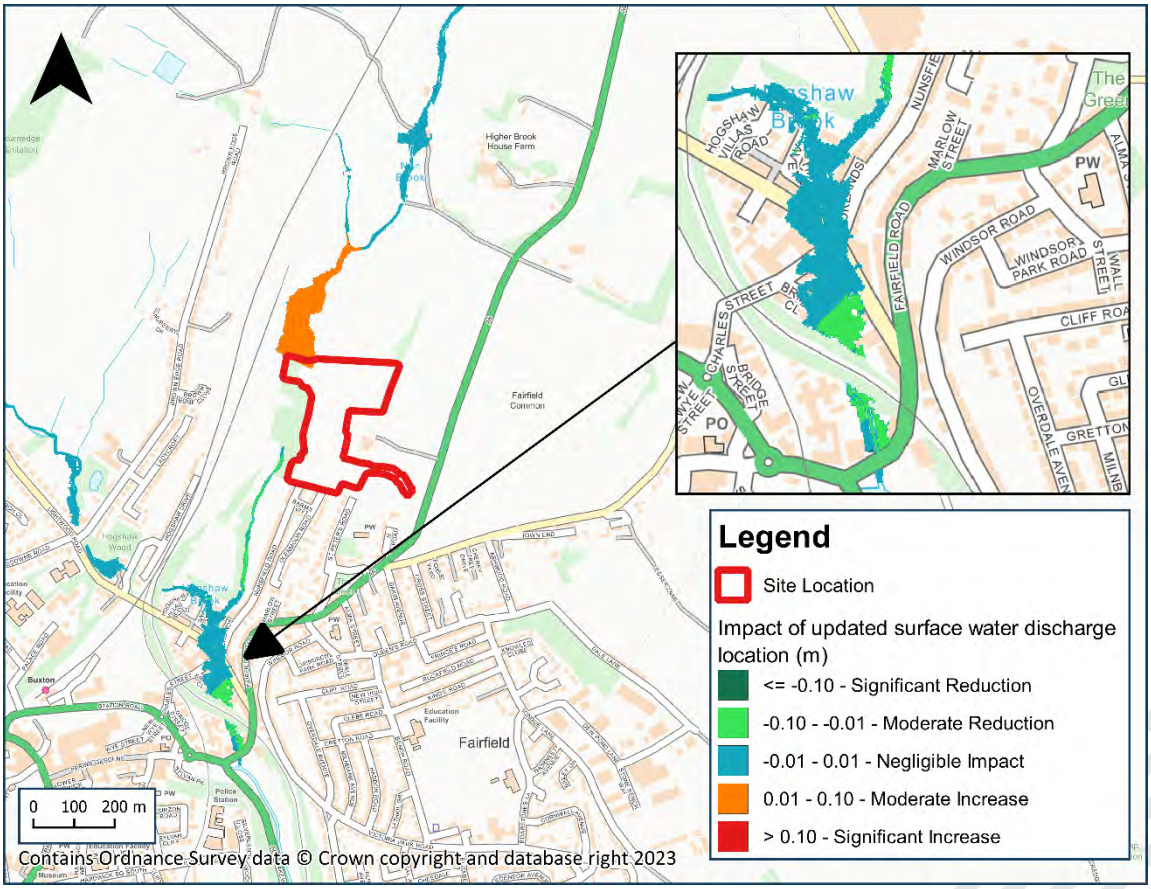


Figure 3-2: Impact on flood depths from surface water discharge amendment

4 Conclusion

- JBA Consulting were commissioned by JPP Consulting Ltd on behalf of Barratt Homes Manchester to undertake a fluvial hydraulic modelling study in order to support their planning application for a proposed development at their site at Hogshaw Farm, Buxton.
- The Nun Brook flows in a southerly direction through the north-western part of the site. The watercourse is culverted during this reach.
- A license to re-use the 1D-2D ESTRY-TUFLOW 2022 Hogshaw and Nun Brook hydraulic model was obtained from the Environment Agency for use in this study. The hydrology inflows, calculated in 2022 as part of the original modelling, were retained as these still reflect best practises.
- New topographic survey data representing the current ground levels within the site was integrated within the model.
- The updated and refined model was run with TUFLOW version 2023-03-AA-iDP-w64 for the 30-year, 100-year, 100-year with climate change (29%) and 1000-year fluvial flood events.
- Baseline model results show:
    - only the north-western area of the site is included with the maximum flood extent during all of the modelled flood extents. Model results show when 29% climate change is applied to the 100-year event, there is no impact on flood extents within the site. Upstream of the site, there is a slight increase in flood extent.
    - Within the site, the maximum flood depths can be found along the north-eastern area of the site upstream of the 1.22m diameter culvert. The maximum flood depth in this area is 4.02m.
    - During the baseline 100-year with 29% climate change event, the peak water levels is 299.90m AOD within the site.
    - The north-eastern areas of the site during the baseline 100-year with 29% climate change event the site is partially within the 'danger for all' hazard category.
- To represent the worst-case scenario, a 100% blockage at the 1.22m diameter culvert has been modelled for the 100-year with 29% climate change event. The blockage model results show that:
    - The flood extent is larger during this event where flows build up behind the culvert inlet before eventually flowing overland to the downstream culvert extent where the Nun Brook becomes open channel.
    - Within the site, during a 100% culvert blockage scenario, the peak water level will be 301.78m AOD in the north-western part of the site.
- In order to assess the impact of the surface water drainage scheme proposed as part of the development, an assessment of the pre- and post- on-site surface water flows was completed.
    - The existing greenfield run-off rates have been calculated as part of the drainage strategy produced for the site. A revised baseline model scenario was

set up which includes a lateral flow into the model to represent the greenfield 1 in 100 year plus climate change peak runoff (116.2 l/s). A review of ground levels within the site shows that the majority of this greenfield flow would enter the Nun Brook downstream of the 1.22m diameter culvert and therefore, this is where the lateral inflow has been applied for the revised baseline model scenario.

- During the post-development scenario, the proposed drainage strategy was represented by applying a lateral inflow at the proposed attenuated rate of 45.2l/s. In line with the proposed strategy, the lateral inflow in the post-developed model was applied upstream of the 1.22m.
- The pre- and post- on-site surface water modelling result show:
  - With the proposed drainage strategy in place, there is a slight reduction in the flood extent downstream of the site.
  - There is a reduction in the flood depths downstream within the north-eastern area of Buxton. There is an increase in flood depths upstream of the site of up to 0.05m however, the extent is unchanged.

Appendix B
Site Investigation

soiltechnics

environmental • geotechnical • building fabric

Proposed residential development
Land off Nunsfield Road
Buxton

Ground Investigation Report

Revision 03

Unit 9, Clarence Avenue, Westpoint Enterprise Park, Trafford Park, Manchester, M17 1QS

t: 0161 9470270 **e**: mail@soiltechnics.net **w**: www.soiltechnics.net

soiltechnics
environmental • geotechnical • building fabric

Proposed residential development
land off
Nunsfield Road
Fairfield
Buxton
Derbyshire
SK17 7HN

GROUND INVESTIGATION REPORT

Revision 03 – updated April 2023

Soiltechnics Ltd. Unit 9, Clarence Avenue, Westpoint Enterprise Park, Trafford Park, Manchester, M17 1QS
Tel: (0161) 9470270 Fax: (01604) 781007 E-mail: mail@soiltechnics.net

Report originators

Prepared by	Tomasz Opara B.Sc (Hons)., M.Sc., AMIEnvSc., FGS	tomasz.opara@soiltechnics.net Assistant Geo-environmental Engineer
Reviewed by	Sam Dean B.Sc. (Hons)., MIEnvSc., FGS	sam.dean@soiltechnics.net Director

Updates from Rev00 to Rev01 are marked by a vertical solid line in the left-hand margin.

Updates from Rev01 to Rev02 are marked by a vertical dashed line in the left-hand margin.

Updates from Rev02 to Rev03 are marked by a vertical dashed line in the left-hand margin.

Aerial photograph of site



Approximate site boundaries edged in **magenta**.
Area denoted in red (area formerly referred to as Zone 1) now excluded from developable site

Bookmarking

As a PDF version this document is bookmarked. If you click on the bookmark icon  on a PDF viewer then the main contents listing is shown and by clicking on the bookmark you can navigate through the report.

Report status and format

Report section	Principal coverage	Report status	
		Revision	Comments
1	Executive summary	Rev03	Updated April 2023
2	Introduction	Rev03	Updated April 2023
3	Desk study information and site observations	Rev02	Updated August 2019
4	Fieldwork	Rev01	Updated June 2019
5	Laboratory testing	Rev01	Updated June 2019
6	Ground conditions encountered	Rev01	Updated June 2019
7	Geotechnical Appraisal	Rev03	Updated April 2023
8	Chemical contamination	Rev02	Updated August 2019
9	Gaseous contamination	Rev02	Updated August 2019
10	Effects of ground conditions on building materials	Rev02	Updated August 2019
11	Landfill issues		
12	Further investigations	Rev02	Updated August 2019
13	Remediation strategy and specification	Rev02	Updated August 2019

List of drawings

Drawing	Principal coverage	Status	
		Revision	Comments
01	Site location plan	Rev 01	Updated June 2019
02	Plan showing existing site features and location of exploratory points	Rev 01	Updated June 2019
03	Plan showing development proposals and location of exploratory points	Rev 02	Updated August 2019
04	Plan showing development proposals, location of exploratory points and zonal assessment	Rev 02	Updated August 2019
05a-05c	Plans showing depths to bedrock and extent of proposed cut into bedrock across the site	Rev 02	Only 05c updated August 2019
06a-06f	Plot summarising pocket penetrometer determinations	Rev 01	Updated June 2019
07a-07f	Plot summarising Standard Penetration Test (SPT) results	Rev 01	Updated June 2019
08	Section showing construction of combined water & gas monitoring standpipe installed in boreholes	Rev 01	Updated June 2019
09	Preliminary foundation zoning plan	Rev 02	Updated August 2019

List of appendices

Appendix	Content		Status	
			Revision	Comments
A	Definitions of geotechnical terms used in this report			
B	Definitions of geo-environmental terms used in this report			
C1	Insitu testing in boreholes / trial pits	Details of standard penetration tests (SPT)	Rev01	Updated June 2019
C2		Details of insitu shear strength determinations	Rev01	Updated June 2019
C3		Results of infiltration testing in boreholes	Rev01	Updated June 2019
D	Trial pit records			
E	Boreholes records			
F	Photographic records of the site			
G	Copies of laboratory test result certificates - Soil classification testing			
H	Copies of laboratory test result certificates - Concentrations of chemical contaminants			
I	Analysis and summary of test data in relation to concentrations of chemical contaminants		Rev02	Updated August 2019
J	Conceptual models for chemical contamination		Rev02	Updated August 2019
K	Record of in-situ gas monitoring results		Rev02	Updated August 2019
L	Copies of statutory undertakers' replies			
M	Copy of desk study information produced by Envirocheck			
N	Copy of cut and fill plan		Rev02	Updated August 2019
O	Current development t layout			

1 Executive summary

General

We recommend the following executive summary is not read in isolation to the main report which follows.

Site description, history and development proposals

The site is positioned in the north-eastern part of Buxton, Derbyshire, approximately 700m from the town centre and located along the eastern and western flanks of Nuns Brook. The site is approximately 21Ha in size and formed of a series of distinct parcels of land, largely unoccupied and covered in vegetation and woodland, in addition to some grazing/pasture land. A recreational ground and play area was located to the south of the site, with areas of tended landscaping located to the east. Surface levels in the eastern part of the site fall significantly from east to west down to the channel of Nun Brook, by some 20-23m. Similarly, levels in the western part of the site fall by some 5m from west to east again into the channel of Nun Brook.

Historically, the north-western part of site was open land until a refuse tip was recorded between 1967 and 1988. The eastern part of the site was used as agricultural land with Russia Mere (a pond) recorded between 1879 and 1967. The western part was used for various activities including a railway line with sidings including an engine shed (1898 to 1974), in addition to allotment gardens (1922 to 1967) and playing fields to the south (1977 to present day).

We understand the scheme will comprise the construction of a large number of dwellings, together with associated gardens, infrastructure and access roads constructed to standards allowing adoption by the local highway authority.

Ground conditions encountered

Topsoil was encountered across Zone 3 and partly within Zone 4. Within Zone 2, Made Ground was encountered, locally consistent with landfill type material (within the area of the existing recreation ground to the south, recorded as a tip by the LA) encountered in Zone 1 previously, but including increased quantities of slag, brick, coal, glass and ash. Such deposits ranged to between depths of 3.0m to >5m to the east and south, with deposits ranging between 0.8m to 1.5m to the northwest of the area. Similar deposits were encountered locally across Zone 4. Natural strata was encountered in all locations. This comprised bedrock deposits, which had generally weathered into gravels, sands and clays from their parent units of Bee Low Limestone Formation (Zone 4), Eyam Limestone Formation (Zone 3 and east of Zone 2) and Weathered Bowland Shale Formation (Zone 2 and western parts of Zone 3).

Further details on ground conditions are provided in Section 6.

Foundation solution

In our opinion naturally deposited weathered bedrock will adequately support proposed buildings on concrete strip/trench fill foundations in Zone 3 and localised areas of Zones 2 and 4. Foundations are likely to require depending in some areas due to the presence of Made Ground or natural soils with low strength/density.

Some areas of land to the west of Nun Brook (former railway land, termed Zone 2) contains deep Made Ground which will be unsuitable for supporting concentrated foundation loads. We do not consider such deposits amenable to improvement techniques such as vibrotreatment (unless screened and sorted), and therefore in our opinion a piled foundation solution will be necessary.

We would recommend that further intrusive investigations are undertaken to confirm foundation requirements on a plot specific basis once development proposals are finalised.

In addition, consideration will need to be given to the requirement for use of breaking equipment to facilitate earthworks and foundation excavations where shallow bedrock is present (Zone 3), in addition to stability of slopes in such areas.

Limestone bedrock in Zones 3 and 4 may be susceptible to formation of dissolution features, and further investigation should be undertaken to determine the risk to the proposed development.

Ground bearing floor slabs can be adopted in Zone 3 at this site where buildings are remote from trees and where Topsoil deposits are fully removed within the footprint of the building. Due to the thickness of Made Ground deposits present in Zone 2 (unless proposed cut removes all Made Ground) and the likelihood that Made Ground or reworked soils are present in Zone 4 in the area of Plots 1 to 12, we recommend a suspended ground floor is adopted.

Concrete in contact with Made Ground will need to be designed to sulphate class DS-3 and ACEC class AC-3. Naturally deposited soils and groundwater would be classified as DS-1 AC-1.

Further details are provided in Section 7.

Chemical and gaseous contamination

Providing the site is developed then the risk of harm being caused to current users from identified contamination will be a short-term issue and unlikely to require any remediation.

Concentrations of chemical contaminants have been measured above guideline values within Made Ground deposits across the site. In such areas, we are of the opinion that the site represents a medium to high risk of causing harm to future end users of the developed site, based on current development proposals. Providing the remedial measures as outlined in Section 8.9 and 13 are implemented, the risk of harm being caused to the health of end users is considered to be low.

We also consider that Topsoil/naturally deposited soils at the site are unlikely to cause significant harm to human health and can be reused within the proposed development where necessary.

The risk of damage to the health of construction operatives and other site investigators is, in our opinion, medium but locally high, primarily due to the presence of asbestos in Made Ground soils. Generally, risks would be minimised by taking adequate hygiene precautions on site, however, consideration will need to be given to the presence of localised asbestos in Made Ground soils onsite and the additional precautions that will need to be taken during groundworks to minimise contact/disturbance and potential release of fibres.

Marginally elevated concentrations of leachable benzo(a)pyrene and copper have been previously been identified in Made Ground soils in Zone 1 (landfill area), with very marginal concentrations of soluble copper identified in groundwater onsite and surface waters downstream of site. Given the marginal exceedances of soluble copper and based on the conservatism factored into the EQS value for copper, we consider the risk of leachable copper, identified in the landfill area adjacent to the developable site, adversely impacting the quality of groundwater and surface waters is low.

In our opinion, marginal contamination identified in Topsoil/natural soils across the site is unlikely to present a risk of causing significant harm to vegetation. Concentrations of contaminants exceed relevant guidelines within Made Ground deposits across the site. In our opinion, such contamination is likely to present a risk of causing significant harm to vegetation. Providing the remedial measures as outlined Section 8.9 and 13 are implemented, the risk of harm being caused to the health of vegetation is considered to be low.

In the area of Zone 2, the development will require gas protective measures which would achieve a *'gas protection score'* of 3.5. Furthermore, with such areas of the site being classified as 'Amber 1', then following NHBC report No 10627-R01(04) table 14.2, 'low level' gas protection measures are required as minimum. We recommend that this is verified by completion of further, more intensive ground gas monitoring to fully classify this area of the site.

The area of Zones 3 and 4 are unlikely to require any gas protective measures. However, we recommend that this is verified by completion of further, more intensive ground gas monitoring to fully classify these areas.

Whilst we have not carried out a full investigation set out in guidance in the UKWIR document, the subject site does exhibit a degree of localised contamination and it is likely that barrier pipes will be required.

It is advised that Japanese Knotweed remedial specialists are contacted for advice and measures to deal with the significant stands suspected to be present around the site (in Zone 2) prior to construction and commencement any earthworks activities.

We have recommended further works which are detailed in Section 12.

2 Introduction

2.1	Objectives
2.2	Status of this report
2.3	Client instructions and confidentiality
2.4	Site location and scheme proposals
2.5	Report format and investigation standards
2.6	Report distribution
2.7	Soiltechnics liabilities

2.1 Objectives

2.1.1 This report describes a ground investigation carried out for a proposed housing development on land off Nunsfield Road, Fairfield, Buxton, Derbyshire, SK17 7HN.

2.1.2 The objective of the ground investigation was to establish ground conditions at the site, sufficient to identify possible foundation solutions for the development and provide parameters necessary for the design and construction of foundations and associated infrastructure.

2.1.3 The investigation included an evaluation of potential chemical and gaseous contamination of the site leading to the production of a risk assessment in relation to contamination.

2.1.4 The investigation has also been produced to support any future planning application for the site by satisfying National Planning Policy Framework (2019) section 178.

2.2 Status of this report

2.2.1 This report is final based on our current instructions. This report has been updated and as a consequence sections of this report have been amended as described in the index. Amendments to report text have been highlighted as follows: -

2.2.2 00 to 01 – updated following completion of the gas monitoring programme at the site. In addition, we have reported separately the investigations in relation to the proposed roundabout development, and reference should be made to our report R-STQ4642M-G02 for further details.

2.2.3 01 to 02 – updated following amendments to the development layout, including final levels. The update briefly comprises the exclusion of development within the area previously referred to as Zone 1, consisting of a former landfill. As a consequence, plot layouts and proposed reprofiling of the site have been amended to optimise more developable areas of the site.

2.2.4 02 to 03 – updated to reflect variation in number of dwellings to be constructed.

2.3 Client instructions and confidentiality

2.3.1 The investigation was carried out from January 2019 to March 2019 and originally reported in April 2019, acting on instructions received from the following parties; Barratt Homes Manchester, Derwent Lodge Estates Limited and Good REIT Ltd, whom shall jointly constitute 'the Client'. The report, as previously mentioned, was later updated in June 2019 (rev01) and August 2019 (rev02).

2.3.2 This report has been prepared for the sole benefit of our above named instructing client, but this report, and its contents, remains the property of Soiltechnics Limited until payment in full of our invoices in connection with production of this report.

2.3.3 Our original investigation proposals were outlined in our e-mail correspondence to Barratt Homes Manchester dated 14th November 2018. The investigation was subsequently amended following completion of a site reconnaissance and initial stages of intrusive investigations. The principal changes were: -

i) Due to large areas of suspected Japanese Knotweed identified in western areas of the site, mitigation measures were introduced to prevent the spread of likely rhizomes in near surface soils, as detailed in our email correspondence of 11th January 2019
ii) Due to encountering suspected ACMs in near surface soils present in the recorded landfill area, mitigation measures were introduced to satisfy HSE requirements where asbestos is suspected to be present onsite, as detailed in our email correspondence of 24th January 2019
iii) Based on the above, the duration of investigations was extended to ensure a sufficient number of exploratory points and site coverage was obtained, as detailed in our email correspondence of 24th January 2019

2.4 Site location and scheme proposals

2.4.1 The National Grid reference for the site is 406520, 374325. A plan showing the location of the site is presented on Drawing 01.

2.4.2 We understand the scheme will comprise the construction of a large number of dwellings, with associated gardens, infrastructure and access roads constructed to standards allowing adoption by the local highway authority.

2.4.3 Current development proposals are presented in Appendix O.

2.5 Report format and investigation standards

2.5.1 Sections 2 to 6 of this report describe the factual aspects of the investigation with Section 7 presenting an engineering assessment of the investigatory data. Section 8 provides a risk assessment of chemical contamination based on readily available historic records, inspection of the soils and laboratory testing. Section 9 provides a similar risk assessment in relation to gaseous contamination with Section 10, a risk assessment relating to construction materials likely to be in contact with the ground. Section 11 discusses issues relating to classification of waste soils for disposal and reuse.

2.5.2 Geotechnical aspects

2.5.2.1 Geotechnical investigations were carried out generally, and where practical following the recommendations of BS EN 1997:2 2007 '*Eurocode 7 – Geotechnical Design – Part 2: Ground Investigation and Testing*'. From a geotechnical viewpoint this is deemed to be a Ground Investigation Report (GIR) as set out in BS EN 1997:2. This report does not however does not constitute a Geotechnical Design Report as defined in section 2.8 of BS EN 1997-1:2004 *'Eurocode 7 – Geotechnical Design – Part 1: General Rules'* and in particular will exclude assessment of lifetime actions to buildings from geotechnical influences.

2.5.3 Geo-environmental aspects

2.5.3.1 The investigation process also followed the principles of BS10175:2011+A2:2017 *'Investigation of potentially Contaminated Sites – Code of Practice'*. In view of the client's requirement for rapid implementation of the investigation, the following elements, defined in BS10175, have been completed and incorporated in this report.

a)	Phase I	Preliminary investigation (desk study and site reconnaissance)
b)	Phase II	Exploratory and main (intrusive) investigations

2.5.3.2 The extent and result of the preliminary investigation (desk study) is reported in Section 3. Fieldwork combined the exploratory investigation and main investigation stages into one phase with the extent of these works described in Sections 4 and 6 of this report. Any supplementary investigations deemed necessary are identified in Section 12. Based on the results of the investigation, Section 8 will identify if any remediation is necessary with respect to chemical contamination, and a strategy for implementation. Similarly, Section 9 will identify if any remediation is necessary with respect to gaseous (landfill gas) contamination, and again a strategy for implementation.

2.5.3.3 This investigation has been carried out and reported based on our understanding of best practice. Improved practices, technology, new information and changes in legislation may necessitate an alteration to the report in whole or part after publication. Hence, should the development commence after expiry of one year from the publication date of this report then we would recommend the report be referred back to Soiltechnics for reassessment. Equally, if the nature of the development changes, Soiltechnics should be advised and a reassessment carried out if considered appropriate.

2.6 Report distribution

2.6.1 This report has been prepared to assist in the design and planning process of the development and normally will require distribution to the following parties, subject to Soiltechnics liabilities defined below, although this list may not be exhaustive:

Table summarising parties likely to require information contained in this report

Party	Reason
Client	For information / reference and cost planning
Developer / Contractor / project manager	To ensure procedures are implemented, programmed and costed
Planning department	Potentially to discharge planning conditions
Environment Agency	If ground controlled waters are affected and obtain approvals to any remediation strategies
Independent inspectors such as NHBC / Building Control	To ensure procedures are implemented and compliance with building regulations
Project design team	To progress the design
Principal Designer (PD)	To advise in construction risk identification and management under the Construction (design and management) regulations

Table 2.6

2.7 Soiltechnics liability

2.7.1 Soiltechnics disclaims any responsibility to our Client and others in respect of any matters outside the scope of this report. This report has been prepared with reasonable skill, care and diligence in accordance with the terms of our contract, taking account of the manpower, resources, investigations and testing devoted to it by agreement with our Client. This report is confidential to our Client and Soiltechnics accepts no responsibility of whatsoever nature to third parties to whom this report or any part thereof is made known. Any such party relies upon the report at their own risk.

3 Desk study information and site observations

3.1	General
3.2	Description of the site
3.3	Injurious and invasive weeds and asbestos
3.4	History of the site
3.5	Geology and geohydrology of the area
3.6	Landfill and infilled ground
3.7	Radon
3.8	Flood risk
3.9	Environmental sensitivity
3.10	Enquiries with statutory undertakers
3.11	Enquiries with Local Authority Building Control and Environmental Health Officers

3.1 General

3.1.1 As outlined in Section 2, the client has opted to exclude development of the former landfill area of the site, referred to as Zone 1. The factual content of this report section has not been amended to exclude reference to Zone 1, however, we have taken this into account within our interpretative assessments presented later in this report.

3.1.2 We have carried out a desk study which was limited to a review of readily available information including:

a) Review of published Ordnance Survey maps dating back to 1879 at various published scales

b) Inspection of geological maps produced by the British Geological Survey together with relevant geological memoirs

c) Consultation with Statutory Undertakers

d) Site reconnaissance

e) Other relevant published documents

3.1.3 We have obtained old Ordnance Survey maps using the Envirocheck database system. In addition to retrieval of historical and current Ordnance Survey data, Envirocheck provide information compiled from outside agencies including: -

- Ordnance Survey
- Environment Agency
- Scottish Environment Protection Agency
- The Coal Authority
- British Geological Survey
- Centre for Ecology and Hydrology
- Countryside Council for Wales
- Scottish Natural Heritage
- Natural England
- Health Protection Agency

3.1.4 The study did not extend to research of meteorological information or consultation with other interested parties such as English Heritage (ancient monuments), Ordnance Survey (survey control points), Planning Authorities or Archaeological Units.

3.1.5 A copy of records produced by Envirocheck is presented in Appendix M. Envirocheck produce a wealth of factual database information. Although we can provide a discussion on each of the database topics, this would produce a very lengthy document, but some of these discussions would not be relevant to the aims of this report. As a consequence, we have extracted some of the relevant topics and discussed them in this section of the report.

3.2 Description of the site

3.2.1 The site is positioned in the north-eastern part of Buxton, Derbyshire, approximately 700m from the town centre and located along the eastern and western flanks of Nuns Brook.

3.2.2 The site is approximately 17.8Ha in size and formed of a series of distinct parcels of land. A rectangular area of land in the north-western corner (termed Zone 1 later in the report) contained semi-mature to mature woodland and rough vegetation with undulating ground levels. Some localised steep slopes were present around the perimeter of this part of the site, which typically formed a 'plateaux' some 2-4m above surrounding ground levels. Nun Brook was culverted through this section of the site, running north to south adjacent to the eastern boundary of this area. A railway line formed the western site boundary. It should be noted that a large extent of this parcel of land was being redeveloped, associated with the railway, and was inaccessible and fenced off. Open land was present beyond the northern boundary.

3.2.3 Adjacently east of this area, (termed Zone 3 later in the report), and beyond the culverted channel of Nun Brook, was located grassed fields used for pasture. Stone walls and fences were present forming field boundaries, accommodating grazing animals locally. A residential property associated with Nunsfield Farm formed part of the site and located in the far eastern boundary of the fields. Surface levels in this area of the site fall significantly from east to west down to the channel of Nun Brook, by some 20-23m. An agricultural supply yard and buildings associated with Nunsfield Farm were present immediately adjacent to the east of this area of the site. Residential properties and a graveyard were located adjacent to the south, with further open land located adjacent to the north and part of Buxton & High Peak golf course located to the northeast.

3.2.4 To the south of the area of the site described in paragraph 3.2.2 above, was a further long, narrow rectangular parcel of land (termed Zone 2 later in the report). A ravine type feature was present between the parcels of land, some 5m deep in places. The southern slope of this area was partially retained by stone walls and the floor was partially stepped. To the south of this, the main body of this area was located on the eastern flanks of Nun Brook, the channel of which formed the eastern boundary. The area appears to have been subject to historic terracing, with a number of plateaus and embankment features present. Typically, surface levels generally fell from west to east by some 5m down towards the channel of the brook. The brook was also free flowing adjacent to this section of the site. This area was generally covered in woodland and parcels of dense vegetation, accessed by a network of north-south trending tracks surfaced in a mixture asphaltic concrete and gravel.

3.2.5 There were also a number of wooden shacks present in this area of the site, some burnt down with others in use, including for housing doves and chickens. A row of three prefabricated garages with evidence of a fourth, including a vehicular service pit, were present in the centre of this area. The south of this area was predominantly occupied by a grassed playing field which was generally flat, with children's play equipment present. To the south of the playing area were mature trees, where ground levels fall by some 3-4m to the south towards an area of prefabricated garages. Hogshaw Brook generally ran west to east and formed the southern boundary of the site, converging with Nun Brook to the southeast. Two footbridges and a small road bridge facilitated access to the garages and most of site. The railway line which forms the western boundary to Zone 1 also forms the western boundary to Zone 3, beyond which further residential properties are present. Residential properties were also located beyond the southern and eastern boundaries, also including allotments beyond the latter.

3.2.6 The far eastern parcel of land (termed Zone 4 later in the report), comprised of open land, covered in tended grass with localised semi mature and mature trees. Some parcels of this area formed part of the golf course as described in paragraph 3.2.3 above. Due to this, the northern area of Zone 4 was inaccessible at the time of our investigation. The A6 runs adjacently east of this area in a north to south direction, forming the site boundary. An access track leading to Nunsfield Farm forms the northern boundary to Zone 4, with Buxton & High Peak golf club located beyond, in addition to the northeast beyond the A6. A small number of residential properties, in addition to St Peters Church and associated graveyard form the western boundary to this area of the site.

3.2.7 A plan showing observed site features and location of exploratory points is presented on Drawing 02. Refer to Drawing 04 for a plan indicating the specific zones of the site as discussed above.

3.2.8 Photographic records of the site are presented in Appendix F.

3.3 Injurious and invasive weeds and asbestos

3.3.1 Injurious and invasive weeds

3.3.1.1 The following weeds are controlled under the Weeds Act 1959:

- Common Ragwort
- Spear Thistle
- Creeping or Field Thistle
- Broad leaved Dock
- Curled Dock

3.3.1.2 Whilst it is not an offence to have the above weeds growing on your land, you must:

- Stop them spreading to agricultural land, particularly grazing areas or land used for forage, like silage and hay
- Choose the most appropriate control method for the your site
- Not plant them in the wild

Should you allow the spread of these weeds to another parties land, Natural England could serve you with an Enforcement Notice. You can also be prosecuted if you allow animals to suffer by eating these weeds.

3.3.1.3 In addition to the above, you must not plant in the wild or cause certain invasive and non-native plants to grow in the wild as outlined in the Wildlife and Countryside act 1981. It is an offence under section 14(2) of the act to *'plant or otherwise cause to grow in the wild'* any plants listed in schedule 9, part II. This can include moving contaminated soil or plant cuttings. The offence carries a fine or custodial sentence of up to 2 years. The most commonly found invasive, non-native plants include:

- Japanese knotweed
- Giant hogweed
- Himalayan balsam
- Rhododendron ponticum
- New Zealand pigmyweed

You are not legally obliged to remove these plants or to control them. However, if you allow Japanese knotweed to spread to another parties land, you could be prosecuted for causing a private nuisance.

3.3.1.4 The presence of such weeds on site may have considerable effects on the cost / timescale in developing the site. Japanese knotweed can cause significant damage to buildings, roads and pavements following development, if untreated prior to development.

3.3.1.5 Our investigations exclude surveys to identify the presence of injurious and invasive weeds. It should be noted that we did observe areas of vegetation, generally to the south-western part of the site, which could be Japanese Knotweed. We recommend specialists in the identification and procedures to deal with injurious and invasive weeds are appointed prior to commencement of any works on site, or if appropriate purchase of the site, to confirm this.

3.3.2 Asbestos

3.3.2.1 Our investigations exclude surveys to specifically identify the presence or indeed absence of asbestos on site. It should be noted that asbestos containing material (ACM) and asbestos fibres were detected in samples of soil submitted for laboratory screening. The implications of the presence of asbestos in soils are discussed in Section 8 (contamination) and Section 11 (waste classification).

3.3.2.2 The presence of asbestos on site may have considerable effects on the cost / timescale in developing the site. There is good guidance in relation to Asbestos available on the Health and Safety Executive (HSE) web site.

3.4 History of the site

3.4.1 An attempt to trace the history of the site has been carried out by reviewing copies of old Ordnance Survey maps provided by Envirocheck. The recent history of the site based on published Ordnance Survey maps is summarised in the following table:

Summary description of site history from Ordnance Survey maps

Date	Onsite	Offsite
1879	Site recorded as open space and largely agricultural. Nuns Brook flows through the site and along south-eastern boundary similar to present day. Russia Mere (a pond) recorded in eastern part of site. Nuns Farm recorded in area of present day Nunsfield Farm.	Old lime kiln recorded 150m to the north. Quarry features located 200m to the east and northeast of the site. Graveyard and Church recorded adjacent to the south. Railway line recorded adjacent to western boundary. Brick Yard with pits recorded beyond railway line. Stream recorded along southern site boundary. Series of engine sheds, goods sheds, coal sheds, tanks, and slaughter houses recorded 15-200m to the south.
1882	No significant changes.	Quarries are located 400m to the northeast. Gas works recorded 300m to the south. Two quarries recorded approximately 700m to the west.
1898-99	Engine shed and railway sidings recorded in southwestern part of site with embankment, including turntable.	Carriage works 100m to the south. Laundry 200m to the southwest. Smithy recorded approximately 200m to the southeast.
1921-23	Allotment gardens with few small structures recorded in southern part of site. Further expansion of embankment adjacent to sidings. Nuns Farm now recorded as Nunsfield Farm.	Quarry recorded 200m to the northeast. Housing development recorded adjacent to south and south east boundary.
1938	No significant changes.	No significant changes.
1955	No significant changes.	No significant changes.
1966-67	Russia Mere no longer recorded. Refuse tip recorded in north-western part of site, with T shape structure. Nun Brook appears to be culverted through this part of the site. Further expansion of sidings in southwestern part of site, including coal hopper and tank. Allotment gardens to the south no longer recorded. Significant earthworks recorded in south-western/southern part of site similar to present day layout. Number of garages and sheds recorded in south-western and southern part of site.	Graveyard to south extended to adjacent to site. Earthwork around northwest corner of graveyard recorded within site boundaries. Quarries to east/northeast no longer recorded. Garage recorded 120m to the southeast of the site.
1973-74	All railway infrastructure to south/southwest of the site no longer recorded. Small number of garages present in central part of southern site area.	No significant changes.

Summary description of site history from Ordnance Survey maps		
Date	**Onsite**	**Offsite**
1975-77	No significant changes. Playing Field recorded in southern part of site, concurrent to present day layout.	Brake lining works and tyre depot noted in area of former carriage works. Much of railway adjacently to the west and south recorded as dismantled.
1989 - 2018	Expansion of Nunsfield Farm buildings. Refuse tip marked as workings (disused)	No significant changes.

Table 3.4.1

3.4.2 In summary, the north-western part of site was open land until a refuse tip was recorded in 1967. The eastern part of the site was used as agricultural land with Russia Mere (a large pond) recorded between 1879 and 1967. The southern and south-western part of the site was used for various activities including a railway line with sidings including an engine shed (1898-1973), tanks and coal hopper (1967-1973), allotment gardens (1922 – 1967) and Playing Fields (1977-present day). In terms of adjacent and surrounding historical land, there were general railway and quarrying industries.

3.5 Geology and geohydrology of the area

3.5.1 Geology of the area

3.5.1.1 Envirocheck reproduce geological map extracts taken from the British Geological Survey (BGS) digital geological map of Great Britain at 1:50,000 scale (ref Appendix M). A summary of the recorded geological information for the site is presented in the following table:

Summary of Geology and likely aquifer containing strata					
Strata	**Bedrock or superficial**	**Approximate thickness**	**Typical soil type**	**Likely permeability**	**Aquifer designation**
Alluvium (confined to Nuns and Hogshaw Brooks)	Superficial	<5m	Clays, Silts, Sands, Gravels	Permeable	Secondary A Aquifer
Bowland Shale Formation (western and central parts of site)	Bedrock	>20m	Mudstone, Siltstone, and sandstone	Permeable	Secondary A Aquifer
Eyam Limestone Formation with Knoll Reefs (central and eastern parts of site)	Bedrock	<20m	Limestone	Permeable	Principal Aquifer
Bee Low Limestone Formation (eastern parts of site)	Bedrock	>70m	Limestone	Permeable	Principal Aquifer

Table 3.5.1

3.5.1.2 A number of faults are recorded in close proximity of the site. The faults recorded adjacent to north-western corner and approximately 500m to the north are both located in Kinderscout Grit, Millstone Grit Group and Bowland Shale Formation. A further fault is recorded approximately 200m to the east within deposits of Bee Low Limestone Formation. Finally, a fault is recorded in between Bowland Shale Formation and Monsal Dale Limestone Formation to the south, which terminates at the southern boundary.

3.5.1.3 It should be noted that the following bedrock formations are recorded by BGS as present adjacent or in close proximity to the site. As such they may be present on site:-

- Kinderscout Grid – Sandstone
- Eyam Limestone Formation (Knoll-Reef) – Limestone
- Milestone Grit Group – Mudstone, Siltstone, Sandstone
- Monsal Dale Limestone Formation - Limestone

3.5.1.4 Superficial deposits are the youngest geological deposits formed during the Quaternary, which extends back about 2.6 million years. They rest on older deposits or rocks referred to as bedrock. Soil types and assessments of permeability are based on geological memoirs, in combination with our experience of investigations in these soil types.

3.5.1.5 Principal aquifers are defined as deposits exhibiting high permeability capable of high levels of groundwater storage. Such deposits are able to support water supply and river base flows on a strategic scale.

3.5.1.6 Secondary A aquifers are predominantly permeable layers capable of supporting water supplies at a local rather than strategic scale. In some cases, Secondary A aquifers can form an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

3.5.2 Water abstractions

3.5.2.1 4 active ground water and 5 active surface water abstraction points are located within 2000m of the site. The closest active groundwater abstraction point lies 672m to the southwest of the site with water abstracted for use as process water. The closest active surface water abstraction point lies 569m to the southwest of the site with water abstracted for general use.

3.5.2.2 The site is not located within a zone protecting a potable water supply abstracting from a principal aquifer (i.e. a source protection zone). However, a source protection zone 1 (SPZ 1) is present 380m to the south of the site.

3.5.3 Groundwater levels

3.5.3.1 We have reviewed the British Geological Survey (BGS) web site, and no borehole / trial pit records are available close to the subject site which may indicate the presence of groundwater in the local area.

3.5.4 Coal mining and brine extraction

3.5.4.1 The site is not recorded to be within an area affected by past or present coal mining, or minerals worked in association with coal or brine extraction (within the Cheshire Brine Compensation District).

3.5.5 Shallow mining and natural subsidence hazards

3.5.5.1 The British Geological Survey present hazard ratings for shallow mining and natural subsidence hazards. We can also confirm that we have obtained a mining and ground stability report from Envirocheck, which is presented in Appendix M. The site has the following ratings;

Table summarising mining and subsidence hazards

Hazard	Rating
Mining hazard in non-coal mining areas	Highly Unlikely
Potential for collapsible ground stability hazard	Very low
Potential for compressible ground stability hazard	**Moderate**
Potential for ground dissolution stability hazard	**Moderate to high**
Potential for landslide ground stability hazard	Low
Potential for running sand ground stability hazard	Low
Potential for shrinking or swelling clay ground stability hazard	Very low

Table 3.5.5

3.5.5.2 The moderate risk rating of compressible ground is associated with the presence of Alluvium in the area of Nun Brook and Hogshaw Brook, which can typically comprise soft organic clays/silts.

3.5.5.3 The moderate to high risk of ground dissolution is associated with limestones in the upper horizons of the Eyam Limestone Formation present within topographically lower parts of the site. Such areas typically lie adjacent to the channel of Nun Brook and limestones here are likely to be more susceptible to dissolution as groundwater and surface accumulates downslope in the lower portions of the site, which is also down dip of the limestone formations in the area (bedding planes dip to the west at ~22°). The high-risk areas are very localised and appear to be confined to the central parts of the site, immediately adjacent to the east of Nun Brook, however due to the mapping scale it is difficult to pin point the actual locations.

3.5.5.4 Envirocheck also records the presence of a natural sink hole and solution pipe 596m to the southeast of the site, present within limestone deposits. The risks associated with dissolution are discussed further in Section 7.

3.5.6 Borehole records

3.5.6.1 The British Geological Survey (BGS) retain records of boreholes formed from ground investigations carried out on a nationwide basis. The location of boreholes with records held by the BGS is recorded on the borehole map contained in Appendix N. We do not normally obtain copies of these records but can do on further instructions. There is normally a charge made by the BGS for retrieving and copying these records.

3.6 Landfill and infilled ground

3.6.1 Envirocheck reports one landfill site in the north-western portion of site, known as Hogshaw refuse tip. Records indicate the site was licenced for receipt of domestic, inert, industrial and commercial wastes, and licence has now lapsed. Furthermore, the Local Authority planning portal of High Peak Borough Council, also records a refuse tip in the area of the existing recreation ground to the southwest of the site (Zone 2).

3.6.2 In addition, we have reviewed old Ordnance Survey maps and there is obvious evidence of quarrying in the area, the closest of which is 200m to the east of site. It is not clear from mapping if the quarries have been restored.

3.6.3 12 BGS mineral sites are recorded within 1000m from site. The closest is located 219m to the northwest, extracting common clay and shale. All mineral sites were opencast type, used to extract common clay, shale or limestone. Extraction at all 12 sites is recorded to have ceased.

3.6.4 A number of infilled land and water bodies are also recorded on site and within 1000m of the site. Table below summarises Envirocheck records.

Summary of Infilled Ground

Landfill name	Type	Location	Use	Date of mapping
Potentially infilled land	Non water	136m NW	Unknown filled ground (pit, quarry)	1977
Potentially infilled land	Non water	227m NE	Unknown filled ground (pit, quarry)	1977
Potentially infilled land	Non water	332m NE	Unknown filled ground (pit, quarry)	1977
Potentially infilled land	Non water	426m E	Unknown filled ground (pit, quarry)	1977
Potentially infilled land	Non water	439m NE	Unknown filled ground (pit, quarry)	1977
Potentially infilled land	Non water	440m E	Unknown filled ground (pit, quarry)	1977
Potentially infilled land	Non water	571m E	Unknown filled ground (pit, quarry)	1977
Potentially infilled land	Non water	663m E	Unknown filled ground (pit, quarry)	1977
Potentially infilled land	Non water	791m E	Unknown filled ground (pit, quarry)	1977
Potentially infilled land	Non water	877m NW	Unknown filled ground (pit, quarry)	1977
Potentially infilled land	Non water	976m NE	Unknown filled ground (pit, quarry)	1977
Potentially infilled land	Water	On site	Unknown filled ground (pond, marsh, river, stream, dock)	1955
Potentially infilled land	Water	33m SW	Unknown filled ground (pond, marsh, river, stream, dock)	1955
Potentially infilled land	Water	52m SW	Unknown filled ground (pond, marsh, river, stream, dock)	1955
Potentially infilled land	Water	115m SW	Unknown filled ground (pond, marsh, river, stream, dock)	1955
Potentially infilled land	Water	184m E	Unknown filled ground (pond, marsh, river, stream, dock)	1955
Potentially infilled land	Water	244m E	Unknown filled ground (pond, marsh, river, stream, dock)	1955
Potentially infilled land	Water	328m SW	Unknown filled ground (pond, marsh, river, stream, dock)	1955
Potentially infilled land	Water	376m E	Unknown filled ground (pond, marsh, river, stream, dock)	1955
Potentially infilled land	Water	736m NE	Unknown filled ground (pond, marsh, river, stream, dock)	1955

Table 3.6.4

3.6.2 The feature recorded onsite is associated with the backfilling of Russia Mere, recorded on historical mapping between 1879 and 1967. The 3 areas adjacent to the southwest of the site appear to be related to localised infilling of the channel of Hogshaw Brook.

3.7 Radon

3.7.1 Envirocheck use the British Geological Survey database to review reported radon levels in the area in which the site is located to establish recommended radon protection levels for new dwellings. The database records the site as being located where full protection is recommended.

3.7.2 The Building Research Establishment publication applies to all new buildings, conversions and refurbishments whether they are for domestic or non-domestic use.

3.7.3 It is noteworthy that the BRE and BGS / HPA information is based on statistical analysis of measurements made in dwellings in combination with geological units, which are known to emit radon. Consequently, there is a risk for actual radon levels at the site to exceed the levels assessed by the BGS / HPA / BRE. Currently, the only true method of checking actual radon levels is by measurement within a building on the site over a period of several months. It should be noted that it is not currently a requirement of the Building Regulations to test new buildings for radon, however the BRE recommends testing on completion or occupation of all new buildings (domestic and non-domestic), extensions and conversions. Should you wish to undertake radon monitoring following completion of the development, we can provide proposals.

3.8 Flood risk

3.8.1 The site is not located within a fluvial or tidal flood plain, with the exception of the far southern part of the site on the southern and south-eastern site boundaries, associated with Hogshaw and Nun Brooks. Areas in the immediate vicinity of Nun Brook are recorded at high risk of surface water flooding. Furthermore, the eastern part of the site has limited potential for groundwater flooding to occur, however localised areas along the course of Nun Brook have potential for groundwater flooding to occur at surface.

3.8.2 It should be noted that this information does not constitute a site specific Flood Risk Assessment (FRA), and a full FRA may be required for the development to support a planning application or satisfy planning conditions.

3.9 Environmental sensitivity

3.9.1 Sensitive land use

3.9.1.1 Based on information provided by Envirocheck, two sensitive land use areas are recorded within 1000m from site. An environmentally sensitive area named South West Peak is recorded 17m to the northwest, however, is termed ‘decommissioned’. An area of ancient woodland called Corbar Woods is also recorded 763m to the west of the site.

3.9.2 Pollution incidents

3.9.2.1 The Envirocheck recorded 15 pollution incidents to controlled waters situated within 1000m of the subject site. 11 of these are recorded as Category 3 – Minor Incidents, with the rest termed Category 2 – Significant Incidents. The nearest incident is recorded 189m to the south of site, associated with release of oils/diesel into Hogshaw Brook, dated in February 1998. The closest significant incident is recorded 316m to the south, associated with release of unknown organic wastes into Hogshaw Brook, dated April 1997.

3.9.3 Industrial land use

3.9.3.1 24 trade directory entries are recorded within 500m of the subject site. 9 of these are recorded as active, the closest of which is recorded 13m to the northeast, classified as Garage Services at Nunsfield Farm (Buxton 4x4). The closest inactive entry is located 5m to the northeast, associated with an Agricultural Merchants at Nunsfield Farm.

3.10 Enquiries with statutory undertakers

3.10.1 We have contacted the following Statutory Undertakers (SUs) to obtain copies of their records in order to avoid damaging their apparatus during our fieldwork activities: -

a) BT Openreach Ltd
b) Cadent Gas
c) Severn Trent Water
d) Electricity Northwest

3.10.2 Furthermore, we can confirm that the client has also provided copies of further following Statutory Undertakers (SUs) plans, listed below: -

a) Western Power Distribution
b) ESP Utilities Group
c) Virgin Media
d) C.A. Telecom
e) Instalcom
f) Plancast
g) SKY
h) SOTA

3.10.3 Copies of responses received prior to publication of this report are presented in Appendix L. These records have been obtained solely for the purposes described above. Some of these records have been obtained from the Internet and from our database without contacting the statutory undertaker direct. Occasionally, SU information is recorded on drawings larger than A3, and thus cannot be easily presented in this report. In such cases we will copy the correspondence but not incorporate the drawing in this report, and maintain the records on our office file.

3.10.4 We have visited the Linesearch web site (www.linesearchbeforeudig.co.uk) which provides a report on national grid networks (National Gas and Electricity Transmission Networks). Again a copy of their report is presented in Appendix L.

3.10.5 In addition we have received records of Nestlé Waters UK Ltd pipe which traverses across the site. A copy of their records is presented in Appendix L. The route of the pipe is also presented on Drawing 02.

3.10.6 Normally Statutory Undertakers drawings record the approximate location of their services. We recommend further on site investigations be undertaken to confirm the position of the apparatus and thus establish the effect on the proposed development and the necessity or otherwise for the permanent or temporary diversion of the service to allow the construction of the development to safely and successfully proceed.

3.10.7 It should be noted that statutory undertakers' records normally exclude private services.

3.11 Enquiries with local authority building control and environmental health officers

3.11.1 We have contacted Local Authority Building Control and Environmental Health Officers at High Peak Borough Council regarding the site. We have not received a response to date. If any information of notable relevance is received following issue of this report we will update accordingly.

4 Fieldwork

4.1	General
4.2	Site restrictions
4.3	Exploratory trial pits
4.4	Boreholes formed using driven tube sampling techniques
4.5	Measurement of landfill type gases in gas monitoring standpipes
4.6	Sampling strategy

4.1 General

4.1.1 Fieldwork comprised the following activities, undertaken between 21st January and 8th February 2019: -

- Excavation of twenty exploratory trial pits (TP01-TP20)
- Excavation of twenty-eight exploratory boreholes formed using driven tube sampling equipment (DTS01-DTS13 and DTS15 to DTS29). DTS14 was not undertaken due to time constraints.
- Infiltration testing undertaken in 3 borehole locations (DTS06, DTS13 and DTS19)

4.1.2 A plan of the site showing existing site features and position of exploratory points is presented on Drawings 02. The position of exploratory points relative to site development preliminary proposals is presented on Drawing 03. The position of exploratory points shown on these plans is approximate only.

4.1.3 The extent of fieldwork activities and position of exploratory points were determined by Soiltechnics.

4.1.4 Exploratory points were positioned to avoid known locations of underground services, to avoid possible location of proposed foundations but were also positioned to provide a reasonable coverage of the site. Prior to commencement of exploratory excavations an electronic cable locating tool was used to scan the area of the excavation. If we received a response to this equipment then the excavation would be relocated.

4.1.5 All soils exposed in excavations were described in accordance with BS EN ISO 14688 *'Identification and Classification of soil'* and BS EN ISO 14689 *'Identification and classification of rock'.*

4.2 Site restrictions

4.2.1 At the time of our investigation the site was open to the public and generally accessible to mechanical excavators and the driven tube sampler borehole rig. The only exception were areas of the site with excessively steep slopes, the western area of the site (Zone 1) adjacent to the railway, which was fenced off and under construction, and the northern area of Zone 4 which formed part of the adjacent golf course. Locations were also positioned remote from potential service locations.

4.2.2 It should also be noted that in large areas of Zones 1 and 2, suspected Japanese Knotweed was present. Precautions were taken to prevent the spread of associated rhizomes by washing down equipment after each excavation and prior to moving to the next. Furthermore, suspected ACMs were encountered in soils in the landfill area of Zone 1. As such excavations were avoided where possible. However, where excavations were necessary, precautions were taken to prevent the release of possible asbestos fibres into the air, by dampening down and providing suitable welfare facilities in case of exposure.

4.3 Exploratory trial pits

4.3.1 Trial pits TP01 to TP20 were excavated to a maximum depth of 4.3m using a 360° tracked or rubber tyred excavator. The excavations were backfilled with excavated material compacted using the back of the excavator bucket. Whilst we attempted to reinstate the excavation to its original condition the soils could not be fully compacted into the trial pit and thus the soils were left proud of the ground surrounding the pit to allow for short-term settlement of the backfill. A Geotechnical Engineer supervised the excavations.

4.3.2 Sampling and logging was carried out as trial pit excavations proceeded but were not entered at depths exceeding 1.2m, or where trial pit sides were deemed unstable. The density of granular soils encountered in excavations was gauged by the ease of excavation.

4.3.3 Soil samples for subsequent laboratory determination of concentration of chemical contaminants were taken from the sides of trial pits using clean stainless-steel equipment and stored in new plastic containers, which were labelled and sealed. Samples from below access depth into trial pits were taken as a sub sample from soil contained in the excavator bucket, discarding any soil, which may have been in contact with the bucket. If as a consequence of visual or olfactory evidence, a sample was suspected to be contaminated by organic material, the sample was stored in an amber glass jar with a PTFE sealing washer.

4.3.4 Soil samples for subsequent laboratory 'classification' testing were taken from the side of trial pits or from bulk samples taken from the excavator bucket. The sample was immediately placed in a plastic bag and subsequently sealed and labelled. Samples for determination of water content were placed in sealable tubs and appropriately labelled. Soil samples were obtained to meet Category A and quality class 3 to 5 as described in BS EN I997-2:2007 (table 3.1) sufficient for laboratory testing being considered. Sample sizes were also appropriate for the laboratory test being considered (refer BS EN I997-2:2007 Annex L).

4.3.5 A pocket penetrometer was used in the cohesive (fine grained) soils encountered. This tool is deemed to measure the apparent ultimate bearing capacity of the soil under test. The pocket penetrometer is calibrated in kg/cm^2. The reading can be approximately converted to equivalent undrained shear strength by multiplying the results by a factor of 50. Tests were carried out in the sides of trial pits when access can be safety achieved otherwise testing was carried out on excavated intact clods. Details of pocket penetrometer determinations are tabulated in Appendix C2. An average of measurements taken at a specific depth are recorded on trial pit records. The pocket penetrometer is not covered by British Standards.

4.3.6 A summary of pocket penetrometer results obtained from the cohesive soils encountered in exploratory excavations are presented in graphical format on Drawings 06a to 06f.

4.3.7 Trial pit records are presented in Appendix D.

4.4 Boreholes formed using driven tube sampling techniques

4.4.1 Boreholes DTS01 to DTS29 were formed using driven tube sampling equipment to a maximum depth of 5.0m. Driven tube sampling comprises driving 1m long steel sample tubes which are screw coupled together or coupled to extension rods and fitted with a screw on cutting edge. The sample tubes are of various diameters, generally commencing with 100mm and reducing, with depth, to 50mm and include a disposable plastic liner which is changed between sampling locations in order to limit the risk of cross contamination. On completion of excavation the liner containing the sample is cut open and the soil sample logged by a geo-environmental engineer. The sample tubes are considered thick walled with reference to BS EN ISO 22475-1:2006 clause 3.3.11.

4.4.2 Samples for determination concentration of chemical contaminants are taken from samples obtained in the disposable tubes as sub-samples using stainless steel sampling equipment.

4.4.3 Soil samples for subsequent laboratory 'classification' testing were taken from samples obtained in the disposable tubes. The sample was placed in a plastic bag and subsequently sealed and labelled. Samples for determination of water content were placed in sealable tubs and appropriately labelled. These samples were obtained with a view to achieve category B sampling methods to meet quality class 3 (for fine grained soils only) as described in BS EN ISO 22475-1: 2006 (table 3). Sample sizes were appropriate for the laboratory test being considered.

4.4.4 Standard Penetration Testing (SPT) was carried out at regular frequencies in the borehole. The test was carried out in accordance with BS EN ISO 22476-3:2005. Key details of the test, as required by BS EN ISO 22476-3 are recorded in Appendix C1. SPT's were carried out using a solid 60° cone in granular material, this test is reported as SPT(C) or using an open sampler in cohesive material, reported as SPT(S). Summary of standard penetration testing is recorded on borehole logs.

4.4.5 A graphical summary of standard penetration test results is presented on Drawings 07a-07f.

4.4.6 Again, a pocket penetrometer was used in cohesive soils. Details of pocket penetrometer determinations are tabulated in Appendix C2. An average of measurements taken at a specific depth are recorded on borehole records. The pocket penetrometer is not covered by British Standards.

4.4.7 A graphical summary of pocket penetrometer measurements is presented on Drawings 06a to 06f.

4.4.8 Combined gas and groundwater monitoring standpipes were installed in boreholes DTS04, DTS06, DTS13, DTS19, DTS24. The standpipes were installed following the recommendations of BS EN ISO 22475-1:2006 '*Geotechnical Investigation and Testing – Sampling methods and groundwater measurements – Part 1: Technical Principles for execution'* (figure 6) and BS8576:2013 *'Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs)'* (figure 7). Details of the standpipe installation are recorded on Drawing 08.

4.4.9 Water levels in the standpipes have been measured during return visits to the site. The water level was measured using a measuring tape calibrated in 1mm intervals with an electronic end piece, which emits an alarm sound in contact with water. Water levels are measured from ground levels at the borehole position. Records of water levels are presented on Appendix K.

4.4.10 A description of measurement of landfill type gases in gas monitoring standpipes is provided in subsequent report paragraphs below.

4.4.11 Indicative soil infiltration testing was carried out in boreholes DTS06 and DTS13. The infiltration testing was carried out generally in accordance with the procedure described in Building Research Establishment (BRE) DG 365 (2016) "*Soakaway Design*". Records of test results and calculations to determine a soil infiltration rate are presented in Appendix C3. It should be noted that testing has not been carried out strictly in accordance with the BRE publication, as this does not specifically provide for calculating an infiltration rate in a borehole. We have adapted the BRE method and calculations in order to provide an indicative infiltration rate.

4.4.12 Permeability testing was carried out in borehole DTS19 following the procedures described in BS EN ISO 22282-2:2012 *'Water permeability tests in a borehole using open systems'*. Records of the test results and calculations to determine the coefficient of permeability (k) are presented in Appendix C3.

4.4.13 Records of boreholes formed using driven tube sampling techniques are presented in Appendix E.

4.5 Measurement of landfill type gases in gas monitoring standpipes

4.5.1 The concentrations of landfill type gases collected within gas monitoring standpipes installed in boreholes DTS04, DTS06, DTS13, DTS19, DTS24 was measured using a portable infra-red gas analyser (model GA5000, manufactured by Geotechnical Instruments). Initially the gas analyser was connected to the gas valve on the top of the standpipe to allow the flow rate to be measured. Essentially this is a measurement of gas pressure produced in the standpipe, which is compared with atmospheric pressure at the time of measurement to produce an equivalent gas 'flow' in l/hr. The equipment used is capable of measuring to an accuracy of 0.1l/hr; below this the gas analyser records zero flow. Following BS8485:2015 '*Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings* (clause 6.3.4), we assume flows of 0.1l/hr when the gas analyser reads zero, thus producing a pessimistic gas flow rate in our assessment of ground gases.

4.5.2 Following measurement of 'flow' the gas analyser pumps gases contained in the standpipe through the analyser. Initial readings of gas concentrations are noted manually, followed by subsequent recordings at regular time periods until 'steady state' concentrations are achieved. The analyser records 'peak' and 'steady' concentrations of the following gases:

- Methane (CH_4)
- Carbon dioxide (CO_2)
- Oxygen (O_2)

4.5.3 The ambient atmospheric temperature and barometric pressure was also recorded at the site. To determine if the atmospheric pressure is rising or falling we interrogate the internet on a daily basis.

4.5.4 Methane in concentrations of between 5 to 15% in air is potentially explosive. The 5% methane concentration in air is defined as the Lower Explosive Limited (LEL). The gas analyser measures a percentage of the LEL. For example, 10% LEL equates to 10% of 5%, i.e. 0.5% methane concentration in air.

4.5.5 Records of gas monitoring data are presented in Appendix K.

4.6 Sampling strategies

4.6.1 Geotechnical

4.6.1.1 In general we adopted a judgemental sampling strategy in relation to geotechnical aspects of the investigation. The location and frequency of sampling was carried out in consideration of the following:

i) Topography
ii) Geology (including Made Ground)

iii) Nature of development proposals

4.6.2 Environmental

4.6.2.1 Details of sampling with respect to contamination issues are described in Section 8.

4.6.3 Sample retention

4.6.3.1 Samples are stored for a period of one month following issue of this report, unless otherwise requested.

5 Laboratory testing

5.1	Classification testing
5.2	Chemical testing

5.1 Classification

5.1.1 Laboratory testing was carried out on samples retrieved from site. The method of testing is recorded on the laboratory test certificate. The following table summarises the classification testing scheduled;

Table summarising classification testing

Exploratory point	Depth (m)	Soil type	Testing scheduled (determination of)
TP01	0.8	Clay	Atterberg Limits, moisture content
TP06	1.2	Clay	
TP07	3.5	Clay	
DTS12	1.2	Clay	
DTS15	0.8	Clay	
DTS17	0.8	Clay	
DTS18	1.8	Clay	
DTS19	3.5	Clay	
DTS23	2.5	Clay	
DTS24	3.5	Clay	
TP01	0.5	Gravel	Particle Size Distribution with hydrometer, moisture content
TP04	0.5	Gravel	
TP08	2.6	Sand	
TP09	2.5	Gravel	
TP11	1.2	Gravel	
TP12	1.2	Gravel	
TP15	1.2	Sand	
TP19	1.2	Sand	
TP20	2.5	Clay	
TP10	3.0	Gravel	Particle Size Distribution, moisture content

Table 5.1.1

5.1.2 Laboratory test certificates are presented in Appendix G.

5.2 Chemical testing

5.2.1 Chemical testing was carried out based on ground conditions and with reference to the contamination Initial Conceptual Model as presented in Section 8. The test methods are recorded on the chemical test certificates. The following table summarises the chemical testing scheduled;

Table summarising chemical testing

Exploratory point	Depth (m)	Medium/soil type	Testing scheduled (Refer to Appendix B for details)
TP01	0.3	Gravel	Suite 1
TP02	0.3	Sand	
TP03	0.2	Topsoil	
TP04	0.2	Topsoil	

Table summarising chemical testing			
Exploratory point	**Depth (m)**	**Medium/soil type**	**Testing scheduled (Refer to Appendix B for details)**
TP05	0.8	Made Ground - Sand	
TP06	0.3	Topsoil	
TP10	0.8	Made Ground - Sand	
TP11	0.3	Topsoil	
DTS01	0.5	Made Ground - Clay	
DTS01	0.8	Made Ground - Clay	
DTS02	0.3	Topsoil	
DTS03	0.3	Topsoil	
DTS04	0.5	Made Ground - Clay	
DTS06	0.3	Topsoil	
DTS07	0.3	Topsoil	
DTS09	0.3	Topsoil	
DTS12	0.3	Topsoil	
DTS15	0.3	Topsoil	
DTS18	0.3	Topsoil	
DTS20	0.5	Made Ground - Sand	
DTS20	0.8	Made Ground - Sand	
DTS23	0.8	Made Ground - Sand	
DTS28	0.8	Clay	
TP05	0.8	Made Ground - Sand	
TP07	0.5	Made Ground - Gravel	
TP09	0.5	Made Ground - Gravel	
TP18	0.8	Made Ground - Sand	
TP18	1.2	Made Ground - Sand	
TP18	1.4	Made Ground - Sand	
TP18	1.6	Made Ground - Sand	
DTS13	0.8	Made Ground - Sand	Asbestos Screening
DTS16	0.8	Made Gravel - Gravel	
DTS20	0.8	Made Ground – Sand	
DTS21	0.5	Made Ground - Sand	
DTS22	1.2	Made Ground - Sand	
DTS26	0.8	Clay	
DTS28	0.8	Clay	
DTS29	1.2	Made Ground - Sand	
TP03	0.5	Gravel	
TP16	0.5	Made Ground - Gravel	
TP18	0.5	Made Ground - Sand	
TP20	0.5	Made Ground - Sand	
DTS02	0.5	Sand	Suite 8
DTS07	0.8	Clay	
DTS19	0.5	Made Ground - Sand	
DTS19	1.2	Gravel	
DTS21	1.8	Made Ground - Clay	
DTS22	1.8	Clay	
TP05	2.5	Made Ground - Sand	Suite 2 - Leachate
TP07	0.8	Made Ground - Gravel	
TP05	1.2	Made Ground – Sand	
TP05	1.8	Made Ground – Sand	
TP08	0.8	Made Ground – Sand	
TP08	1.2	Made Ground – Sand	
TP09	0.8	Clay	
TP20	1.2	Made Ground – Clay	Suite 17
DTS04	0.8	Made Ground – Gravel	
DTS09	0.5	Clay	
DTS16	0.8	Made Ground - Gravel	
DTS20	1.2	Made Ground - Sand	
DTS25	0.5	Made Ground - Sand	

Table summarising chemical testing			
Exploratory point	**Depth (m)**	**Medium/soil type**	**Testing scheduled (Refer to Appendix B for details)**
Nuns Brook Upstream	Surface	Water	
Nuns Brook Downstream	Surface	Water	Suite 17 - Water
DTS19	3.2	Water	
Table 5.2.1			

5.2.2 Laboratory testing was carried out by an independent specialist testing house, which operates a quality assurance scheme. Laboratory test certificates for chemical testing are presented in Appendix H.

6 Ground conditions encountered

6.1	Soils/rocks
6.2	Geotechnical parameters
6.3	Topsoil
6.4	Groundwater
6.5	Evidence of contamination
6.6	Obstructions and instability

6.1 Soils / Rocks

6.1.1 The exploratory excavations encountered the following geological formations across the site: -

- Topsoil
- Made Ground
- Weathered Bee Low Limestone Formation
- Weathered Eyam Limestone Formation
- Weathered Bowland Shale Formation

6.1.2 In addition, locally across the main development area, reworked naturally deposited soils were suspected to be present (TP09, DTS18, DTS22 and DTS26).

6.1.2 For clarity we have referred to the composition of soils within each of the Zones as described in Section 3 and presented on Drawing 04.

6.1.3 Made Ground

6.1.3.1 Within Zone 1 Made Ground was typically encountered as medium dense, dark brown or dark grey, very gravelly SAND or very sandy GRAVEL. Gravel consisted of coarse angular bricks, concrete, glass, plastic, metal wire, vehicle parts, shoes, paper, timber ceramic tiles, roof tiles and slag, with such deposits encountered to depths beyond 5m. The material was consistent with landfilling as recorded by Envirocheck, which appeared to be of 1950-80s origin.

6.1.3.2 Within Zone 2, the Made Ground was consistent with that encountered in Zone 1 (although not physically recorded as a landfill site), but included increased volumes of slag, brick, coal and glass, and was typically much ashier in composition. It is thought that the deposition of the waste here possibly dates from around the late 1800s to early 1900s based on evidence on newspaper clippings encountered in excavations. Made Ground in Zone 2 typically ranged to between depths of 3.0m to >5m to the east and south, with deposits ranging between 0.8m to 1.5m to the northwest of the area. This is likely to be a result of the terracing that this area of the site has been subject to historically.

6.1.3.3 Made Ground in Zone 4 to the east of the site was similar in composition to that encountered in Zone 2, particularly in the location of the former mere (DTS13 and DTS18). No significant Made Ground was encountered in Zone 3.

6.1.4 Weathered Bee Low Limestone Formation

6.1.4.1 Weathered Bee Low Limestone Formation was typically encountered as medium dense orangish brown slightly silty fine SAND or stiff high strength orangish brown sandy CLAY. In the majority of excavations, such deposits extended beyond depths of 5m, however, locally refused at depths of between 1.0m to 3.3m. Refusal is likely to be attributed to encountering more competent deposits of bedrock. Such deposits were only encountered in the eastern part of the site within Zone 4.

6.1.4.2 It should be noted that deposits encountered in borehole DTS18 are suspected to have been reworked, based on their density/strength and depositional characteristics.

6.1.5 Weathered Eyam Limestone Formation

6.1.5.1 Weathered Eyam Limestone Formation was encountered in Zone 3 and the eastern most parts of Zone 2 only, locally below Made Ground deposits. Such deposits were typically encountered as medium dense brown SAND or very sandy GRAVEL of sandstone and shale in the northern parts of Zone 3, and across the rest of the areas as firm to stiff low to medium strength sandy gravelly CLAY. Gravel consisted of fine to coarse angular mudstone and limestone. Rare limestone cobbles / boulders were encountered locally. Generally, all excavations refused between depths of 0.88m to 3.9m below surface levels. Again. refusal is likely to be attributed to encountering more competent deposits of bedrock.

6.1.6 Bowland Shale Formation

6.1.6.1 Bowland Shale Formation was initially encountered as a weathered material below Made Ground, present in Zone 2 and western parts of Zone 3. Deposits typically comprised of firm to stiff, low to medium strength, light brown mottled dark brown, sandy in places, CLAY. Also, such deposits were encountered as a medium dense orangish brown SAND or loose to medium dense grey GRAVEL of angular limestone, sandstone or shale.

6.1.6.2 Locally, in the areas of TP09, DTS22 and DTS26, deposits of weathered Bowland Shale Formation were suspected to have been reworked, based on their density/strength and depositional characteristics.

6.1.6.3 In one location (DTS10), Bowland Shale was encountered as bedrock comprised of very weak dark grey thickly laminated mudstone. In the majority of excavations, such deposits extended beyond depths of 4-5m, however, locally refused at depths of between 3.3m and 3.45. Excluding DTS10, refusal was likely to be attributed to encountering more competent deposits of bedrock.

6.1.7 Summary

6.1.7.1 The following table summarises the geology encountered.

Table summarising soil types

Strata	Depth to top (m)	Depth to bottom (m)	Thickness (m)	Summary description
Topsoil (Zone 3, 4)	0.0	0.15 – 0.5 (0.3)	0.15 – 0.5 (0.3)	Dark brown SAND and CLAY.
Made Ground (Zone 1)	0.0	>5.45	Strata not penetrated (>5.45)	Medium dense, dark brown or dark grey, very gravelly SAND or very sandy GRAVEL. Gravel consists of coarse angular bricks, concrete, glass, plastic, metal wire, car parts, shoes, paper, timber, ceramic tiles, roof tiles, slag.
Made Ground (Zones 2 & 4)	0.0	0.3 ->5.45 (1.65)	0.3 – >5.45 (1.65)	Very Loose dark brown or dark grey, very gravelly slightly clayey SAND, or very sandy gravel GRAVEL. Gravel consists of coarse angular ash, slag, coal, shale, bricks, concrete with minor, glass, plastic, metal wire, car parts, shoes, paper, timber, ceramic tiles and roof tiles. Also includes suspected reworked natural soils.
Weathered Bee Low Limestone Formation (Zone 4)	0.3 – 1.6 (1.0)	Strata not penetrated	Strata not penetrated (>5.45)	Medium dense orangish brown gravelly slightly silty fine SAND or stiff high strength orangish brown sandy CLAY.
Weathered Eyam Limestone Formation (Zone 3)	0.2 – 1.5 (0.4)	Strata not penetrated	Strata not penetrated (>5.45)	Firm low strength light brown mottled dark brown CLAY or medium dense orangish brown SAND or medium dense grey GRAVEL of coarse angular limestone or shale.
Weathered Bowland Shale Formation (Zone 2, 3)	0.3 – 3.0 (1.43)	Strata not penetrated	Strata not penetrated (>5.45)	Medium dense brown very sandy GRAVEL or Firm, low strength sandy gravelly CLAY. Gravel consisted of fine to coarse angular mudstone and limestone.
Bowland Shale Formation bedrock (Zone 3)	2.8 (DTS10 only)	Strata not penetrated	Strata not penetrated (>3.45)	Very weak dark grey thickly laminated mudstone

Table 6.1.7

Figures in brackets are average values

6.1.7.2 With the exception of Made Ground, the investigation generally confirmed published geological records.

6.2 Geotechnical parameters

6.2.1 The following table summarises test data in the weathered Bowland Shale Formation (in Zone 2 and western parts of Zone 3).

Table summarising soil testing and derived geotechnical parameters					
Geotechnical parameter	**Method**	**Value range**	**Characteristic value**	**Comments**	**Notes**
Weight density (above water table)	Soil descriptions	15-19 kN/m^3	15kN/m^3	Derived from BS 8004 figure 1. Most suitable value to be used in structural design.	
Weight density (below water table)	Soil descriptions	14-19 kN/m^3	14kN/m^3	Derived from BS 8004 figure 2. Most suitable value to be used in structural design.	
Plasticity index	Laboratory testing	18-45	31	Report average as representative of the soil as a whole.	1
Water content (%)	Laboratory testing	16 – 62	N/A		1
Undrained Shear strength (kN/m^2)	Insitu testing	10-150 kN/m^2	50kN/m^2	Typical value adopted.	2
Table 6.1.2.1					

1. Laboratory testing presented in Appendix G.
2. Presented on Drawings 06a-06f

6.2.2 The following table summarises test data in the weathered Eyam Limestone Formation (in Zone 3).

Table summarising soil testing and derived geotechnical parameters					
Geotechnical parameter	**Method**	**Value range**	**Characteristic value**	**Comments**	**Notes**
Weight density (above water table)	Soil descriptions	15-19 kN/m^3	15kN/m^3	Derived from BS 8004 figure 1. Most suitable value to be used in structural design.	
Weight density (below water table)	Soil descriptions	14-19 kN/m^3	14kN/m^3	Derived from BS 8004 figure 2. Most suitable value to be used in structural design.	
Plasticity index	Laboratory testing	17 – 37	25	Report most common as representative of the soil as a whole.	1
Water content (%)	Laboratory testing	7.3 - 65	N/A		1
Undrained Shear strength (kN/m^2)	Insitu testing	20-100 kN/m^2	50kN/m^2	Typical value adopted.	2
Table 6.2.2					

1. Laboratory testing presented in Appendix G.
2. Presented on Drawings 06a-06f

6.2.3 The following table summarises test data in the weathered Bee Low Limestone Formation (in Zone 4).

Table summarising soil testing and derived geotechnical parameters

Geotechnical parameter	Method	Value range	Characteristic value	Comments	Notes
Weight density (above water table)	Soil descriptions	15-19 kN/m^3	15kN/m^3	Derived from BS 8004 figure 1. Most suitable value to be used in structural design.	
Weight density (below water table)	Soil descriptions	14-19 kN/m^3	14kN/m^3	Derived from BS 8004 figure 2. Most suitable value to be used in structural design.	
Plasticity index	Laboratory testing	23	23	Report value tested	1
Water content (%)	Laboratory testing	32-44	N/A		1
Undrained Shear strength (kN/m^2)	Insitu testing	0-117 kN/m^2	50kN/m^2	Typical value adopted.	2

Table 6.2.3

1. Laboratory testing presented in Appendix G.
2. Presented on Drawings 06a-06f

6.3 Topsoil

6.3.1 As a practice we have adopted the following policy for description of topsoil. If surface soils exhibit a visually significant organic content and darker colour than the soils it overlies (which are considered to be naturally deposited) then we will describe the soil as topsoil. In some cases, it is difficult to visually distinguish the interface between topsoil and subsoils below, which may also exhibit an organic content, and in such cases we will adopt an estimate of the interface but may also use the terms 'grading into' with some defining depths.

6.3.2 If 'topsoil' deposits include materials such as ash, brick and other man-made materials, or the topsoil overlies Made Ground deposits we will term the material 'Made Ground', even though it may still be able to support vegetable growth, and potentially reused as topsoil.

6.3.3 Topsoil can be classified following a number of test procedures as described in BS3882:2015 *'Specification for Topsoil'* to allow its uses to be determined. We do not carry out such testing unless specifically instructed to do so.

6.4 Groundwater

6.4.1 Groundwater inflows were observed in many of the exploratory excavations. A summary of our observations is tabulated below:

Table summarising groundwater observations

Exploratory point	Date of observation	Depth (m) bgl	Observations
DTS02	08/02/2019	1.3	Groundwater encountered at 1.9m, filling borehole to 1.3m in 10 minutes.
DTS03	08/02/2019	2.0	Groundwater encountered at 2.3m, filling borehole to 2.0m in 10 minutes.
DTS04	06/02/2019	3.0	Groundwater level remain constant.
DTS05	06/02/2019	3.0	Groundwater level remain constant.
DTS10	06/02/2019	1.0	Groundwater level remain constant.
DTS29	29/01/2019	3.0	Groundwater level remain constant.
TP09	22/01/2019	1.3	Groundwater seepages encountered at 1.3m and 2.0m. Not sufficient to fill the pit.
TP12	21/01/2019	4.2	Seepage observed at 4.3m, filling trial pit to 4.2m in 20 minutes.
TP20	21/02/2019	2.3	Groundwater seepage encountered at 2.3m. Not sufficient to fill the pit.
DTS04	18/02/2019 04/03/2019 20/03/2019 01/04/2019	3.97 1.3 Dry Dry	Groundwater level measured during monitoring visit.
DTS06	18/02/2019 04/03/2019 20/03/2019 01/04/2019	Dry 2.7 Dry 2.62	Groundwater level measured during monitoring visit.
DTS13	18/02/2019 04/03/2019 20/03/2019 01/04/2019	Dry 3.98 Dry Dry	Groundwater level measured during monitoring visit.
DTS19	18/02/2019 04/03/2019 20/03/2019 01/04/2019	3.16 3.05 3.1 3.1	Groundwater level measured during monitoring visit.

Table 6.4.1

6.4.2 It should be noted that water levels will vary depending generally on recent weather conditions and only long-term monitoring of levels in standpipes will provide a measure of seasonal variations in groundwater levels.

6.5 Evidence of contamination

6.5.1 During the excavation of our exploratory points, other than the presence of Made Ground within Zones 1, 2 and 4, the only other evidence of potential contamination was related to hydrocarbon odours noted within such deposits in trial pit TP05 between depths of 1.9-3.4m.

6.6 Obstructions and instability

6.6.1 The following table summarises obstructions and instability encountered during our exploratory excavations;

Table summarising obstructions and instability observations		
Exploratory point	**Depth of obstruction**	**Description of obstruction and/or instability**
DTS01	3.5m	Obstruction at the base of exploratory hole, possibly timber.
DTS03	2.3m	Obstruction at the base of exploratory hole, anticipated bedrock encountered
DTS06	3.0m	
DTS07	0.88m	
DTS09	0.60m	
DTS10	3.0m	
DTS11	1.57m	
DTS12	2.40m	
DTS15	1.52m	
DTS16	2.60m	
DTS17	3.60m	
DTS19	5.43m	
DTS22	5.42m	
DTS26	3.30m	
DTS28	2.80m	
TP01	1.20m	
TP02	2.60m	
TP03	1.70m	
TP04	1.00m	
TP08	3.30m	
TP10	3.50m	
TP11	1.20m	
TP13	1.00m	
TP03	0.4m	Collapse of trial pit sides from 0.4m to 0.7m depth on eastern wall, widening trial pit by 0.3m.
TP06	0.0m	Collapse of trial pit sides from 0.0m to 1.9m depth, widening trial pit by 0.25m each side.
TP07	0.3m	Collapse of trial pit sides from 0.3m to 3.7m depth on southern wall, widening trial pit by 0.3m.
TP09	1.3m	Collapse of trial pit sides from 1.3m to 2.0m depth on southern wall, widening trial pit by 0.2m.
TP10	1.0m	Collapse of trial pit sides from 1.0m to 3.0m depth, widening trial pit by 0.5m each side.
TP14	2.2m	Collapse of trial pit sides from 2.2m to 3.4m depth, widening trial pit by 0.3m each side.
TP15	0.3m	Collapse of trial pit sides from 0.3m to 3.5m depth, widening trial pit by 0.3m on eastern and western sides.
TP16	0.1m	Collapse of trial pit sides from all directions, widening trial pit by 0.1 to 0.2m
TP20	0.2m	Collapse of trial pit sides from 0.2m to 1.0m and 2.2m to 3.0m depth, widening trial pit by 0.2-0.25m each side.
Table 6.6.1		

7 Geotechnical Appraisal

7.1	General description of the development
7.2	Building regulations and this report section
7.3	Zone 1 (north-western part of the site)
7.4	Zone 2 (south-western part of the site)
7.5	Zone 3 (central part of the site)
7.6	Zone 4 (eastern part of the site)
7.7	Determination of bearing capacities using pre-Eurocode 7 methods
7.8	Influence of trees and other major vegetation
7.9	Ground Floor Construction
7.10	Requirements for steel reinforcement in building foundations
7.11	Foundation and service trench stability and excavation considerations
7.12	Slope stability
7.13	Dissolution features
7.14	Infiltration potential
7.15	Pavement foundations
7.16	Reuse of excavated soils from the site

7.1 General description of the development

7.1.1 The following assessments are made on the investigatory data presented in the preceding sections of this report and are made with reference to specific nature of the development. Should scheme proposals change then it may be necessary to review the investigation and report.

7.1.2 Based on updated sketch layouts, we understand the scheme will comprise the construction of a large number of dwellings, together with associated gardens, infrastructure and access roads constructed to standards allowing adoption by the local highway authority. Preliminary development proposals are presented in Appendix O. Following previous reporting and recent discussions with the client, it is understood that the former landfill area referred to as Zone 1 will not be developed, and layout/reprofiling of more developable areas of the site has been optimised accordingly. The following assessment has been updated to reflect this.

7.2 Building regulations and this report section

7.2.1 Building Regulations

7.2.1.1 Current Approved Document A of the building Regulations references Eurocodes and their UK National Annexes as practical guidance in meeting part A requirements. Approved document A advises there may be alternative ways of achieving compliance with requirements where it can be demonstrated that the use of withdrawn standards no longer maintained by the British Standards Institution continues to meet Part A requirements.

7.2.2 This report section

7.2.2.1 This chapter of the report provides a foundation strategy for the proposed development based on 'Traditional Methods' which relate (in part) to withdrawn British Standards. However, a number of the geotechnical design parameters comply with Eurocode 7 (BSEN1997-1:2004 '*Geotechnical Design – part 1 General Rules'* and the corresponding UK National Annex). We can provide a full foundation strategy based on Eurocode 7 where required. It is for the foundation designer to select the design methodology and demonstrate compliance with part A requirements.

7.2.3 Geotechnical terms

7.2.3.1 Definitions of geotechnical terms used in the following paragraphs are provided in Appendix A.

7.2.4 Foundation solutions

7.2.4.1 Due to the complex nature of soils encountered across the site, and for ease/clarity, we have provided specific foundation assessments in the following paragraphs for each of the zones as presented on Drawing 04, with the exception of Zone 1 for reasons as described in paragraph 7.1.2 above. We have also provided a foundation zoning plan, presented on Drawing 09, to assist in the interpretation of the following assessments.

7.3 Zone 1 (north-western part of the site)

7.3.1 Ground conditions

7.3.1.1 A detailed summary of ground conditions is provided in Section 6. In summary, significant deposits of Made Ground were encountered in this area of the site, consistent with landfilling as recorded by Envirocheck, which appeared to be of 1950-80s origin. Soils typically comprised of coarse angular bricks, concrete, glass, plastic, metal wire, vehicle parts, shoes, paper, timber ceramic tiles, roof tiles and slag. The full thickness of Made Ground was not proven in this area of the site. Perched groundwater was encountered locally within deposits of Made Ground.

7.3.1.2 It should be noted that a western half of this area of the site could not be investigated due to the presence of a construction site associated with the adjacent railway. Based on desk study information presented in Section 3, it is likely that the landfill material encountered to the east, extends across the entire area and is likely to be consistent.

7.3.2 Foundation solution

7.3.2.1 Based on the updated layout provided by the Client, development is no longer planned for Zone 1, largely due to the above ground conditions encountered. Therefore, we have not provided a foundation strategy for this area.

7.4 Zone 2 (south-western part of the site)

7.4.1 Ground conditions

7.4.1.1 In summary, significant deposits of Made Ground were encountered in large portions of this part of the site, consistent in part with that encountered in Zone 1, but included increased volumes of slag, brick, coal and glass and was typically much ashier in composition. This is likely to be a result of the terracing that this area of the site has been subject to historically, in addition the presence of a small area of landfill on the existing recreational ground as recorded by the Local Authority. Made Ground was encountered to depths >3m in such areas of the site.

7.4.1.2 Locally, the full thickness of Made Ground deposits and possible reworked natural soils was proven, between depths of 1m to 2.7m below existing surface levels. Below such deposits, weathered deposits of Bowland Shale Formation were encountered, typically consisting of medium dense orangish brown SAND medium dense grey GRAVEL of angular limestone, sandstone or shale. Natural Bowland Shale to the southern area of Zone 2 typically comprised of medium to high strength clays.

7.4.2 Foundation solution

7.4.2.1 In view of the depth, apparent variation in the compaction, and composition of the near surface Made Ground deposits, such soils in our opinion are incapable of supporting concentrated foundation loads without promoting excessive amounts of total and differential settlements outside recognised limits for the proposed buildings. We have therefore identified other foundation options as described below.

7.4.2.2 Due to the composition of such soils they are not considered to be amenable to improvement using vibrotreatment techniques, or any other technique which would otherwise have the effect of increasing the density of the Made Ground.

7.4.2.3 In addition, we do not consider a raft foundation feasible due to the compaction, and composition of Made Ground and the likely long term degradation of deposits which will promote collapse settlement.

7.4.2.4 In areas of deep Made Ground a piled foundation is recommended. A piled foundation would transmit superstructural loads down through the Made Ground into the Bowland Shale Formation at depth to obtain end bearing and shaft adhesion support. A supplementary borehole investigation should be carried out to explore ground conditions at depths beyond possible pile lengths in such areas.

7.4.2.5 Based on the preliminary foundation zoning plan presented on Drawing 09, Plots 178 to 184, 223 to 246 and 261 to 267 will require piled foundations. It is noted that granular deposits in the area of trial pit TP15 are recorded as natural, however, significant collapse of trench sides occurred during excavations. We have therefore considered this area with deeper Made Ground and requirement for piled foundations, given deposits are likely to be loose and unsuitable for more traditional foundations. Further intrusive investigations would need to be undertaken to confirm this.

7.4.2.6 In the area of Plots 178 to 222, 247 to 260, 268 to 283, traditional concrete trench fill foundations could be adopted, founding on deposits of weathered Bowland Shale Formation at depth. Foundations would need to be deepened through any Made Ground and reworked natural soils and extend into the naturally deposits soils by a minimum of 0.3m, subject to an overall minimum foundation depth of 1.0m (based on laboratory determination of plasticity). Bearing capacities are provided in Section 7.7 below.

7.4.2.7 Typically, based on recorded depths of Made Ground and reworked natural soils, trench fill foundations in the area of Plots 185 to 222 would need to be excavated to depths of between 1.3 to 2.0m below existing surface levels. In the area of Plots 247 to 260 and 268 to 283, trench fill foundations would need to be excavated to depths of 2.2m to 2.7m. Whilst technically feasible, consideration will need to be given to the stability of Made Ground deposits where foundation excavations exceed depths of 2m, and the possible requirement for shoring. It is considered unlikely that significant groundwater/perched groundwater inflows would be encountered in such areas of the site based on investigations to date. Further intrusive investigations would need to be undertaken to confirm this.

7.4.2.8 Based on the cut and fill that is proposed at present (refer to Appendix N), there is likely to be a marginal degree of cut (~0.5m-1.0m) in areas of the site where trench fill foundations could be adopted. This will assist with reducing thicknesses of Made Ground/reworked soils and thus overall foundations depths (providing the minimum depth as defined above is achieved).

7.4.2.9 It should be noted that there are a number of trees and major vegetation in this area of the site which may require foundation depths exceeding the minimum depth defined above. Further guidance on this is provided in the following report paragraphs.

7.4.2.10 With reference to the site history presented in Section 3.4, this part of the site was subject to significant development associated with railway infrastructure. Consideration should be given to the possibility that underground structures may be present locally which have not been encountered to date and could influence the development.

7.5 Zone 3 (central part of the site)

7.5.1 Ground conditions

7.5.1.1 In summary, Weathered Eyam Limestone Formation was generally encountered in Zone 3, with a covering of Topsoil some 0.3m thick on average. Eyam limestone was typically encountered as medium dense brown SAND or very sandy GRAVEL of sandstone and shale in the northern parts of Zone 3, and across the rest of the area as firm to stiff low to medium strength sandy gravelly CLAY.

7.5.1.2 In eastern parts of Zone 3, in the areas of DTS10, DTS17, DTS28, TP06, weathered Bowland Shale Formation deposits were present, typically comprising of medium to high strength CLAY and GRAVELS of angular mudstone and shale.

7.5.1.3 Generally, the majority of excavations in Zone 3, with the exception of TP06, terminated on deposits of suspected bedrock between depths of 0.6m to 3.9m below surface levels. We have presented contour plots on Drawings 05a and 05b which indicate the depths at which bedrock has been encountered within Zone 3, in mbgl and mAOD respectively.

7.5.2 Foundation solution

7.5.2.1 In our opinion naturally deposited Weathered Eyam Limestone Formation in Zone 3 will adequately support proposed buildings on concrete strip/trench fill foundations. Based on laboratory determination of plasticity and following National House Building Council (NHBC) Standards Chapter 4.2, we recommend foundations extend to a minimum depth of 0.9m below existing or proposed ground levels whichever gives the deeper founding level. Bearing capacities are provided in Section 7.7 below.

7.5.2.2 With reference to Drawing 09, due to the presence of near surface clays, which exhibit a combination of low shear strengths (typically <25kN/m^2) and SPT N Values (typically <2), foundations in the area of Plots 33 to 36 and 100 to 155 will require deepening, with excavations taken down to depths of between 1.2m to 1.7m below existing surface level. Further intrusive investigations would need to be undertaken to confirm this.

7.5.2.3 With reference to the bedrock contour plots presented on Drawings 05a and 05b, where foundation excavations require depending, there is the possibility that bedrock could be encountered in the base of excavations, or a combination of bedrock and weathered Eyam Limestone Formation deposits. In such instances, we would recommend that all excavations are located on bedrock to minimise the effects of differential settlement.

7.5.2.4 Furthermore, in central parts of Zone 3 (TP04 and DTS07 and DTS09), bedrock has been encountered at depths of between 0.6m to 1.0m below existing surface levels. Consideration will need to be given to the requirement to excavate into bedrock in such areas of the site. Where bedrock is present at depths shallower than the minimum foundation depth defined in paragraph 7.5.2.1 above, excavations could be reduced, providing sufficient penetration into bedrock is obtained in order to 'key' in the base of the foundation. Again, as described in paragraph 7.5.2.3, if a combination of bedrock and weathered Eyam Limestone Formation deposits is present in the base of foundation excavations, we would recommend that all excavations are located on bedrock to minimise the effects of differential settlement.

7.5.2.5 Based on the proposed cut and fill, there is likely to be a large amount of cut (up to 3m in places) undertaken across central areas of Zone 3. This is likely to assist with reducing thicknesses of unsuitable founding strata in the area of Plots 100-155, and thus overall foundations depths (providing the minimum depth as defined above is achieved unless bedrock is encountered). In addition, consideration will need to be given to the requirement for use of breaking equipment to facilitate cut where bedrock is present. The contour plot presented on Drawing 05c shows the likely extent of cut required into bedrock based on current and proposed levels. This will assist in determining the volume of proposed cut located in areas of bedrock.

7.5.2.6 It should be noted that there are a number of trees and major vegetation which border this area of the site which may require foundation depths exceeding the minimum depth defined above. Further guidance on this is provided in the following report paragraphs.

7.6 Zone 4 (eastern part of the site)

7.6.1 Ground conditions

7.6.1.1 At present we have been unable to confirm ground conditions in the northern part of Zone 4 due to access restrictions. Where access was available in the southern half of Zone 4, ground conditions were variable. Made Ground was encountered to depths of 1.3m in DTS13, 1.6m in TP08 and 3.0m in DTS18 and was similar in composition to that encountered in Zone 2, comprising of granular material with gravels of slag, brick, coal and glass, textile, timber, plastic and metal. The exception was TP13, which encountered Topsoil onto naturally deposited Weathered Bee Low Limestone Formation comprising orange brown slightly clayey sand. TP13 terminated on what is suspected to be bedrock, located at depths of 1.0m below surface level.

7.6.1.2 Locally, in boreholes DTS18 and DTS102, deposits of suspected reworked Weathered Bee Low Limestone Formation were present, extending beyond termination depths of the boreholes (>5-5.45m). Such deposits regularly exhibited a combination of low shear strengths (typically <20kN/m^2) and SPT N Values (typically <2, often 0), which would suggest the presence of voiding or poorly compacted soils. Elsewhere, naturally deposited Weathered Bee Low Limestone Formation was present below Made Ground, comprising of medium dense orangish brown slightly silty fine SAND or stiff high strength orangish brown sandy CLAY.

7.6.2 Foundation solution

7.6.2.1 Based on development proposals, Plots 1 to 12 are located in Zone 4, and within the area that was not accessible at the time of our investigation. Given the variable nature of ground conditions encountered in the accessible areas of this part of the site, we recommend that further plot specific intrusive investigations are undertaken to confirm the composition of soils. Particularly given that a shallow bathing lake feature was recorded in this area of the site historically (known as 'Russia Mere').

7.6.2.2 Based on excavations completed to date, it is possible that at the very least, deeper traditional trench fill foundations would be required, located on naturally deposited Weathered Bee Low Limestone Formation at depth. Given the presence of suspected reworked Weathered Bee Low Limestone Formation adjacent to the east of Plots 1 to 12 (refer to Roundabout G02 report for further details), there could also be the possibility that plots will require piled foundations. At present, consideration of a worst-case scenario is likely to be sensible. Bearing capacities for trench fill foundations located on naturally deposited Weathered Bee Low Limestone Formation are provided in Section 7.7 below.

7.6.2.3 Based on the proposed cut and fill, there is likely to be a marginal degree of cut (~0.5m-1.0m) in this area of the site, if deeper trench fill foundations are required, this will assist with reducing thicknesses of Made Ground/reworked soils and thus overall foundations depths.

7.7 Determination of preliminary bearing capacities using pre-Eurocode 7 methods

7.7.1 The following paragraphs derive preliminary bearing capacities using 'traditional' techniques adopting global factors of safety against failure where experience shows has worked well, and are considered appropriate to satisfy part A of the building regulations. These should be considered preliminary and should be verified with further plot specific investigation as outlined in preceding paragraphs once development proposals are finalised.

7.7.2 Due to the variable nature of the near surface naturally deposited weathered Bowland Shale, Weathered Eyam Limestone Formation and Weathered Bee Low Limestone Formation, our foundation assessments take into consideration the effects of both cohesive (clays) and granular (sands/gravels) soils. Bearing pressures outlined in the following paragraphs are considered preliminary and are based on providing values for clay soils at the site, as in this instance they typically yield more conservative bearing capacities than those for granular soils at the site. However, the effects of both soil types are taken into consideration in the assessment of differential settlement. Foundation depths within each of the assessed Zones are outlined in sections 7.3 to 7.5 above. This provides a worst case scenario for the site.

7.7.3 Based on the results of the investigations, and adopting a cohesive ground model for the site, we have adopted a characteristic undrained shear strength (C_u) for soils below and around likely foundation levels of 50kN/m^2 based on the results of field measurements (refer Appendix C2), and our experience. Calculations indicate following preliminary bearing values for varying width concrete trench fill/ strip foundations: -

Table of preliminary bearing values for traditional strip/trench fill foundations

Width (m)	Ultimate bearing value kN/m^2	Presumed bearing value kN/m^2	Allowable bearing pressure kN/m^2
0.45	350	125	125
0.6	330	120	120
0.75	320	115	115
1.0	310	110	110

Table 7.7.3

7.7.4 The presumed bearing value has been derived from the ultimate bearing value by applying a factor of safety of 3, and the allowable bearing pressure derived to limit total settlement to 25mm.

7.7.5 It is difficult to accurately predict the amount of total and differential movement caused by consolidation of the foundation supporting subsoils, however, providing the foundation loads do not exceed the allowable bearing pressure provided in the preceding paragraphs, we suggest total settlement will be small, and probably less than 25mm. It is likely settlement will be substantially achieved within say 10-15 years of construction. If stresses applied at foundation formation levels vary significantly then this will increase levels of differential settlement produced by variation in ground conditions alone.

7.7.6 Based on the table above, we would recommend that further onsite trial pit/ borehole investigations are undertaken to confirm foundation requirements on a plot specific basis once development proposals are finalised.

7.8 Influence of trees and other major vegetation

7.8.1 Soil classification and new foundation design

7.8.1.1 The results of plastic and liquid limit determinations performed on samples of the, weathered Bowland Shale Formation and weathered Eyam Limestone Formation (form Zones 2 and 3) indicate these deposits are soils of high and medium volume change potential respectively when classified in accordance with National House Building Council (NHBC) Standards, Chapter 4.2. Foundations taken down onto a depth of 1.0m (for high) and 0.9m (for medium) will penetrate the zone of shrinkage and swelling caused by seasonal wetting and drying. Trees and other major vegetation extend this zone and will require deeper foundations. A good guide to this subject is provided in NHBC Standards, Chapter 4.2.

7.8.2 Tree species identification

7.8.2.1 There are a number of trees and other major vegetation at the site (and adjacent to the site). On this basis it will be necessary to appoint a qualified Arboriculturist (listed in the Arboricultural Association Directory of Consultants – www.trees.org.uk) to determine the location, height (and mature height) and water demand of all trees/major hedgerows at and close to the site, information, which will be necessary to design foundations in accordance with NHBC Standards, Chapter 4.2.

7.8.3 New planting

7.8.3.1 Any planting schemes should also take into account the effect that new trees could have on foundations when they reach maturity. Again, a good guide to this subject is provided in NHBC Standards, Chapter 4.2.

7.9 Ground Floor Construction

7.9.1 Ground bearing floor slabs can be adopted in Zone 3 at this site where buildings are remote from trees and where Topsoil deposits are fully removed within the footprint of the building. We recommend a blanket of good quality compacted granular material be placed prior to construction of the floor slabs.

7.9.2 Due to the thickness of Made Ground deposits present in Zone 2 (unless proposed cut removes all Made Ground) and the likelihood that Made Ground or reworked soils are present in Zone 4 in the area of Plots 1 to 12, we recommend a suspended ground floor is adopted.

7.9.3 Furthermore, in areas close to existing major vegetation at the site (or where ground floors are elevated requiring in excess of 600mm of fills) then we recommend the use of a suspended ground floor with a sub floor void determined following NHBC Standards, Chapter 4.2.

7.10 Requirements for steel reinforcement in building foundations

7.10.1 Based on observations in trial pit excavations, it is likely that excavations to founding levels will encounter both fine grained (clay type) and coarse grained (granular) soils. Whilst these soils will ultimately generate similar amounts of total settlement under applied foundation loads, the rate at which settlement will be achieved will differ. Granular soils will produce settlements almost immediately loads are applied, with fine grained (clay type) soils generating settlement sometime after completion of construction. Thus foundations (particularly strip / trench fill concrete foundations) traversing differing soil types will be subject to some differential settlements due to differing rates at which total settlement will be achieved. To minimise the effects of such differing rates of settlement we recommend foundations are reinforced to stiffen concrete and thus resist the effects of differential movement where foundations traverse cohesive and granular soils. In the event that a soft area is located in the course of foundation excavations then we recommend excavations continue to locate stiffer/denser soils.

7.10.2 It is understood that due to the possible risks of dissolution of the underlying limestone at the site (refer to Section 7.12 below), any strip/trench fill foundations at the site will be significantly reinforced as a matter of course, subject to Local Authority approval.

7.11 Foundation and service trench stability and excavation considerations

7.11.1 Based on our observations of the stability of the sides of trial pit excavations in Made Ground in Zone 2 we consider there is a possibility of some over break/instability in the sides of foundation excavations, particularly where excavations are deepened through more significant deposits of Made Ground. Such excavations are likely to require shoring to maintain an open excavation.

7.11.2 In addition, instability was also observed locally (TP03 and TP06) in near surface weathered Eyam Limestone Formation in Zone 3 between depths of 0.7m and 1.9m. consideration should be given to the requirement of localised shoring in such areas.

7.11.3 Typically, groundwater observations in natural soils suggest that levels are remote from founding depths and located at depths of around 2-3m. Beyond this depth the risks of encountering groundwater increase significantly with groundwater inflows promoting collapse of trench sides and the construction of a successful spread type foundation difficult. Locally, adjacent to Nun Brook, groundwater levels were measured within 2m of surface level. It is likely that in such areas of the site, the groundwater is in continuity with the level in the book. Perched water was also present locally in Made Ground deposits. We anticipate any water will be controlled with nominal pumping techniques.

7.11.4 As indicated in Section 7.5 above, excavations in Zone 3, and to a lesser extent in Zone 4, are at risk of encountering limestone bedrock, particularly during cut and fill works. Consideration will need to be given to the requirement for use of breaking equipment to loosen the deposit prior to excavation. Given the cut depths of up to 3m are likely in Zone 3, we consider this a high possibility and consideration of difficulty of excavation within the bedrock will be required.

7.11.5 We recommend any trench excavation requiring human entry is shored as necessary to conform with current best practice, and accepted by the Health and safety Executive (HSE) and in particular, following guidance provided in the HSE publication '*Health and safety in construction (HSG 150)*' (www.hse.gov.uk).

7.12 Slope stability

7.12.1 Existing slope stability

7.12.1.1 Based on topographical survey data, site levels fall towards Nun brook in the centre of the site, at inclinations of around 20° in Zone 3. It is also noted that the BGS map for the area records the Eyam Limestone within Zone 3 to dip at 22° to the north-west/west, consistent with surface levels. Although the area is not recorded as a landslip site on geological maps and Envirocheck data (refer to Appendix M for latter), and during our site reconnaissance no signs of instability was noted, due to the relatively steep dip of bedrock, consideration should be given to the potential risk of natural slope instability during construction works.

7.12.2 Slope stability during and following construction

7.12.2.1 Based on current earthworks proposals, whilst large areas of limestone in Zone 3 are weathered to clays and granular material, significant areas of cut are likely in areas of limestone bedrock. Based on the dip orientation of limestone in Zone 3, it is likely that excavations will be undertaken perpendicular to the dip. Given the typical jointed and fractured nature of limestone, in addition to the severity of dip, slippage of rock mass may occur along bedding planes at the face of the cuttings. This may also occur within foundation trench excavations. As a consequence, assuming that limestone does dip at the angle as indicated above, we would recommend the following outline restraints be imposed on the development to minimise the risk of mass block failure: -

a) The length of open trench excavations (for foundations and service installations) following ground contours shall not exceed say 10m and a gap of at least 20m shall be provided between adjacent excavations following ground contours.

b) No permanent cuttings following ground contours shall extend more than say 1m into the limestone bedrock.

c) Filling parts of the site following ground contours shall not exceed 1m and this includes temporary spoil heaps.

d) Concentrated infiltration into limestone bedrock is minimised, which would otherwise also act as a possible mechanism for dissolution

7.13 Dissolution features

7.13.1 Eyam Limestone and Bee Low Limestone present in Zones 3, 4 and 5 at the site are typically rich in Calcium Carbonate. CIRIA reports PR11 and C574 (relating to chalk sites) states 'The presence of dissolution features should be expected on all calcium carbonate rich sites'. Dissolution features in general comprise the following:

- Sinkhole, formed by dissolution of near surface limestone reducing their volume and creating a surface depression.
- Dissolution pipe, a cone or pipe like cavity typically in filled with limestone which has subsided into the cavity, with the infill limestone much weaker than the surrounding.
- Swallow holes, a surface feature where a void in the limestone continuously or intermittently 'swallows' wholly or partially a surface stream.

7.13.2 Assessment of the risk to foundations posed by dissolution features

7.13.2.1 Dissolution features pose a hazard to foundations because of the presence of one or more of the following:

1. Large variations in intact limestone horizon
2. Loose limestone or superficial deposits infilling pipes
3. Cavities or caves within the limestone
4. Dissolution widened discontinuities in the limestone affecting its load carrying capacity

These features are generally located above the groundwater table level.

7.13.2.2 Clearly the risk that these hazards present to a building relates to its vulnerability, which in turn relates to the foundation type. A building on shallow spread type foundations and ground bearing floors is more vulnerable than piled foundations extending through the base of these features supporting a suspended ground floor slab.

7.13.2.3 Research suggests that the majority of recent occurrences of ground subsidence was induced by man. The most common activities triggering subsidence are as follows: -

- Dynamic and static loading
- Leaking drains
- Leaking water supply pipes
- Water flows from soakaways
- Overzealous garden watering in dry weather

7.13.3 Risk assessment and mitigation

7.13.3.1 Unfortunately in many cases it is not possible to confidently discount the presence of dissolution features, but we have assessed the risk based on the following: -

Item	Observation / enquiry	Assessed risk
Surface features	No obvious evidence of any surface depressions in topography local to the site. Although Envirocheck record a natural sink hole and solution pipe 596m to the SE.	Low-moderate
Variation in density of near surface soils	It was noted during site investigations that localised areas of near surface weathered Eyam Limestone in Zone 3 exhibited very low shear strengths and SPT N Values. This appears to be consistent with the zone of moderate to high risk of dissolution as recorded by Envirocheck (refer to Drawings 03 and 09 for details). Furthermore, there was a significant variation in the thickness of more weathered deposits overlying bedrock in Zone 3.	Moderate
Variation in intact limestone horizon	No significant penetration was gained into limestone deposits to assess this.	Unknown
Adverse movement in nearby buildings	No adverse movement in neighbouring properties close to the site (viewed from public roads / footways only).	Low
Envirocheck data base	Assessed risk considered moderate to high within Zone 3 – refer to Drawings 03 and 09 for zone of dissolution.	Moderate-high
Enquiries to local authority building control and NHBC	High Peak Borough Council have been contacted but are yet to respond to our enquiry. The client has been able to contact NHBC for advice. They have indicated that in such areas they would typically require plots to be founded on raft foundations. Further probe holes would typically be required to confirm that presence, or otherwise, of dissolution features and depth to bedrock, following which reinforced trench fill foundations could be adopted rather than rafts.	Moderate-high

Table 7.13.3

7.13.3.2 Based on the above, the risk of the site being subject to the effects of dissolution features is considered moderate to high.

7.13.4 Risk mitigation measures

7.13.4.1 We therefore recommend that non-intrusive geophysical surveys are undertaken by a specialist across the area of Zones 3 and 4 to determine if there are any anomalies near surface which could indicate the presence of such features.

7.13.4.2 Regardless of the outcome of the above, it is likely that plots located directly on limestone bedrock would not require mitigation measures incorporated within the foundation design.

7.13.4.3 Typically NHBC and Local Authority Building Control would expect to see the use of stiff raft foundations in such areas to resist any loss of ground support due to dissolution. It is understood that due to the severity of the surface levels within Zone 3, the construction of raft foundations is likely to be difficult to successfully achieve. A highly reinforced trench fill/strip foundation is likely to be considered acceptable by the NHBC, subject to further plot specific investigations being undertaken to confirm the competency of underlying soils.

7.13.4.4 As infiltration systems may be utilised at the site, we recommend water is not concentrated in isolated locations but evenly distributed in say level trench type soakaways to minimise the risk of promoting the formation of dissolution features. Again, such soakaways need to be positioned remote from buildings and remote from settlement sensitive features.

7.13.4.5 Water supply pipes need to be watertight and flexible to minimise risks of leaks. Heavy vibration from compaction plant shall not be used.

7.14 Infiltration potential

7.14.1 Contamination considerations

7.14.1.1 With reference to Environment Agency (EA) publication '*Groundwater protection: Policy and practice (GP3) Section G,* 2012, outside of SPZ1, the EA will support sustainable drainage systems for new discharges to ground. This is subject to an appropriate risk assessment to demonstrate that ground conditions are suitable and infiltration systems do not present an unacceptable risk of promoting mobilisation of contaminants or creating new pathways for contaminant migration.

7.14.1.2 The permeability of the near surface weathered Eyam Limestone, Bowland shale and Bee low Limestone Formation in combination with the site located over Secondary A (Bowland Shale) and principal aquifers (limestone deposits) suggests the site is sensitive to migration of contaminants. The site is not located within or close to a source protection zone. Providing that surface water is restricted from freely migrating though Made Ground deposits, the risk of infiltration systems promoting mobilisation of contaminants at the site is considered low. All discharges to groundwater are subject to compliance with the Water Framework Directive (2000/60/EC) and Groundwater Daughter Directive (2006/118/EC).

7.14.2 Requirements for use of infiltration systems

7.14.2.1 It is a requirement under H3 (3) of the current building regulations to discharge stormwater collected by a development to soakaways as a priority (as opposed to water courses and sewers)

7.14.3 Infiltration measurements

7.14.3.1 The permeability of the weathered Bee Low Limestone and weathered Eyam Limestone Formations was measured in boreholes DTS06 and DTS13 respectively, following the principles described in Building Research Establishment (BRE) Digest 365 (2016) "*Soakaway Design*". Tests were carried out between depths of 1.87m and 3.0m in DTS06 (deposits of clay) and 1.75m and 3.89m in DTS13 (deposits of clay), providing infiltration rates of 3.81 x 10^{-6} m/s in DTS06 and between 2.67 x 10^{-4} m/s and 4.72 x 10^{-5} m/s in DTS13. Records of testing and calculations are presented in Appendix C3.

7.14.3.2 It should be noted that testing has not been strictly carried out in accordance with the BRE publication, as the minimum size of the test hole (BRE 365 states that the trial pit should be 0.3 to 1 m wide and 1 to 3 m long and should have vertical sides trimmed square) could not be achieved in the borehole, however the test provides an indication of the likely permeability of the soils under test. Further on-site testing is recommended using machine dug trial pits to allow test procedures to conform with the requirements of BRE digest 365. We can carry out such testing on further instructions.

7.14.3.3 The indicative permeability of weathered Bowland Shale Formation deposits was measured using falling head tests carried out in borehole DTS19 (gravels) following the Hvorslev method as defined in BS EN ISO 22282-2:2012. Records of the test results and calculations to determine the soil infiltration rate is presented in Appendix C3. The testing provided an indicative permeability between 2.94 x 10^{-6} m/s to 3.12 x 10^{-6} m/s.

7.14.4 Design of infiltration systems

7.14.4.1 With regard to the deposits of reworked weathered Bee Low Limestone Formation (refer to Section 7.15 for further details), there is evidence of possible voiding and poor compaction within soils. Such deposits will exhibit a varying degree of permeability and potentially will be able to dispose of stormwater using infiltration systems. Such a method of stormwater disposal does have the following potential drawbacks: -

- Water freely/directly discharged into the reworked soils could cause collapse of air voids contained in these deposits, which promotes compaction of the soils around the soakaway causing depression of the general area around the soakaway as well as potentially affecting pipe runs leading to the soakaway.

- Water freely/directly discharged into soils close to cutting slopes could promote instability of such slopes. Typically, railway companies (possible adjacent land owners) restrict the use of soakaways close to their land boundaries.

7.14.4.2 Naturally deposited soils exhibit some variation in composition across the site and thus likely permeability. On this basis the use of trench type soakaways will increase the likelihood of locating more permeable soils along its length and by evenly distributing stormwater along their length minimise the risk of promoting formation of solution cavities.

7.14.4.3 Testing completed to date should be considered preliminary only and we recommend further, more intensive, on site testing is carried out targeting this part of the investigation allowing detailed design of infiltration systems to be progressed if such systems are to be adopted.

7.14.4.4 If infiltration systems are adopted as a means of stormwater disposal (including permeable pavement construction), we recommend approval for the use of soakaways is sought from the Environment Agency. It should be noted that the Groundwater Regulations 1998 require that list 1 substances (e.g. Hydrocarbons) are to be prevented from entering groundwater receptors and list 2 substances (e.g. metals) are also restricted. Typically, the Environment Agency will require details of the proposed soakaway systems, showing pollution prevention measures. They will also require geological and geo-hydrological information, (contained in this report) as well as the risks of chemical contaminants in the ground affecting water resources. It is also typical requirement that there is an 'unsaturated zone' between the base of the soakaway system and the groundwater table (saturated zone) providing attenuation capacity.

7.15 Pavement foundations

7.15.1 Criteria for design of the pavement foundation

7.15.1.1 The thickness of the pavement foundation (typically unbound granular materials- or sub-base and capping materials) is derived from a combination of the following:

- Number of passes of standard (80kN) axles from construction traffic (HGV). i.e. construction traffic loading which the foundation is required to carry.
- The location of the water table.
- Weather conditions at the time of construction.
- The strength of the subgrade, determined by measurement of the California Bearing Ratio (CBR).

7.15.1.2 For road designs meeting the requirements of the Highways Agency, then subgrade CBR will derive a foundation layer thickness relating to differing subgrade stiffness's. (refer interim advice note 73/06).

7.15.2 Methods of determination of CBR values

7.15.2.1 The following table identifies common methods of determination of CBR values

Common methods of CBR determination				
Method	**reference**	**Outline methodology**	**Advantages**	**Disadvantages**
Direct on soil in CBR mould	BS1377 and Interim advice note 73/06 (2009)	Soil sample in steel mould. Can be undisturbed or disturbed (recompacted in mould). Load measured to force 50mm diameter steel plunger 2.5 and 5mm into soil to derive CBR	BS procedure Department for transport procedure	CBR measured at water content at time of test. CBR may not reflect changes in water content during life of pavement. Unsuitable for very coarse grained (> 20mm) soils
Plate bearing test	Interim advice note 73/06 (2009)	Load required to displace a 762mm diameter steel plate 1.25mm into the subgrade to derive a CBR	Department for transport procedure. Suitable for coarse grained soils	CBR measured at water content at time of test. CBR may not reflect changes in water content during life of pavement. Reasonably slow procedure.
Dynamic cone	Interim advice note 73/06 (2009)	Record number of blows of 8kg drop weight falling 575mm to drive 20mm 60-degree steel cone 50 to 550mm into the subgrade.	Department for transport procedure. Reasonably rapid assessment.	CBR measured at water content at time of test. CBR may not reflect changes in water content during life of pavement. Unsuitable for very coarse-grained soils
Soil classification characteristics	LR 1132 structural design of bituminous roads (Transport Research laboratory)	Measurement of plasticity or particle side distributions, and knowledge of location of water table required to derive CBR for varying construction conditions	CBR derive for subgrade during life of pavement. Simple testing. Relates to long term research and experience at the TRL	Interim Advice note 73/06 (section 5.5) says this should only be used samples cannot be taken for laboratory testing.
Undrained shear strength	TRRL report 889 Strength of clay fill subgrades: its prediction in relation to road performance.	CBR = Cu/23, where Cu is the undrained shear strength (kN/m2).	Cu could be measured by hand held shear vane rapidly and in great quantities. Relates to long term research and experience at the TRL	Cu measured at water content at time of test. Derived CBR may not reflect changes in water content during life of pavement. Unsuitable for coarse grained soils

Table 7.15.2

7.15.2.2 Methodology can sometimes be dictated by design manuals of a local highway authority who may adopt the road network and would probably favour methods described in Interim advice note 73/06.

7.15.3 Location of the pavement formation

7.15.3.1 For the purposes of the following assessment we have reviewed likely formation strata in each of the specific developable zones (2-4) on the residential site as indicated on Drawing 04. We anticipate that proposed access roads and associated hardstanding areas within each zone will be located at or about existing ground levels with formation located on the following soils: -

- Zone 2 – Made Ground (landfill type material) and general Made Ground with anthropogenic material
- Zone 3 – Weathered Eyam Limestone Formation
- Zone 4 – Typically Made Ground (landfill type material) as per Zone 2 (and Zone 1), in addition to very locally reworked Bee Low Limestone Formation and naturally deposited Bee Low Limestone Formation.

7.15.3.2 It should be noted that proposals include a significant cut and fill exercise across the site, which is likely to alter the composition and strength/density of subgrade below proposed roads/hardstanding. We have based the following CBR assessment on current condition of soils at likely formation levels below existing surface level. Reassessment of such values will be required following finalisation of cut and fill works across the site. Clearly, in areas of significant fill, the compaction achieved on such material will dictate overall subgrade CBR value.

7.15.4 Zone 2 (south-western part of the site) and Zone 4 (eastern part of the site)

7.15.4.1 Equilibrium CBR (California Bearing Ratio) values (with reference to Transport and Road Research Laboratory (TRRL) Report LR1132 '*Structural design of Bituminous Roads*') are derived from knowledge of soil classification data (plasticity index for soils exhibiting cohesion (clay type) and particle size distribution for granular soils), the location of the water table pavement thickness, and weather conditions at the time of construction. It is anticipated that excavations to formation levels will encounter a mixture of both granular and cohesive soils. Granular soils will provide numerically high CBR values, but cohesive soils will typically provide significantly lower values.

7.15.4.2 It is possible to derive the 'insitu' CBR value at formation from undrained shear strength data by applying a conversion factor of 23 (refer TRRL laboratory report LR889). Thus, adopting pessimistic undrained shear strength of say 50kN/m^2 at formation level (based on insitu shear strength measurements) then an equivalent CBR value can be obtained i.e.

Insitu CBR = undrained shear strength 50 / 23 = 2.1%

7.15.4.3 The 'insitu' CBR derived above, is susceptible to change dependent upon weather conditions during construction. We recommend the insitu CBR of 2.1% derived from shear strength data be utilised for design purposes and reassessed during construction. It should be noted that the thickness of the pavement foundation also relates to the amount and loading from construction traffic, which is discussed in detail in the Transport and Road Research Laboratory (TRRL) Report LR1132 '*Structural design of Bituminous Roads'.*

7.15.4.4 Made Ground deposits to some extent in Zones 2 and 4, comprise of landfill type material which will exhibit a degree of variation in compactness. Such material also contains elements of anthropogenic material which is likely to be susceptible to decomposition. Inundation settlement and possibly collapse settlement of voids could result in differential settlement to manifest across the pavement surface. It is difficult to calculate this accurately however to limit the amount of settlement across pavements in this area of the site, a number of options are available:

1. Either; once formation levels have been established the formation can be trimmed and rolled following current requirements of the Highways Agency Specification for Highways Works (clause 616) (refer www.dft.gov.uk/ha/standards/mchw/vol1). Such a process will identify any soft/loose areas, which we recommend be either excavated out and backfilled with a suitable well compacted material similar to those exposed in the sides of the resulting excavation, or large cobbles of a good quality stone rolled into the formation to stabilise the 'soft/loose' area. If excavated material is proposed to be re-used then any boulders and potentially degradable material should be removed prior to compaction.

2. **Or,** to further limit the degree of potential differential settlement, the initial 1m of soils below formation level could be excavated out, sorted and compacted in accordance with the Specification for Highways Works described above. This would not mitigate against settlement induced from decomposing of any fill material at depth.

3. **Or,** increasing and homogenising the density of the Made Ground/natural soils through ground improvement techniques such as vibrotreatment or permeation grouting/lime stabilisation. These are notably expensive and would require specialist input at the feasibility stage.

4. **And**, a geogrid could be incorporated within the design. Such a solution would not mitigate the potential for differential settlement but would limit the impact of such settlement at surface.

7.15.4.5 Consideration will need to be given to the possibility of proposed roads spanning across Made Ground and naturally deposited soils within Zone 4 and the likelihood that differential settlement will occur. This could be minimised by adopting some of the strategies outlined in paragraph 7.15.4.4 above.

7.15.5 Zone 3 (central part of the site)

7.15.5.1 Similarly with Zones 2 and 4, it is anticipated that excavations to formation level will encounter a mixture of both granular and cohesive soils within Zone 3.

7.15.5.2 Equilibrium CBR (California Bearing Ratio) values (with reference to Transport and Road Research Laboratory (TRRL) Report LR1132 '*Structural design of Bituminous Roads')* are derived from knowledge of soil classification data (plasticity index for soils exhibiting cohesion (clay type) and particle size distribution for granular soils), the location of the water table pavement thickness, and weather conditions at the time of construction. Assuming an average plasticity index of say 30 for cohesive soils (which will provide more conservative values), a low water table, a 'thin' pavement the following equilibrium CBR values are derived for varying construction conditions.

Equilibrium CBR values for differing construction conditions		
Poor	**Average**	**Good**
CBR = 3%	CBR = 4%	CBR = 4%

Table 7.15.5

We recommend these CBR values be utilised for design purposes and reassessed immediately prior to construction.

7.15.5.3 Again, it is possible to derive the 'insitu' CBR value at formation from undrained shear strength data by applying a conversion factor of 23 (refer TRRL laboratory report LR889). Thus, adopting pessimistic undrained shear strength of say 50kN/m^2 at formation level (based on insitu shear strength measurements) then an equivalent CBR value can be obtained i.e.

Insitu CBR = undrained shear strength 50 / 23 = 2.1%

7.15.5.4 The 'insitu' CBR derived above, is susceptible to change dependent upon weather conditions during construction. We recommend the insitu CBR of 2.1% derived from shear strength data be utilised for design purposes and reassessed during construction. It should be noted that the thickness of the pavement foundation also relates to the amount and loading from construction traffic, which is discussed in detail in the Transport and Road Research Laboratory (TRRL) Report LR1132 '*Structural design of Bituminous Roads'.*

7.15.5.5 Once formation levels have been established it is recommended that the formation be trimmed and rolled following current requirements of the Highways Agency Specification for Highways Works (clause 616) (refer www.dft.gov.uk/ha/standards/mchw/vol1). Such a process will identify any soft/loose areas, which we recommend be either excavated out and backfilled with a suitable well compacted material similar to those exposed in the sides of the resulting excavation, or large cobbles of a good quality stone rolled into the formation to stabilise the 'soft/loose' area.

7.15.6 Subgrade frost susceptibility

7.15.6.1 Near surface soils across the site are considered frost susceptible and this may override the CBR criteria for pavement foundation design purposes.

7.15.7 Moisture susceptibility

7.15.7.1 It is possible that due to the nature of near surface soils across the site, they could be moisture susceptible with small increases in moisture content giving rise to a rapid loss of support to construction plant. We therefore recommend, as soon as formation is trimmed and rolled, that sub-base is laid in order to avoid deterioration of the subgrade in wet or frosty conditions.

7.16 Reuse of excavated soils from the site

7.16.1 Generally naturally deposited soils excavated from the site could be reused as bulk filling, if reused at their natural moisture content. We recommend soils be classified and compacted in accordance with the current Highways Agency '*Specification for Highway Works'* (600 series) – table 6/1 (refer www.dft.gov.uk/ha/standards/mchw/vol1).

7.16.2 As described in preceding paragraphs, a significant cut and fill exercise is proposed across the site. We recommend that prior to works commencing, soils which are proposed for fill are tested to determine their suitability for reuse. Soiltechnics would be happy to undertake this upon further instruction.

8 Chemical contamination

8.1	Contaminated land, regulations and liabilities
8.2	Objectives and procedures
8.3	Development characterisation and identified receptors
8.4	Identification of pathways
8.5	Assessment of sources of contamination
8.6	Initial conceptual model
8.7	Laboratory testing
8.8	Updated conceptual model
8.9	Remedial action
8.10	Risk assessment in relation to infiltration systems
8.11	Risk assessment summary and recommendations
8.12	Final conceptual model
8.13	Statement with respect to National Planning Policy Framework
8.14	On site monitoring

8.1 Contaminated land, regulation and liabilities

8.1.1 Statute

8.1.1.1 Part IIA of the Environment Protection Act 1990 became statute in April 2000. The principal feature of this legislation is that the hazards associated with contaminated land should be evaluated in the context of a site-specific risk based framework. More specifically contaminated land is defined as:

> *"any land which appears to the local authority in whose area it is situated to be in such a condition, by reasons of substances in, on or under the land, that:*
>
> *a) Significant harm is being caused or there is a significant possibility of such harm being caused; or*
> *b) Pollution of controlled waters is being or is likely to be caused".*

8.1.1.2 Central to the investigation of contaminated land and the assessment of risks posed by this land is that:

i) There must be contaminants(s) at concentrations capable of causing health effects (*Sources).*
ii) There must be a human or environmental receptor present, or one which makes use of the site periodically *(Receptor)*; and
iii) There must be an exposure pathway by which the receptor comes into contact with the environmental contaminant *(Pathway).*

8.1.1.3 In most cases the Act is regulated by Borough or District Councils and their role is as follows:

i) Inspect their area to identify contaminated land
ii) Establish responsibilities for remediation of the land
iii) See that appropriate remediation takes place through agreement with those responsible, or if not possible:
- by serving a remediation notice, or
- in certain cases carrying out the works themselves, or
- in certain cases by other powers

iv) keep a public register detailing the regulatory action which they have taken

8.1.1.4 For "special" sites the Environment Agency will take over from the Council as regulator. Special sites typically include:-

- Contaminated land which affects controlled water and their quality
- Oil refineries
- Nuclear sites
- Waste management sites

8.1.2 Liabilities under the Act

8.1.2.1 Liability for remediation of contaminated land would be assigned to persons, organisations or businesses if they caused, or knowingly permitted contamination, or if they own or occupy contaminated land in a case where no polluter can be found.

8.1.3 Relevance to predevelopment conditions

8.1.3.1 For current use, Part IIA of the Environmental Protection Act 1990 provides the regulatory regime. The presence of harmful chemicals could provide a 'source' in a 'pollutant linkage' allowing the regulator (local authority or Environment Agency) to determine if there is a significant possibility of harm being caused to humans, buildings or the environment. Under such circumstances the regulator would determine the land as 'contaminated' under the provision of the Act requiring the remediation process to be implemented.

8.1.4 Relevance to planned development

8.1.4.1 The developer is responsible for determining whether land is suitable for a particular development or can be made so by remedial action. In particular, the developer should carry out an adequate investigation to inform a risk assessment to determine:

a) Whether the land in question is already affected by contamination through source – pathway – receptor pollutant linkages and how those linkages are represented in a conceptual model
b) Whether the development proposed will create new linkages e.g. new pathways by which existing contaminants might reach existing or proposed receptors and whether it will introduce new vulnerable receptors, and

c) What action is needed to break those linkages and avoid new ones, deal with any unacceptable risks and enable safe development and future occupancy of the site and neighbouring land?

8.1.4.2 Building control bodies enforce compliance with the Building Regulations. Practical guidance is provided in Approved documents, one of which is Part C, '*Site preparation and resistance to contaminants and moisture*' which seeks to protect the health, safety and welfare of people in and around buildings, and includes requirements for protection against harm from chemical contaminants.

8.1.5 Pollution of controlled waters

8.1.5.1 Part IIA of the Environment Protection Act 1990, defines pollution of controlled waters as

'The entry into controlled waters of any poisonous, noxious or polluting matter or any solid waste matter'

8.1.5.2 Paragraphs A36 and A39 of statutory guidance (DETR 2000) further define the basis on which land may be determined to be contaminated land on the basis of pollution of controlled waters.

'Before determining that pollution of controlled waters is being, or likely to be, caused, the Local Authority should be satisfied that a substance is continuing to enter controlled waters, or is likely to enter controlled waters. For this purpose, the local authority should regard something as being likely when they judge it more likely than not to occur'

'Land should not be designated as contaminated land where:

a) A substance is already present in controlled waters:
b) Entry into controlled waters of that substance from the land has ceased, and
c) It is not likely that further entry will take place.

Substances should be regarded as having entered controlled waters where:

a) They are dissolved or suspended in those waters; or
b) If they are immiscible with water, they have direct contact with those waters, or beneath the surface of the waters'

8.1.5.3 Controlled waters are defined in statute to be:

'territorial waters which extend seawards for 3 miles, coastal waters, inland freshwaters, that is to say, the waters in any relevant lake or pond or of so much of any relevant river or watercourse as is above the freshwater limit, and groundwaters, that is to say, any waters contained in underground strata.'

8.1.6 Further information

8.1.6.1 The above provides a brief outline as regards current statute and planning controls. Further information can be obtained from the Department for the Environment, Food and Rural Affairs (DEFRA) and their Web site www.defra.gov.uk.

8.2 Objectives and procedures

8.2.1 Objectives

8.2.1.1 This report section discusses investigations carried out with respect to chemical contamination issues relating to the site. As stated in Section 2.4.2, the investigation process followed the principles of BS10175: 2011 *'Investigation of potentially contaminated sites – Code of Practice',* with the investigation combining a desk study (preliminary investigation) together with the exploratory and main investigations (refer BS10175: 2011 for an explanation).

8.2.1.2 This section of the report produces *'Conceptual models'* based on investigatory data obtained to date. The conceptual model is constructed by identification of *contaminants* and establishment of feasible *pathways* and *receptors.* The conceptual model allows a *risk assessment* to be derived. Depending upon the outcome of the risk assessment it may be necessary to carry out remediation and/or further investigations with a view to eliminating, reducing or refining the risk of harm being caused to identified receptors. If appropriate, our report will provide recommendations in this respect.

8.2.1.3 We must consider the current pre-development condition, establishing risks which may require action to render the site safe to all relevant (current) receptors meeting the requirements of current legislation (Part IIA of the Environmental Protection Act 1990).

8.2.1.4 Definition of terms used in the preceding paragraph and subsequent parts of this section of the report are presented in Appendix B.

8.2.2 Procedure to assess risks of chemical contamination

8.2.2.1 For the purposes of presenting this section of this report, we have adopted the following sequence in assessing risks associated with chemical contamination.

Table outlining sequence to assess risk associated with chemical contamination

Conceptual model element	Contributory information	Outcome
Receptor	Development categorisation	Identification of receptors at risk of being harmed Method of analysing test data Criteria for risk assessment modelling
Pathways	Geology and ground conditions Development proposals	Identification of critical pathways from source to receptor
Source	Previous site history Desk study information Site reconnaissance Fieldwork observations	Testing regime Identification of a chemical source Analysis of test data and other evidence

Table 8.2.2

8.2.2.2 We have adopted, in general, the procedures described in CIRIA C552 *'Contaminated land risk assessment - a guide to good practice'* in deriving a risk assessment. Initially we have carried out a 'phase 1 assessment' based on desk study information and site reconnaissance, to produce an initial conceptual model and thus a preliminary risk assessment. This model / assessment is then used to target fieldwork activities and laboratory testing, with the results of this part of the investigation used to allow a phase 2 assessment to be produced by updating the conceptual model and refining the risk assessment.

8.3 Development characterisation and identified receptors

8.3.1 Site characterisation

8.3.1.1 As outlined in Section 2, the client has opted to exclude development of the former landfill area of the site, referred to as Zone 1. As a consequence, plot layouts and proposed reprofiling of the site have been amended to optimise more developable areas of the site (Zones 2-4). Following receipt of updated layout plans, we have refined the below assessment based on development not being undertaken within Zone 1. Should this change, then this assessment should be revisited.

8.3.1.2 The nature of the site has a significant influence on the likely exposure pathways between potentially contaminated soils and potential receptors. The following table summarises elements which characterise the site based on site observations and desk study information.

Summary of site characteristics		
Element	**Source / criteria**	**Characteristic**
Current land use	Observations	Publicly accessible land, playing fields with children's play area, agricultural land and part of a golf course.
Future land use	Advice	Residential development which includes domestic gardens, and access roads
Site history	Desk study	Agricultural land (zones 3 and 4) railway land (zone 1 and 2) including an engine shed, coal hopper, recorded and unrecorded refuse tips (zone 1 and 2), infilled pond (zone 4).
Geology	Desk study	Less than 5m thickness of Alluvium (confined to area of brook), with Bowland Shale Formation to western and central parts of site (>20m thick), Eyam Limestone Formation to central and eastern parts of the site (<20m thick) and Bee Low Limestone Formation to east (>70m).
	Site investigation	Substantial Made Ground located within Zones 1 and 2 (some natural Bowland Shale Formation observed at depth in latter area), with Topsoil over weathered Eyam Limestone and Bowland Shale Formation to Zone 3, and Made Ground consistent with Zones 1 & 2 located in Zone 4 with some weathered Bee Low Limestone Formation (reworked locally).
Ground water	Aquifer potential	Principal aquifers within Eyam and Bee Low Limestone Formations. Secondary A Aquifer within Bowland shale Formation.
	Abstractions	4 active groundwater abstraction points within 2000m. Closest 672m to the southwest.
	Source protection zone	Site not within a source protection zone
Surface waters	Location	Nuns Brook present onsite flowing north-south between Zones 1/2 and 3. Culverted across the northern part.
	Abstractions	5 active surface water abstraction points within 2000m. Closest 569m to the southwest.

Table 8.3.1

8.3.2 Identified receptors

8.3.2.1 The principal receptors subject to harm caused by any contamination of the proposed development site are as follows.

Principle Receptor	Detail
Humans	Users of the current site
	End user of the developed site
	Construction operatives and other site investigators
Vegetation	Plants and trees, both before and after development
Controlled waters	Surface waters (Rivers, streams, ponds and above ground reservoirs)
	Ground waters (used for abstraction or feeding rivers / streams etc)
Building materials	Materials in contact with the ground

Table 8.3.2

This section of the report assesses those receptors listed above. Section 10 provides a risk assessment in relation to building materials.

8.3.3 Human receptors

8.3.3.1 The Contaminated Land Exposure Assessment (CLEA) model can be used to derive guideline values, against which land quality data can be compared to allow an assessment of the likely impacts of soil contamination on humans. The parameters used within the model can be chosen to allow guideline values to be derived for a variety of land uses and exposure pathways. For example, a construction worker is likely to be exposed in different ways and for different durations than an adult in a residential setting.

8.3.3.2 As the current site is largely accessible to the general public the critical site user (receptor) is considered to be a child under the age of 6 years. Following completion of the residential development in Zones 2 to 4, the critical site user (receptor) is again considered to be a child under the age of 6 years. This criterion has been used in the conceptual model for the current and future site use. Our assessment also considers construction operatives as adult receptors.

8.3.4 Vegetation receptors

8.3.4.1 Soil contaminants can have an adverse effect on plants if they are present at sufficient concentrations. The effects of phytotoxic contaminants include growth inhibition, interference with natural processes within the plant and nutrient deficiencies.

8.3.4.2 Mature and semi-mature trees are present on site and will remain so following development to some extent, with the addition of garden areas. Therefore, vegetation is considered as a viable receptor in both current and future land use.

8.3.5 Water receptors

8.3.5.1 The site lies in an area designated as a principal aquifer contained in the Eyam Limestone Formation and Bee Low Limestone Formation, as well as a secondary A aquifer within the Bowland Shale Formation. The channel of Nun Brook is present onsite, flowing north-south between Zones 1/2 and 3, culverted in the northern part of site. Based on such, both surface water and groundwater are considered to be viable receptors.

8.3.5 Summary of identified receptors

8.3.5.1 Based on the above assessments, the following table summarises identified and critical receptors.

Table summarising identified (viable) receptors				
Principle Receptor	**Detail**	**Viable and critical receptors**		
		Viability and justification		**Critical receptor**
Humans	Users of the current site (Zones 2-4 only)	Yes	Site accessible to public including children	Child
	End user of the developed site (Zones 2-4 only)		Residential development	
	Construction operatives and other site investigators			Adult
Vegetation	Current site		Trees on site	Vegetation
	Developed site		Trees to remain	
Controlled waters	Surface waters (Rivers, streams, ponds and above ground reservoirs)		Nun Brook onsite	Surface waters
	Ground waters (used for abstraction or feeding rivers / streams etc)		Site over principal aquifers	Groundwater
Building materials	Materials in contact with the ground		Assessed in report section 10	Building materials
Table 8.3.5				

8.4 Identification of pathways

8.4.1 Pathways to human receptors

8.4.1.1 Guidance published by the Environment Agency in Science Report SC050021/SR3 *'Updated technical background to the CLEA model'* provides a detailed assessment of pathways and assessment and human exposure rates to source contaminants. In summary, there are three principal pathway groups for a human receptor:

Table summarising likely pathways	
Principal pathways	**Detail**
Ingestion through the mouth	Ingestion of air-borne dusts
	Ingestion of soil
	Ingestion of soil attached to vegetables
	Ingestion of home grown vegetables
Inhalation through the nose and mouth.	Inhalation of air-borne dusts
	Inhalation of vapours
Absorption through the skin.	Dermal contact with dust
	Dermal contact with soil
Table 8.4	

8.4.1.2 The site is currently used as agricultural/grazing land and publicly accessible areas. All the above pathways are present on site with the exception those related to consumption of vegetables for current users. Such pathways will also be considered for construction operatives.

8.4.1.3 Zone 2, 3 and 4 are to be developed for residential end use with gardens. Therefore, all of the above pathways will be viable for end users of the site.

8.4.1.4 A summary of our pathway assessment is presented in Section 8.4.4.

8.4.2 Pathways to vegetation

8.4.2.1 Guidance published by the Environment Agency in Science Report SC050021/SR (Evaluation of models for predicting plant uptake of chemicals from soil) provides a detailed assessment of plant uptake pathways. In summary, plants are exposed to contaminants in soils by the following pathways:

- Passive and active uptake by roots.
- Gaseous and particulate deposition to above ground shoots.
- Direct contact between soils and plant tissue.

8.4.2.2 All of the above routes of exposure are considered to be present for vegetation.

8.4.3 Pathways to controlled waters

8.4.3.1 A number of pathways exist for the transport of soil contamination to controlled waters. A summary of these pathways is presented below:

- Percolation of water through contaminated soils.
- Near-surface water run-off through contaminated soils.
- Saturation of contaminated soils by flood waters.

8.4.3.2 All of the above pathways are considered to be present to controlled waters, however saturation of contaminated soils by flood waters is likely to be extremely limited and confined to the channel of Nun Brook to the far south of the site. Therefore, we have assumed such a pathway would have a negligible impact on the site at present.

8.4.4 Summary of identified likely pathways

8.4.4.1 Based on the above assessments, the following table summarises likely pathways of potential chemical contaminants at the site to identified receptors.

Table of likely pathways		
Receptor group	**Critical receptor**	**Pathway**
Current and proposed site users	Child	Ingestion air-borne dusts
		Ingestion of soil
		Inhalation air-borne dusts
		Inhalation of vapours
		Dermal contact with dust
		Dermal contact with soil
Construction Operatives	Adult	Ingestion air-borne dusts
		Ingestion of soil.
		Inhalation air-borne dusts
		Inhalation of vapours
		Dermal contact with dust
		Dermal contact with soil
Proposed site users	Child	Ingestion of home grown vegetables
		Ingestion of soil attached to vegetables
Vegetation		Root uptake, deposition to shoots and foliage contact.
Controlled waters	Groundwater	Percolation of water through contaminated soils
	Surface water	Near-surface water run-off through contaminated soils

Table 8.4.4

8.5 Assessment of sources of chemical contamination

8.5.1 Introduction

8.5.1.1 Initially, potential sources of contamination are assessed using the following elements of the investigation process.

- History of the site
- Desk study information
- Site reconnaissance
- Geology
- Fieldwork

These elements will dictate a relevant soil/water testing regime to quantify possible risks of any identified contaminative sources which may harm identified receptors.

8.5.2 Source assessment – History of the site

8.5.2.1 The history of the site and its immediate surroundings based on published Ordnance Survey maps is described in Section 3.

8.5.2.2 Based on published historical maps, the area of Zone 2 to the west/southwest was occupied by railway sidings with associated engine shed, turntable, coal hopper and localised tanks between 1898 and 1974. A refuse tip was present in the area of Zone 1 to the northwest between 1966 and 1989. Additionally, a mere (large pond) was present in Zone 4 to the east of the site between 1879 and 1967.

8.5.2.3 The former railway land site usage associated to the railway is included in *'Industry profiles' Railway land;* published by the department of the Environment, which provides an indication of the type of chemical contaminants likely to be used by the industry. In addition, the landfill area to the northwest is included in *'Industry profiles' Waste recycling, treatment and disposal sites.* Clearly, the possibility of potential soil contamination from this former land use would be dependent upon the management of the potential contaminants within this former industry. Contaminants of concern are listed in table 8.5.2.6 below. At this stage we have assumed there is a risk of each of the potential contaminants impacting soils at the site, and thus there is a potential (and thus a risk) of this chemical source causing harm to site receptors.

8.5.2.4 Some areas of the site formed agricultural land and allotments historically, and may have been utilised for growing crops and thus likely to have been subject to the use of pesticides/herbicides. It is considered unlikely that significant concentrations of such chemicals will have been utilised in recent years in accordance with DEFRA standards for growing crops. Considering the components of pesticide, organics are unlikely to persist in the environment however metals are present in pesticides which can persist in the environment and thus could remain present in soils. Such metals include arsenic, copper, chromium, lead, zinc and vanadium. These metals form part of our suite of laboratory tests for which concentrations are measured in soil samples.

8.5.2.5 A small number of historical surrounding land uses (other than the landfill site to Zone 1) may also have the potential to generate sources of contamination which could impact the subject site. These would include similar land uses to those identified onsite already, in addition to works and depots. Such contaminants are similar to those already identified, thus, to save repetition, we have not specifically included as a source.

8.5.2.6 Clearly, the possibility of potential soil contamination from these land uses would be dependent upon the management of the potential contaminants within the business. An assessment of the likelihood of this land use impacting the site is summarised in the table below: -

Table summarising results of source assessment

Historical/ current activity	Contaminant(s)	Source assessment	Probability of source	Testing required?
On site				
Railway land	Metals, PAHs, TPHs, acids and alkalis, asbestos	Railway land recorded in area of Zone 2.	Likely	Yes
Infilled pond	Metals, Organics, PAH, TPH, asbestos	Pond infilled to east in Zone 4.	Likely	Yes
Agricultural land and allotments	Metals	Particularly area of Zone 3 and 4.	Likely	Yes
Adjacent sites				
Hogshaw Landfill	Metals, Organics, PAH, TPH, asbestos	Former landfill to northwest in Zone 1.	Likely	Yes

Table reference 8.5.2.6

8.5.3 Source assessment – Desk study information

8.5.3.1 Envirocheck presents a detailed database of environmental information in relation to the site including;

- Pollution incidents
- Landfill sites
- Trading activities

8.5.3.2 Based on the Envirocheck data (refer Appendix M) area of land forming Zone 1 has been subject to landfilling activities. Records indicate that it was licenced for receipt of inert, industrial and commercial waste. Furthermore, the Local Authority planning portal of High Peak Borough Council, records a refuse tip in the area of the existing recreation ground to the southwest of the site (Zone 2). The extent of the tip is not recorded. In addition to this a number of quarries were noted on historical mapping which may pose a source of contamination if infilled. Envirocheck also record an area of infilled land to the east (Zone 4), associated with the backfilling of Russia Mere. The above are likely to represent sources of contamination worthy of further consideration.

8.5.3.3 The nearest incident is recorded 189m to the south of site, associated with release of oils/diesel into Hogshaw Brook, dated in February 1998. The closest significant incident is recorded 316m to the south, associated with release of unknown organic wastes into Hogshaw Brook, dated April 1997. Given these incidents are located downstream from site, they are not likely to represent sources of contamination worthy of further consideration.

8.5.3.4 Nine active trade directory entries are recorded within 500m of the site, the closest of which is recorded 13m to the northeast, classified as Garage Services at Nunsfield Farm (Buxton 4x4). The closest inactive entry is located 5m to the northeast, associated with an Agricultural Merchants at Nunsfield Farm. The garage use may provide a source of localised contamination which could affect the subject site and is worthy of further consideration.

8.5.4 Source assessment – Site reconnaissance

8.5.4.1 A full description of the site and observed adjacent land uses is provided in Section 3 of this report. A plan summarising observations made on site during our site reconnaissance visit is presented on Drawing 02.

8.5.4.2 Localised areas of fly tipping were observed in Zone 2, and garages were present in the central and southern parts of this area, which may pose a localised source of contamination, including solvents, metals, PAHs, TPHs and asbestos.

8.5.5 Source assessment – Geology

8.5.5.1 The geological map of the area indicates the topography local to the site is formed in deposits of Bowland Shale Formation, Eyam Limestone Formation and Bee Low Limestone Formation. Typically, and in our experience, such deposits do not exhibit any abnormal concentrations of naturally occurring chemical contaminants.

8.5.6 Source assessment - Fieldwork observations

8.5.6.1 During excavation of exploratory locations within western parts of the site (Zone 2), we observed significant quantities of anthropogenic material, generally consistent with localised landfilling activities, and associated with the former railway land. Specifically, these included, slag, ash and general commercial wastes (textiles, paper etc). Similar materials were encountered locally in the eastern part of site (Zone 4), likely associated with infilling of the Mere and localised earthworks adjacent to the graveyard.

8.5.6.2 It should be noted that localised investigations undertaken in the Zone 1 landfill area identified significant quantities of anthropogenic material, consistent with landfilling activities. Specifically, these included potential asbestos containing materials (ACMs), significant quantities of biodegradable matter and general commercial wastes (textiles, paper etc).

8.5.6.3 In addition, a hydrocarbon odour was observed in Made Ground soils encountered between depths of 1.9-3.4m in trial pit TP05 (Zone 1 landfill area).

8.5.6.4 We obtained samples of the potentially chemically impacted soils for subsequent laboratory testing.

8.5.7 Source assessment - summary

8.5.7.1 Based on the paragraphs above, we have identified the following potential sources of contamination:

Table summarising results of source assessment				
Source	**Origin of information**	**Possible contaminant**	**Probability of risk occurring**	**Likely extent of contamination**
On site				
Railway Land	Desk Study and site investigations	Metals, PAHs, TPHs, acids and alkalis, asbestos	Likely	Western part of site (Zone 2)
Infilled Pond				Eastern part of site (Zone 4)
Agricultural land and allotments		Metals		Particularly area of Zones 3 and 4
Fly tipping and garages	Site reconnaissance	Solvents, metals, PAHs, TPHs and asbestos	Possible	Central and south parts of site (Zone 2)
Localised landfill type materials and TPH contamination	Fieldworks	Metals, Organics, PAH, TPH, asbestos	Likely	Zones 2, 4 and local to TP05 (TPH)
Adjacent sites				
Garage services	Site reconnaissance	Metals, PAHs, TPH, asbestos	Possible	Eastern part of site (Zone 3 and 4)
Former quarries	Desk Study		Low Likelihood	Site wide
Hogshaw Landfill/ Hogshaw Tip	Desk Study and site investigations	Metals, Organics, PAH, TPH, asbestos	Possible	Western parts of Zone 3 and northern parts of Zone 2
Table reference 8.5.7				

8.6 Initial Conceptual Model

8.6.1 Based on our assessment of potential contaminative sources, identified receptors and viable pathways to receptors described in preceding paragraphs, we have produced an initial conceptual model in the form of a table which is presented in Appendix J.

8.6.2 Based on the conceptual model there are risks which exceed the low category which in our opinion are unacceptable and require either remedial action, or further investigation by laboratory testing of soil / water samples to refine the risk assessment.

8.7 Laboratory testing

8.7.1 Testing regime

8.7.1.1 Based on our source assessment (and our initial conceptual model) we have evidence to suggest that significant sources of specific contamination are potentially present onsite and on immediately adjacent sites. In order to carry out a quantitative, we have scheduled testing to measure the concentration of commonly occurring inorganic and organic contaminants, in addition to specific contaminants where necessary based on the locations of identified sources.

8.7.1.2 As outlined in paragraph 8.3.1.1, we have refined the following assessments based on development not being undertaken within Zone 1. We have presented the testing that was originally scheduled on soils taken from exploratory investigations within Zone 1 in the following table for completeness, however, such results have been omitted from subsequent interpretive analysis.

8.7.1.3 The following table summarises the chemical testing scheduled as well as a rationale for the testing: -

Table summarising scheduled testing

Exploratory point	Depth (m)	Strata/ medium	Targeted sampling?	Scheduled testing	Rationale
TP01	0.3	Gravel	N		General site coverage
TP02	0.3	Sand	N		
TP03	0.2	Topsoil	N		
TP04	0.2	Topsoil	N		
TP05*	0.8	Made Ground - Sand	Y		Historical landfill area
TP06	0.3	Topsoil	N		General site coverage
TP10	0.8	Made Ground - Sand	Y		Former railway land
TP11	0.3	Topsoil	N		General site coverage
DTS01*	0.5	Made Ground - Clay	Y		Historical landfill area
DTS01*	0.8	Made Ground - Clay	Y		
DTS02	0.3	Topsoil	N		General site coverage
DTS03	0.3	Topsoil	N	Suite 1	
DTS04*	0.5	Made Ground - Clay	Y		Historical landfill area
DTS06	0.3	Topsoil	N		General site coverage
DTS07	0.3	Topsoil	N		
DTS09	0.3	Topsoil	N		
DTS12	0.3	Topsoil	Y		Next to agricultural supplier yard
DTS15	0.3	Topsoil	N		General site coverage
DTS18	0.3	Topsoil	N		
DTS20	0.5	Made Ground - Sand	Y		Next to garage
DTS20	0.8	Made Ground - Sand	Y		
DTS23	0.8	Made Ground - Sand	Y		General site coverage
DTS28	0.8	Clay	N		
TP05*	0.8	Made Ground - Sand	N		General site coverage
TP07	0.5	Made Ground - Gravel	Y		Potential ACM contamination
TP09	0.5	Made Ground - Gravel	N		General site coverage
TP18*	0.8	Made Ground - Sand	Y		Potential ACM material
TP18*	1.2	Made Ground - Sand	Y		
TP18*	1.4	Made Ground - Sand	Y	Asbestos screening	
TP18*	1.6	Made Ground - Sand	Y		
DTS13	0.8	Made Ground - Sand	N		General site coverage
DTS16	0.8	Made Ground - Gravel	N		
DTS20	0.8	Made Ground – Sand	Y		Potential ACM contamination
DTS21	0.5	Made Ground - Sand	N		General site coverage
DTS22	1.2	Made Ground - Sand	N		
DTS26	0.8	Made Ground - Clay	N		
DTS28	0.8	Clay	N		
DTS29	1.2	Made Ground - Sand	N		
TP03	0.5	Gravel	N		General site coverage
TP16	0.5	Made Ground - Gravel	N		
TP18*	0.5	Made Ground - Sand	N		
TP20	0.5	Made Ground - Sand	N	Suite 8	
DTS02	0.5	Sand	N		
DTS07	0.8	Clay	N		
DTS19	0.5	Made Ground - Sand	N		

DTS19	1.2	Gravel	N		
DTS21	1.8	Made Ground - Clay	N		
DTS22	1.8	Clay	N		
TP05*	2.5	Made Ground - Sand	Y	Suite 2	Hydrocarbon odour noted
TP07	0.8	Made Ground - Gravel	Y		Garages with asbestos noted
TP05*	1.2	Made Ground – Sand	Y		Historical Landfill
TP05*	1.8	Made Ground – Sand	Y		
TP08	0.8	Made Ground – Sand	Y		Potentially infilled pond
TP08	1.2	Made Ground – Sand	Y		
TP09	0.8	Clay	N		General site coverage
TP20	1.2	Made Ground – Clay	Y	Suite 17	Next to garage
DTS04*	0.8	Made Ground – Gravel	Y		Historical landfill area
DTS09	0.5	Clay	N		Next to agricultural supplier yard
DTS16	0.8	Made Ground - Gravel	N		General site coverage
DTS20	1.2	Made Ground - Sand	Y		Landfill material encountered
DTS25	0.5	Made Ground - Sand	Y		
Nuns Brook Upstream1	Surface	Water	Y		Nuns Brook immediately upstream of site
Nuns Brook Downstream1	Surface	Water	Y	Suite 17 – Water	Nuns Brook immediately downstream of site
DTS19	3.2	Water	Y		Groundwater onsite

Table 8.7.1.2

Refer to Appendix B for testing suite descriptions
*Exploratory points located within former landfill area (Zone 1), excluded from subsequent interpretative analysis.

8.7.1.4 Obviously, additional testing (quantity and types) would allow a more accurate risk assessment to be made. The results of laboratory determination of the concentrations of chemical contaminants are presented in Appendix H.

8.7.2 Criteria for assessment of test data – Human receptors

8.7.2.1 Assessment of laboratory test data has been carried out with reference to current nationally recognised documents listed in the final page of Appendix B. Due to changes in guidance on contaminated land, items 6-8 and item 10 in the document listing above have been withdrawn. In the absence of alternative guidance however we have used these documents. Where new guidance is available, this has been followed in preference to superseded guidance.

8.7.2.2 The Land Quality Management (LQM) and the Chartered Institute of Environmental Health (CIEH) have derived Suitable for Use Levels (S4ULs) which are presented in *'The LQM/CIEH S4ULs for Human Health Risk Assessment'* (2015). S4ULs have been used as a screening tool to assess the risks posed to the health of humans from exposure to soil contamination in relation to appropriate land uses. Where published S4ULs are not available, we have adopted C4SLs (Category 4 Screening Levels) produced by DEFRA or SGVs (Soil Guideline Values) as appropriate. Where available, we have adopted the upper bound C4SL value. In the absence of any of these criteria we have adopted Soil Screening Values (SSV) derived by Soiltechnics and by Atkins (SSV^{ATK}). The CLEA model used to derive SSVs has been used with toxicology data presented by the EA, LQM/CIEH and Atkins (in that order of preference). SSVs produced by Atkins are presented on their $ATRISK^{SOIL}$ website.

8.7.2.3 S4ULs, C4SLs, SGVs, SSVs and SSV^{ATK}s represent 'intervention values'; indications to an assessor that soil concentrations above these levels might present an unacceptable risk to the health of site users. These guideline values have been produced using conceptual exposure models, which use assumptions and are applied to differing end uses of land. If the values are exceeded, it does not necessarily imply there is an actual risk to health and site-specific circumstances should be taken into account. Conversely, where a critical pathway or chemical form of the contaminant has not been evaluated, a risk may be present even if the adopted guideline value has not been exceeded.

8.7.2.4 For evaluation of test data in relation to polycyclic aromatic hydrocarbon (PAH), phenols and total petroleum hydrocarbon (TPH) contamination, we have compared measured concentrations with corresponding S4ULs. The S4UL fractions are dependent on the Soil Organic Matter (SOM) content of the soils. We have adopted the relevant guideline values based on SOM testing.

8.7.2.5 We have followed procedures outlined by the CIEH to compare measured concentrations of metals and PAH contaminants against guideline values. TPH contamination results are compared directly with the relevant guideline values. The guidance presents an approach to data analysis and includes the examination of data for potential outliers, assessment of the normality of the test data and the calculation of a 95% Upper Confidence Limit (UCL). The UCL provides an estimate of the population mean, based on test data, with a 95% confidence that the actual mean does not exceed this value. The UCL is compared to the guideline value for the site.

8.7.2.6 We have adopted a public open space (POS park) land use for current site users and a residential land use for proposed end users of the site.

8.7.3 Criteria for assessment of test data – Construction operatives

8.7.3.1 In the absence of guidelines we have adopted industrial/commercial guideline values for assessment of construction operatives.

8.7.4 Criteria for assessment of test data – Vegetation

8.7.4.1 Guidance published by Forest Research in "*BPG Note 5 - Best Practice Guidance for Land Regeneration*" suggests that a residential without plant uptake or industrial/commercial CLEA model should be adopted for this receptor. Specific guideline values are provided for copper and zinc at 130mg/kg and 300mg/kg respectively within BPG 5, however, this document has recently been withdrawn. As a practice we have adopted the industrial / commercial CLEA model for assessment of test data for vegetation, including those specific values outlined in BPG 5 until updated guidance is published.

8.7.4.2 It is difficult to quantify the phytotoxity of a contaminant as large variations exist between plant tolerances, soil effects and synergistic/antagonistic reactions between chemicals. Due to the complexities of the effects of soil contamination on different plant species, we recommend that the test results presented in this report are passed to a landscape architect for the selection of suitable planting.

8.7.5 Criteria for assessment of test data – Controlled waters

8.7.5.1 For interpretation of test data in relation to water receptors we have directly compared measured values with the Drinking Water Standards (DWS) as presented in *"The Water Framework Directive (Standards and Classification) Directions (England and Wales)* 2015*"*. Where DWS are not available we have adopted EQS values where applicable.

8.7.5.2 For assessment of TPH concentrations, we have adopted World Health Organisation (WHO) Drinking Water Guidelines as presented in CL:AIRE guidance *"Petroleum Hydrocarbons in Groundwater"*, 2017.

8.7.5.3 Following our receptor assessment (outlined in Section 8.3.5 above), given that Nun Brook flows through site, we have adopted EQS values in preference to UKDWS. It is acknowledged that the site is underlain by Principal Aquifers in the limestones, however given the relative position of the brook onsite, in comparison to groundwater abstractions (closest 672m southwest), we have considered the brook to be at greater risk of being adversely impacted by any contamination onsite.

8.7.6 Evaluation of test data – Human receptors

8.7.6.1 Tables summarising and analysing test data are presented in Appendix I. The following table summarises the outcome of the analyses. It should be noted that we have assessed measured concentrations in Topsoil separate to those measured in Made Ground deposits across the site, given their distinct compositional difference.

Table Summarising assessment of test data for Human receptors

Analysis tables	Receptor group	Critical receptor	CLEA model	Inorganic contaminants	Organic contaminants
1, 2, 9, 10 and 15	Current site users	Child	Public open space (park)	Refer to Section 8.7.6.2 below	Refer to Section 8.7.6.2 below
3, 4, 11, 12 and 16	Future site users	Child	Residential with plant uptake	Refer to Section 8.7.6.3 below	Refer to Section 8.7.6.3 below
5, 6, 13, 14 and 17	Construction operatives	Adult	Industrial / commercial	Refer to Section 8.7.6.4 below	Refer to Section 8.7.6.4 below

Table 8.7.6.1

8.7.6.2 Current site users

8.7.6.2.1 With reference to tables 1, 2, 9, 10 and 15 in Appendix I, analysis of chemical test data with respect to critical (child) receptors for current site uses, indicates all measured concentrations of selected contaminants and 95th percentile upper confidence limits (UCL) are below relevant adopted guideline values, with the exception of lead and dibenzo(a,h)anthracene in two samples, and benzo(a)pyrene and benzo(b) fluoranthene in one sample, all measured in Made Ground deposits (total of 10 No. samples tested).

8.7.6.2.2 Lead was measured at concentrations of 2700mg/kg (DTS20 0.5m) and 7400mg/kg (DTS23 0.8m) exceeding the C4SL (u) of 1400mg/kg. The UCL of 4482.7mg/kg for lead also exceeds the guideline value. Dibenzo(a,h)anthracene was measured at concentrations of 3.4mg/kg and 4.8mg/kg, exceeding the S4UL of 1.3mg/kg. The UCL of 3.3mg/kg for dibenzo(a,h)anthracene also exceeds the guideline value. The elevated concentrations of benzo(a)pyrene and benzo(b)fluoranthene were measured at 15mg/kg and 18mg/kg, exceeding the respective S4ULs of 12mg/kg and 15mg/kg), both located within TP10 at 0.8m depth. Such contamination was present in Zones 2 and 4.

8.7.6.2.3 Analysis indicates that concentrations of contaminants measured in all Topsoil and naturally deposited soils (17 No. samples) fall below relevant guidelines for current users.

8.7.6.3 Future site users

8.7.6.3.1 With reference to tables 3, 4, 11, 12 and 16 in Appendix I, analysis of chemical test data with respect to critical (child) receptors for future site uses, indicates all measured concentrations of selected contaminants and 95 percentile upper confidence limits (UCL) are below relevant adopted guideline values, with the exception of arsenic, beryllium, lead and nickel in a small number of Topsoil/natural soil samples, and arsenic, beryllium, lead, mercury, benzo(a) anthracene, benzo(a)pyrene, benzo(b)fluoranthene and dibenzo(a)anthracene in a large number of Made Ground samples.

8.7.6.3.2 Four elevated concentrations of arsenic have been measured in Topsoil/natural soils, recorded between 49mg/kg and 65mg/kg (S4UL of 37mg/kg), with five elevated concentrations of beryllium recorded ranging between 1.8mg/kg to 2.5mg/kg (S4UL of 1.7mg/kg), three elevated concentrations of lead ranging between 250mg/kg and 320mg/kg (C4SL (u) of 210mg/kg) and a single elevated concentration of nickel measured at 200mg/kg (S4UL of 180mg/kg). Such contamination was locally present in Topsoil/natural soils within Zones 3 and 4.

8.7.6.3.3 Within Made Ground samples, the following exceedances have been identified: -

- Arsenic within 9 of 10 samples, with exceedances measured at concentrations ranging between 47mg/kg and 160mg/kg. The mean value of 84.3mg/kg and UCL of 109.6mg/kg also exceed the guideline value (S4UL of 37mg/kg). Samples are located within Zones 2 and 4.
- Beryllium within 8 of 10 samples, with exceedances measured at concentrations ranging between 3.6mg/kg and 9.6mg/kg. The mean value of 5.3mg/kg and UCL of 7.2mg/kg also exceed the guideline value (S4UL of 1.4mg/kg). Samples are located within Zones 2 and 4.
- Lead within 7 of 10 samples, with exceedances measured at concentrations ranging between 420mg/kg and 7400mg/kg. The mean value of 1357.4mg/kg and UCL of 4482.7mg/kg also exceed the guideline value (C4SL(u) of 210mg/kg). Samples are located within Zones 2 and 4.

- Mercury within 1 of 10 samples, with an exceedance measured at a concentration of 1.6mg/kg (DTS23 0.8m) within Zone 2, exceeding the S4UL of 1.2mg/kg. The mean value of 1.3mg/kg also exceeds the guideline value.
- Benzo(a)anthracene within 1 of 10 samples, with an exceedance measured at a concentration of 12mg/kg, (TP10 0.8m) within Zone 2, exceeding the S4UL of 11mg/kg.
- Benzo(a)pyrene within 3 of 10 samples, with exceedances measured at concentrations ranging between 3.1mg/kg and 15mg/kg, exceeding the S4UL of 2.7mg/kg. The UCL of 9.0mg/kg also exceeds the guideline value. Samples are located within Zones 2 and 4.
- Benzo(b)fluoranthene within 3 of 10 samples, with exceedances measured at concentrations ranging between 3.6mg/kg and 18mg/kg, exceeding the S4UL of 3.3mg/kg. The UCL of 11.0mg/kg also exceeds the guideline value. Samples are located within Zones 2 and 4.
- Dibenzo(a,h)anthracene within 3 of 10 samples, with exceedances measured at concentrations ranging between 1.1mg/kg and 4.8mg/kg, exceeding the S4UL of 0.28mg/kg. The mean value of 1.0mg/kg and UCL of 3.3mg/kg also exceed the guideline value. Samples are located within Zones 2 and 4.

8.7.6.4 *Construction operatives*

8.7.6.4.1 With reference to tables 5, 6, 13, 14 and 17 in Appendix I, analysis of chemical test data with respect to construction operatives (adult receptors), indicates all measured concentrations of selected contaminants and 95 percentile upper confidence limits (UCL) are below relevant adopted guideline values, with the exception of one concentration of both lead and dibenzo(a,h)anthracene in Made Ground deposits.

8.7.6.4.2 Elevated lead was measured at a concentration of 7400mg/kg (DTS23 0.8m) exceeding the C4SL (u) of 6000mg/kg, with dibenzo(a)anthracene measured at a concentration 4.8mg/kg (TP08 1.2m), exceeding the S4UL of 3.6mg/kg, Such contamination was present in Zone 4.

8.7.6.4.3 Analysis indicates that concentrations of contaminants measured in all Topsoil and naturally deposited soils (17 No. samples) fall below relevant guidelines for construction operatives.

8.7.6.5 *Asbestos*

8.7.6.5.1 Asbestos screening was carried out in 9 samples of Made Ground and 1 sample of natural soil. Analysis indicates that asbestos is present in 3 of the 14 samples of Made Ground tested (DTS13, DTS20 and DTS22 within Zones 2 and 4), described as chrysotile fibres/clumps. Where analysed, total asbestos (%) content was recorded below 0.002% w/w with the exception for DTS13 at 0.8m depth, which recorded asbestos at 53% w/w.

8.7.6.6 VOCS & SVOCs

8.7.6.6.1 In addition to the above, with the exception of PAHs, BTEX and MTBE, a number of other Volatile and Semi Volatile Organic Compounds (VOC & SVOCs) were scheduled for testing. The majority of compounds tested for indicated measured concentrations below detectable limits, however, concentrations were measured for a select number, as follows: -

Table Summarising VOC/SVOC contamination for Human receptors

Location	Depth (m)	Compound	Concentration	Guideline*
DTS25	0.5	2-Methylnaphthalene	0.17mg/kg	N/A
DTS16	0.8	Carbazole	0.087mg/kg	N/A
		Butylbenzyl Phthalate	0.074mg/kg	N/A
TP08	1.2	2-Methylnaphthalene	0.43mg/kg	N/A
		Dibenzofuran	0.32mg/kg	N/A
		Carbazole	0.56mg/kg	N/A
		Butylbenzyl Phthalate	0.094mg/kg	N/A
		Bis(2-Ethylhexyl)Phthalate	0.31mg/kg	N/A
		Di-N-Octyl Phthalate	0.067mg/kg	N/A
		4-Nitrophenol	0.31mg/kg	N/A

Table 8.7.6.6

*Guideline values presented in from Soil Generic Assessment Criteria for Human Health Risk Assessment, January 2010, produced by CL:AIRE (including EIC and AGS).

8.7.6.6.2 Based on the above, guideline values are not currently available for the measured concentrations of VOCs/SVOCs detected. Thus, we have provided further details on these in the following paragraphs. It is noted that the CL:AIRE document as outlined in Table 8.7.6.6 above indicates that the pathway exposure contributions SVOCs are predominantly associated with inhalation of vapours and background inhalation.

8.7.6.6.3 A large number of the VOCs/SVOCs for which guidelines are not currently available are commonly used in insecticides, fungicides, herbicides, pesticides, in addition to dyes, heat transfer agents, plasticisers, lubricants and fuel additives.

8.7.6.6.4 The contaminants identified above have all been measured in Made Ground deposits at the site, largely consistent with the landfill type Made Ground deposits encountered in Zone 2 and partly Zone 4. It is therefore, most likely that such contamination is indicative of the source location where the materials were imported from prior to landfilling or re-profiling works which the site has been subject to.

8.7.6.6.5 Based on the above, such contaminants are unlikely to pose a risk to human health via pathways associated with dermal contact or ingestion. The greatest risk will be associated with vapour pathways and background inhalation, as outlined above in paragraph 8.7.6.6.2. Given the relatively insignificant concentrations measured, however, and when taken in context with the GACs that are currently available for VOC/SVOC for varying land uses, it is considered unlikely that such contaminants would pose a risk to human health via vapour pathways.

8.7.7 Evaluation of test data – Vegetation

8.7.7.1 With reference to tables 7, 8, 13, 14 and 17 in Appendix I, analysis of chemical test data with respect to vegetation indicates all measured concentrations of selected contaminants and 95 percentile upper confidence limits (UCL) are below relevant adopted guideline values, with the exception of copper, and zinc in a small number of Topsoil/natural soil samples, and copper, lead, zinc and dibenzo(a,h)anthracene in a number of Made Ground samples.

8.7.7.2 Two elevated concentrations of zinc have been measured in Topsoil/natural soils, recorded at 350mg/kg and 370mg/kg (BPG 5 value of 300mg/kg), with copper elevated in one sample, measured at a concentration of 140g/kg (BPG 5 of 130mg/kg). Such contamination was locally present in Topsoil/natural soils within Zone 3.

8.7.7.3 Within Made Ground samples, the following exceedances have been identified: -

- Copper within 9 of 10 samples, with exceedances measured at concentrations ranging between 140mg/kg and 700mg/kg. The mean value of 388.4mg/kg and UCL of 754.3mg/kg also exceed the guideline value (BPG 5 value of 130mg/kg). Samples are located within Zones 2 and 4.
- Zinc within 4 of 10 samples, with exceedances measured at concentrations ranging between 440mg/kg and 1000mg/kg. The mean value of 357.1mg/kg and UCL of 756.8mg/kg also exceed the guideline value (BPG 5 value of 300mg/kg). Samples are located within Zones 2 and 4.
- Lead within one sample (DTS23 0.8m), measured at a concentration of 7400mg/kg and exceeding the S4UL of 6000mg/kg. Sample located within Zone 2.
- Dibenzo(a,h)anthracene within one sample (TP08 1.2m), measured at a concentration of 4.8mg/kg and exceeding the S4UL of 3.6mg/kg. Sample located within Zone 4.

8.7.8 Evaluation of test data – Controlled waters

8.7.8.1 Inorganic contaminants

8.7.8.1.1 With reference to Table 18 in Appendix I, none of the measured concentrations of inorganic soluble and leachable contaminants exceed the relevant guidelines with the exception for soluble copper (EQS of 1µg/l) within a groundwater sample from DTS19 at 3.2m, measured at 1.2µg/l, and a surface water sample from Nun Brook downstream of the site, measured at 1.1µg/l. In addition, a leachable concentration of copper was measured in natural soils from DTS106 0.8m, measured at 10µg/l.

8.7.8.2 Organic contaminants (polycyclic aromatic hydrocarbons)

8.7.8.2.1 With reference to Table 18 in Appendix I, none of the measured concentrations of inorganic soluble and leachable contaminants exceed the relevant available guidelines.

8.7.8.3 *Organic contaminants (total petroleum hydrocarbons)*

8.7.8.3.1 The measured values of soluble TPH contaminants fall below the relevant guideline values, with many being below the limit of detection.

8.8 Updated conceptual model

8.8.2 Current site users

8.8.2.1 Contaminants measured in existing Topsoil deposits present in Zones 3 and to some extent Zone 4 are unlikely to present a risk of causing harm to human health.

8.8.2.2 A small number of measured concentrations of contaminants (lead, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene), within Made Ground deposits in the areas of Zones 2 and 4 exceed respective guideline values. Due to the relatively high concentrations measured, the UCL for lead and dibenzo(a,h)anthracene exceed the respective C4SL (u) and S4ULs for current users.

8.8.2.3 Providing the site is developed then the risk of harm being caused to current users from identified contamination is clearly a short-term issue and unlikely to require any remediation. If development does not proceed as planned, further consideration should be given to such risks and the requirement for remediation.

8.8.3 Future site users

8.8.3.1 Elevated localised concentrations of arsenic, beryllium, lead and nickel have been measured in a small number of Topsoil/natural soil samples within Zones 3 and 4. As these areas of the site have remained 'greenfield' over the years, and not been subject to past industrial activities which could have handled such contaminants, then we are of the opinion that contamination is likely to be naturally occurring. Typically, however, a significant proportion of compounds forming naturally occurring contaminants are not toxic to humans.

8.8.3.2 The existing guideline value for beryllium is based on research into the impact of **industrial** exposure, where the inhalation exposure route poses the most significant risk to end users. Indeed, the overwhelming majority of the existing literature strongly indicates that intake of beryllium orally through dermal contact has no ill health effects on humans and there is no evidence to suggest that naturally occurring beryllium poses a risk to end users.

8.8.3.3 As Zones 3 and 4 where Topsoil is present have not been subject to past industrial activities which are likely to have handled beryllium, concentrations recorded on site are likely to be naturally occurring. The average concentration of natural beryllium in the earth's crust is approximately 2 to 5mg/kg which notably exceeds the residential guideline value of 1.7mg/kg, derived by research into industrial exposure. On site, the concentrations of beryllium within soils were recorded between 1.8mg/kg to 2.5mg/kg, which reflect natural, background concentrations. On this basis, the recorded concentrations of beryllium are not considered to present a risk to end users of the site.

8.8.3.4 Similarly, concentrations of lead were measured between 250mg/kg and 320mg/kg, exceeding the C4SL (u) of 210mg/kg. It is noted that lead concentrations in the Derbyshire and Peak District area are frequently elevated above the national average. This is due to the presence of lead mineral veins in the underlying limestones, which were also mined/quarried and smelted historically. With reference to Envirocheck data presented in Appendix M, soil geochemistry mapping indicates background concentrations of lead of up to 200mg/kg at the site, however, it is noted that concentrations across the Peak District are typically higher. On this basis, the recorded concentrations of lead in Topsoil/natural soils across Zones 3 and partly Zone 4 are not considered to present a risk to end users of the site.

8.8.3.5 Similarly, the very localised elevated arsenic and nickel is likely to be associated with localised ferruginous inclusions which can be present within the limestone. This is similar to the issues experienced in Northamptonshire with arsenic, vanadium and nickel contamination, associated with the naturally deposited Northampton Sand Formation. Again, on this basis, the recorded concentrations of arsenic and nickel (the latter very marginally exceeding the S4UL) are not considered to present a risk to end users of the site.

8.8.3.6 Based on the assessment provided in paragraphs 8.8.3.1 to 8.8.3.5 above, we consider that Topsoil/naturally deposited soils at the site are unlikely to cause significant harm to human health and can be reused within the proposed development where necessary.

8.8.3.7 With reference to paragraph 8.7.6.3.3 above, a significant number of concentrations of contaminants exceed relevant guidelines for end users within Made Ground deposits across the site, largely encountered in Zone 2, and to a lesser extent in Zone 4. Notably, arsenic, beryllium and lead and a number of PAHs have been identified. Rather than naturally occurring, based on the composition of Made Ground across the areas where elevated contaminants have been measured, and based on the considerably high concentrations recorded, it is most likely to be attributed to the presence of anthropogenic material such as slag, ash and localised landfill type materials.

8.8.3.8 Based on the above, where Made Ground is present in Zones 2 and 4 such soils are likely to cause harm to the health of end users in their current condition. Proposed buildings and hardstanding will sever the pathway to such soils, however, where landscaping/gardens/POS is proposed, remedial measures will need to be implemented to render such areas fit for purpose. Typically, this could take the form of a cover system of clean Topsoil/subsoil placed in such areas. The recommended remedial measures are summarised in Section 8.9 below.

8.8.3.9 Furthermore, we have identified asbestos in 3 of 14 samples of Made Ground soils tested. Such asbestos has been identified in Made Ground soils in Zones 2 and partly Zone 4 across the site.

8.8.3.10 If Made Ground soils are not disturbed, there is likely to be a low risk of identified ACMs or free fibres causing harm to human health, including the health of current users. If such areas are developed, which they are likely to be, there remains a risk that end users are likely to come into contact with such soils and potentially disperse fibres into the air. Whilst we have not encountered asbestos in other laboratory samples tested, we cannot say for certain that ACM would not be encountered elsewhere onsite. The proposed cover system as recommended in paragraph 8.8.3.8 will serve to sever the pathway to such ACMs and reduce potential exposure.

8.8.4 Construction operatives

8.8.4.1 Analysis indicates that concentrations of contaminants measured in all Topsoil and naturally deposited soils fall below relevant guidelines for construction operatives.

8.8.4.2 Based on Section 8.7.6.4 above, a single concentration of both lead and dibenzo(a,h) anthracene have been measured above guideline values for construction operatives out of 10 Made Ground samples across the site. Based on such, providing adequate hygiene precautions are adopted at all times, we do not consider there to be a significant possibility of significant harm being caused to the health of construction operatives at the site (see Section 8.10 below). This is with the exception of risks associated with asbestos as discussed below.

8.8.4.3 If Made Ground soils are not disturbed, there is likely to be a low risk of identified ACMs causing harm to the health of construction operatives. If such areas are developed, which they are likely to be, there remains a risk that construction operatives are likely to come into contact with such soils and potentially disperse fibres into the air. Whilst we have not encountered asbestos in other laboratory samples tested, we cannot say for certain that ACM would not be encountered elsewhere onsite.

8.8.4.4 Consequently we recommend that a suitably experienced asbestos specialist is consulted to confirm the precautions that could be taken during groundworks to minimise contact/disturbance and potential release of fibres. It would also be prudent to undertake further testing of Made Ground soils across the site to determine if asbestos is present elsewhere. We would be happy to undertake such testing on further request.

8.8.5 Vegetation

8.8.5.1 Two elevated concentrations of zinc and a single elevated concentration of copper have been measured in Topsoil/natural soils, which marginally exceed the respective guideline values (see Section 8.7.7 above). Such contamination was locally present in Topsoil/natural soils within Zone 3. In our opinion, such contamination is unlikely to present a risk of causing significant harm to vegetation.

8.8.5.2 It is difficult to quantify the phytotoxity of a contaminant as large variations exist between plant tolerances, soil effects and synergistic/antagonistic reactions between chemicals. Due to the complexities of the effects of soil contamination on different plant species, we recommend that the test results presented in this report are passed to a landscape architect for the selection of suitable planting.

8.8.5.3 With reference to paragraph 8.7.7.3 above, a significant number of concentrations of contaminants exceed relevant guidelines for vegetation within Made Ground deposits encountered in Zones 2 and 4. Notably copper, zinc, lead, dibenzo(a,h)anthracene have been identified. In our opinion, such contamination is likely to present a risk of causing significant harm to vegetation. Consequently, remedial measures will need to be implemented to render such areas fit for purpose. Typically, this could take the form of a cover system of clean Topsoil/subsoil, suitably deepened where major vegetation is likely to be present, which will provide a suitable growing medium. The recommended remedial measures are summarised in Section 8.9 below.

8.8.6 Controlled waters

8.8.6.1 With reference to 8.7.8.1, groundwater at the site local to the channel of Nun Brook exhibits very marginal elevated concentrations of soluble copper (1.2µg/l compared to a guideline of 1.0µg/l). Based on leachate testing previously undertaken within landfill type Made Ground deposits in Zone 1, such soils exhibit slightly elevated concentrations of leachable copper (10µg/l), which could be the source of copper found in groundwater adjacent to the brook.

8.8.6.2 It is also noted that concentrations of soluble contaminants in a sample from the brook taken upstream from site are all below relevant guidelines. However, a sample taken downstream of the site suggests very marginal elevated concentrations of soluble copper (1.1µg/l). The copper identified in the brook could be sourced from the marginally impacted groundwater onsite, which is likely to be providing a base flow to the brook.

8.8.6.3 Based on the above, given the marginal exceedances of soluble copper identified in groundwater and surface waters, and also based on the conservatism factored into the EQS value for copper (we have not adjusted the guideline based on hardness at the site), then we consider the risk of leachable copper previously identified within landfill material to Zone 1 adversely impacting the quality of groundwater and surface waters is low.

8.8.6.4 Having now completed analysis of laboratory testing, we can now update our conceptual model which is presented in Appendix J.

8.8.6.5 Based on the conceptual model there are risks which exceed the low category which in our opinion are unacceptable and require remedial action which is discussed below.

8.9 Remedial action

8.9.1 Based on the above we recommend the following action is taken: -

a) Provision of a capping in garden and soft landscaping areas where Made Ground is present in Zones 2 and 4, deepened in areas of major vegetation as required. Details of this remediation (in the form of a statement / specification) is provided in Section 13.

b) Adoption of adequate hygiene precautions for construction operatives.

8.9.2 In addition to the above, we recommend that a suitably experienced asbestos specialist is consulted to confirm the precautions that could be taken during groundworks to minimise contact/disturbance and potential release of asbestos fibres identified in Made Ground deposits across the site. It would also be prudent to undertake further testing of Made Ground soils across the site to determine if asbestos is present elsewhere. We would be happy to undertake such testing on further request.

8.10 Risk assessment in relation to use of infiltration systems

8.10.1 With reference to Environment Agency publication '*Groundwater protection: Policy and practice (GP3)* 2012, outside of SPZ1, the EA will support sustainable drainage systems for new discharges to ground. This is subject to an appropriate risk assessment to demonstrate that ground conditions are suitable and infiltration systems do not present an unacceptable risk of promoting mobilisation of contaminants or creating new pathways for contaminant migration.

8.10.2 The permeability of the near surface weathered Eyam Limestone, Bowland shale and Bee low Limestone Formation in combination with the site located over Secondary A (Bowland Shale) and principal aquifers (limestone deposits) suggests the site is sensitive to migration of contaminants. The site is not located within or close to a source protection zone. Providing that surface water is restricted from freely migrating though Made Ground deposits, the risk of infiltration systems promoting mobilisation of contaminants at the site is considered low. All discharges to groundwater are subject to compliance with the Water Framework Directive (2000/60/EC) and Groundwater Daughter Directive (2006/118/EC).

8.11 Risk assessment summary and recommendations

8.11.1 Based on our assessments described above, we can provide the following summary and recommendations for each identified receptor.

8.11.2 Current site users

8.11.2.1 Providing the site is developed then the risk of harm being caused to current users from identified contamination is clearly a short-term issue and unlikely to require any remediation. If development does not proceed as planned, further consideration should be given to such risks and the requirement for remediation.

8.11.3 End users

8.11.3.1 Concentrations of chemical contaminants have been measured above guideline values within Made Ground deposits across the site. In such areas, we are of the opinion that the site represents a medium to high risk of causing harm to future end users of the developed site, based on current development proposals. Providing the remedial measures as outlined in 8.9 above and Section 13 are implemented, the risk of harm being caused to the health of end users is considered to be low.

8.11.3.2 We also consider that Topsoil/naturally deposited soils at the site are unlikely to cause significant harm to human health and can be reused within the proposed development where necessary.

8.11.4 Construction operatives and other site investigators

8.11.4.1 The risk of damage to health of construction operatives and other site investigators is, in our opinion, medium to high, primarily due to the presence of asbestos in Made Ground soils. Generally, risks would be minimised by taking adequate hygiene precautions on site. Such precautions would be: -

- Wearing protective clothing particularly gloves to minimise ingestion from soil contaminated hands.
- Avoiding dust by dampening the soils during the works.
- Wearing masks if processing produces dust.

8.11.4.2 Consideration will need to be given to the presence of asbestos in Made Ground soils onsite and the additional precautions that will need to be taken during groundworks to minimise contact/disturbance and potential release of fibres.

8.11.4.3 Guidance on safe working practices can be obtained from the following documents

- The Health and Safety Executive Publication *"Protection of Workers and the General Public during the Development of Contaminated Land"* (HMSO) and
- *"A Guide to Safer Working on Contaminated Sites"* (CIRIA Report 132).

8.11.4.4 In addition, reference should be made to the Health and Safety Executive. In all cases work shall be undertaken following the requirements of the Health and Safety at Work Act 1974 and regulations made under the Act including the COSHH regulations.

8.11.5 Controlled waters

8.11.5.1 Marginal elevated concentrations of leachable copper have previously been identified in landfill Made Ground soils to Zone 1, with very marginal concentrations of soluble copper identified in groundwater onsite and surface waters downstream of site. Given the marginal exceedances of soluble copper, and based on the conservatism factored into the EQS value for copper, we consider the risk of leachable copper previously identified adversely impacting the quality of groundwater and surface waters is low.

8.11.6 Vegetation

8.11.6.1 In our opinion, marginal contamination identified in Topsoil/natural soils across the site is unlikely to present a risk of causing significant harm to vegetation.

8.11.6.2 Concentrations of contaminants exceed relevant guidelines within Made Ground deposits across the site. In our opinion, such contamination is likely to present a risk of causing significant harm to vegetation. Providing the remedial measures as outlined in 8.9 above ad Section 13 are implemented, the risk of harm being caused to the health of vegetation is considered to be low.

8.12 Final conceptual model

8.12.1 On the assumption that remedial action described above has been successfully completed, we have produced a final conceptual model which is presented in Appendix J, which shows the risks for human health have been reduced to acceptable levels and the site therefore fit for purpose.

8.13 Statement with respect to National Planning Policy Framework

8.13.1 Based on investigations completed to date with respect to chemical contamination, we are of the opinion the proposed development will be safe and suitable for use for the purpose for which it is intended (without the need for any remedial action) thus meeting the requirements of the National Planning Policy Framework section 178, and compliant with the Building Regulations Part C, '*Site preparation and resistance to contaminants and moisture'.*

8.14 On Site Monitoring

8.14.1 We have attempted to identify the potential for chemical contamination on the site, however, areas, which have not been investigated at this stage, may exhibit higher levels of contamination. If such areas are exposed at any time during construction we will be pleased to re-attend site to assess what action is required to allow the development of safely proceed.

9 Gaseous contamination

9.1	Legislative framework
9.2	General
9.3	Assessment of source of gases
9.4	Gas migration
9.5	Conceptual model
9.6	Development categorisation
9.7	Monitoring observations
9.8	Classification of site characteristic gas situation
9.9	Gas protective measures – new buildings
9.10	Flammability
9.11	Gas protective measures – construction operatives
9.12	Statement with respect to National Planning Policy Framework

9.1 Legislative framework

9.1.1 There is currently a complex mix of documentation relating to legislative and regulatory procedures on the issue of contamination and it is not considered a purpose of this report to discuss the detail of these regulations. Essentially, Government Policy is based on *'suitable for use approach',* which is relevant to both the current and proposed future use of land. For current use Part IIA of the Environmental Protection Act 1990 provides the regulatory regime (see Section 8.1 above). The presence of harmful soil gases could provide a 'source' in a 'pollutant linkage' allowing the regulator (Local Authority) to determine if there is a significant possibility of harm being caused to humans, buildings or the environment. Under such circumstances the regulator would determine the land as 'contaminated' under the provision of the Act requiring the remediation process to be implemented with the Environment Agency responsible for enforcement.

9.1.2 The Town and Country Planning (General Development Procedure) Order 1995, requires the planning authority to consult with the Environment Agency before granting planning permission for development on land within 250 metres of land which is being used for deposit of waste, (or has been at any time in the last 30 years) or has been notified to the planning authority for the purposes of that provision.

9.1.3 Building control bodies enforce compliance with the Building Regulations. Practical guidance is provided in Approved documents, one of which is Part C, '*Site preparation and resistance to contaminants and moisture'* which seeks to protect the health, safety and welfare of people in and around buildings and includes requirements for protection against harm from soil gas.

9.2 General

9.2.1 The following assessment relates to the potential for, and the effects of, gases generated by biodegradable matter. A separate, but related class of problem involves migration of vapour phase of hydrocarbons, but this is addressed under organic contamination in Section 8. The potential for the development to be affected by radon gas is considered in Section 3 above. The principal ground gases are carbon dioxide (CO_2) and methane (CH_4). The following table provides a summary of the effects of these gases when mixed with air.

Significant gas concentrations in air		
Gas	**Concentration by volume**	**Consequence**
Methane	0.25%	Ventilation required in confined spaces
	5 - 15%	Potentially explosive when mixed with air
	30%	Asphyxiation
	75%	Death after 10 minutes
Carbon Dioxide	0.5%	8 hour long term exposure limit (LTEL) (HSE workplace limit)
	1.5%	15 min short term exposure limit (STEL) (HSE workplace limit)
	>3%	Breathing difficulties
	6 – 11%	Visual distortion, headaches, loss of consciousness, possible death
	>22%	Death likely to occur

Table 9.2.1

9.2.2 Following the current Building Regulations Approved Document C1, Section 2 '*Resistance to Contaminants*' (2004 incorporating 2010 and 2013 amendments) a risk assessment approach is required in relation to gaseous contamination based on the source-pathway-receptor conceptual model procedure. We have adopted procedures described in the following reference documents for investigation and assessments of risk of the development being affected by landfill type gases (permanent gases) and if appropriate the identification of mitigation measures.

- BS10175:2011 *'Investigation of potentially contaminated sites- Code of Practice'*
- BS8576:2013 *'Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs)'*
- BS8485:2015 *'Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings'*
- CIRIA Report C665 '*Assessing risks posed by hazardous ground gases to buildings*' (2007)
- NHBC report No 10627-R01(04) *'Guidance on development proposals on sites where methane and carbon dioxide are present'* (January 2007)
- CL:AIRE Research Bulletin RB17 *'A pragmatic approach to ground gas risk assessment'* (November 2012)

Whilst we have followed the guidance and recommendations of BS8576, we have used BS8485:2015 to derive recommendations for protective works where considered necessary supplemented by NHBC report No 10627-R01(04).

9.2.3 An assessment of the risk of the site being affected by ground gases is based on the following aspects:

a) Source of the gas
b) Investigation information
c) Migration feasibility
d) Sensitivity of the development and its location relative to the source

9.3 Assessment of source of gases

9.3.1 General sources

9.3.1.1 The following table summarises the common sources of ground gases and parameters affecting the generation of ground gases:

Source and control of gases	
Type	**Parameters affecting the rate of gassing**
Landfills	Portion of biodegradable material, rate reduces with time
Mineworkings	Flooding reduces rate of gassing
Dock silt	Portion of organic matter
Carbonate deposits	Ground / rainwater (acidic) reacts with some carbonates to produce carbon dioxide.
Made Ground	Thickness of Made Ground and proportion of degradable organic matter
Naturally deposited soils/rocks	Portion of organic matter

Table 9.3.1

The rate of decomposition in gas production is also related to atmospheric conditions, pH, temperature, and water content / infiltration.

9.3.1.2 As the site is not within a dockland environment or an area affected by mineworkings. However the site may be affected by underlying limestone deposits, landfilling activities and near surface Made Ground soils.

9.3.2 Landfill and infilled ground sources

9.3.2.1 Waste Management Paper 27 (1991) produced by the Department of the Environment '*Control of Landfill Gases'* contains the recommendation to avoid building within 50m of a landfill site actively producing large quantities of landfill type gases and to carry out site investigations within a zone 250m beyond the boundary of a landfill site. No distinction is made between sites of differing ground conditions, but the paper does not advocate the site is safe beyond the 250m zone, dependant, of course, upon the type of landfill and potential for migration of landfill gases.

9.3.2.2 Envirocheck reports one landfill site adjacent to the northwest, known as Hogshaw refuse tip (known as Zone 1). Records indicate the site was licenced for receipt of domestic, inert, industrial and commercial wastes, and licence has now lapsed. Furthermore, the Local Authority planning portal of High Peak Borough Council, records a refuse tip in the area of the existing recreation ground to the southwest of the site (Zone 2). The extent of the tip and the type of wastes deposited are not recorded.

9.3.2.3 In addition, we have reviewed old Ordnance Survey maps and there is obvious evidence of quarrying in the area, the closest of which is 200m northwest. Such sites may have been restored with materials which could generate landfill gases.

9.3.2.4 In addition 12 BGS mineral sites are recorded within 1000m from site. The closest is located 219m to the northwest, which extracted common clay and shale. All mineral site were opencast type, used to extract clay, shale or limestone. We anticipate that these are related to the quarries recorded on the historical mapping. All extraction activities have ceased.

9.3.2.5 A number of infilled land and water bodies are also recorded on site and within 1000m of the site. A feature is recorded onsite, associated with the backfilling of Russia Mere, recorded on historical mapping between 1879 and 1967.

9.3.2.6 Based on the above, records suggest there are potential sources of ground gasses in the area worthy of further consideration.

9.3.3 Soil conditions

9.3.3.1 Laboratory testing indicates that the Made Ground soils beneath the site contain between 3.1% and 40% of organic matter. The majority of these values are from Topsoil which we do not consider to represent of significant gas generation source. However, 9 No. locations where these results are higher than 5% are from deeper Made Ground deposits, which contain between 8.6% to 40% of organic matter. Our observations during the intrusive investigation, (of Made Ground materials) indicated the presence of decomposing timber, textile, paper and fibrous material. Such deposits have the potential to produce elevated quantities of carbon dioxide and / or methane gas.

9.3.3.2 The site is underlain by soils and rocks which have a naturally high carbonate content. Following BS8576 figure 6, such soils are determined to represent a very low potential for generation of a source of carbon dioxide.

9.3.4 Source assessment summary

9.3.4.1 The following table summarises the possibility of a source of landfill type gases.

Source assessment summary		
Potential source origin	**Viability of source**	**Evidence**
Landfills	Likely	Desk study information Landfill adjacent to northwest part of site (Zone 1), and LA recorded tip in south-western part (Zone 2). Potentially backfilled quarries located within 500 of the site, in addition to infilled pond to east of site (Zone 4)
Mineworkings	Unlikely	Desk Study information Geological conditions not amenable
Dock silt	Unlikely	Site remote from dockland environment
Carbonate deposits	Unlikely	Bedrock consists of limestone, however the generation potential of this source is very low
Made Ground	Likely	Made Ground >3m thickness with TOC >5%
Naturally deposited soils/rocks	Unlikely	Soils exposed in exploratory excavations do not exhibit high concentrations of organic matter

Table 9.3.4

9.3.4.2 Based on the above it there is a possibility of a source of potential landfill gases which may affect the subject site. On this basis, it is considered necessary to consider possible pathways for migration of ground gases from this potential source to the site.

9.4 Gas migration

9.4.1 Exploratory excavations encountered predominantly coarse-grained Made Ground to depths typically between 2m to 5m within Zone 2. Made Ground was also encountered locally to depths of 1.3m to >5m in Zone 4. In our opinion, these deposits are relatively permeable and would provide little resistance to both lateral and vertical migration of landfill type gases, which would migrate directly into buildings present in such areas.

9.4.2 In addition, natural granular strata in the form of weathered bedrock (sands and gravels) and limestone is present across the site, and near surface in the area of Zones 3 and 4. It is therefore considered possible that the landfill type gases identified offsite and could feasibly migrate to the ground surface of the site, as well as migrating from areas of Made Ground, including in Zone 1 to adjacent areas of the site where such deposits are not present. Notwithstanding the above, we anticipate that the presence of localised near surface cohesive deposits could minimise vertical and lateral migration of landfill gasses within the subsurface, particularly between Zones 1 towards Zones 2/3. However, we have considered a worst-case scenario at this stage.

9.5 Conceptual model

9.5.1 Based on the above, there is a potential source of landfill type gases, and a feasible migration pathway to the site via potentially permeable Made Ground and near surface natural strata. Our conceptual model is tabled below. On this evidence we are of the opinion that the site is at risk of being affected by ground gases (carbon dioxide / methane) sufficient to potentially cause harm to human end users of the site, construction operatives or indeed buildings. On this basis, we have installed monitoring standpipes in boreholes, and implemented a monitoring regime, generally following procedures described in BS8576:2013 to quantify the risk and, if appropriate, identify mitigation measures.

Conceptual model		
Potential source origin	**Potential pathway**	**Receptors at risk**
Landfills Restored mere and number of opencast quarries – source of backfill not known. Made Ground onsite	Via near surface permeable soils and directly via Made Ground	End users Construction operatives Buildings

Table 9.5.1

9.6 Development categorisation

9.6.1 With reference to BS8485:2015 (table 3), the proposed building type would be classified as *'Type A - Private'*.

9.7 Monitoring observations

9.7.1 Five standpipes have been installed at the site in accordance with BS8576:2013, Section 9 (refer Drawing 08). Following BS8576:2013 (Figure 6) and CIRIA Report C665 (Tables 5.5a and 5.5b) we have provisionally assessed the site as moderate to high generation potential of source ideally requiring fortnightly readings taken over a 2 to 12 month period. We can confirm we have completed 6 No. monitoring visits over a two month period.

9.7.2 We have returned to site for all of the six proposed monitoring visits to obtain measurements of landfill type gases at atmospheric conditions in the range of 955mb to 996mb and temperatures in the range of 4°C to 12°C. Essentially, within Zones 2 to 4, we detected concentrations of methane in the range of 0.0% to 0.2% and concentrations of carbon dioxide measured in the range of 0.2% to 7.9%. If flows were detected during our monitoring visits then these are recorded, but where no flow is detected then we have assumed flow at the detection limit of the monitoring equipment at 0.1l/s.

9.7.3 Within Zone 1 we detected concentrations of methane in the range of 9.6% to 24.8% and concentrations of carbon dioxide measured in the range of 14.1% to 19.9%

9.7.3 Gas monitoring results are summarised in Appendix K. It should be noted that gas measurements from location DTS06 could not be undertaken on the initial visit of the 18th February 2019 due to technical issues with the analyser at the time.

9.8 Classification of site characteristic gas situation

9.8.1 As outlined in previous sections, we have refined the following assessments based on development not being undertaken within Zone 1. Whilst we have not discussed any requirements for gas protection within Zone 1, we have discussed the presence gases in this area affecting other areas of the site.

9.8.2 Significant concentrations of landfill gases have been measured at location DTS04, situated in the main landfill site in Zone 1. Concentrations of carbon dioxide range from 18.6% to 19.9%, with methane ranging from 9.6% to 24.8%. Elsewhere onsite, concentrations of carbon dioxide range from 0.2% to 7.9%, with methane ranging from 0.0% to 0.2%.

9.8.2 Within Zone 2, in areas where Made Ground deposits exceed depths of >2m, and such deposits consist of landfill type materials (associated with the Local Authority recorded refuse tip), concentrations of methane rarely exceed 0.2%, however, concentrations of carbon dioxide have been measured between 1.8% and 7.9% (DTS24). Based on flow rates and gas screening values, the area would be classified as characteristic gas situation CS1 and traffic light colour 'Green'. However, concentrations of carbon dioxide have been measured at and above the maximum typical value of 5% for a green classification on 4 of the 6 monitoring occasions within DTS24, measured between 5.0% and 7.9%. It is acknowledged that borehole DTS19, also located in Zone 2, suggests a Green traffic light classification based on both gas screening values and actual measured concentrations. However, the response zone in this area is formed within natural soils and not the Made Ground observed across the zone. Based on the above, we recommend that the entire area of Zone 2 is classified as characteristic gas situation CS2 and traffic light colour 'Amber 1'.

9.8.3 In all other areas of the site, using test data obtained to date, Zones 3 and 4 would be classified as characteristic gas situation CS1 and traffic light colour 'Green'. Concentrations of carbon dioxide have exceeded the maximum typical value of 5% for a Green classification on one occasion to date, measured at 5.2% in borehole DTS13. Given the marginal exceedance, at this stage we do not consider it reasonable to increase the classification to CS2/Amber 1 for such areas of the site. This is likely to be associated with Made Ground deposits recorded locally in Zone 4.

9.8.4 Given the nature of the Made Ground encountered within Zones 2 and 4, and access issues experienced to date, we would recommend that further, more intensive ground gas monitoring is undertaken to fully classify these areas, particularly in the southern part of Zone 2 and along the boundary between Zone 1 (landfill) and Zones 2 and 3 to assess the potential for localised migration between such areas.

9.9 Gas protective measures – new buildings

9.9.1 Based on monitoring observations to date, development categorisation (Section 9.6 above) and the site characteristic gas situation (Section 9.8 above) and with reference to Table 4 of BS8485:2015, the area of Zones 3 and 4 are unlikely to require any gas protective measures. However, as outlined in paragraph 9.8.4 above, we recommend that this is verified by completion of further, more intensive ground gas monitoring to fully classify these areas.

9.9.2 In the area of Zone 2, the development will require gas protective measures which would achieve a '*gas protection score'* of 3.5. Lists of protective measures which each produce a score value are produced in Tables 5, 6 and 7 of BS8485:2015.

9.9.3 Furthermore, with such areas of the site being classified as 'Amber 1', then following NHBC report No 10627-R01(04) table 14.2, the following 'low level' gas protection measures are required as minimum in Zone 2: -

a) Installation of a suitable gas resistant membrane

b) Ventilated subfloor to facilitate a minimum of one complete volume change per 24 hours.

c) Gas protective measures shall be as presented in Building Research Establishment Report 414

9.9.4 It is important that the necessary gas protection measures are adopted to comply with the requirements of Local Authority Building Control and Environmental Protection; considering both the British Standard and NHBC guidance, whichever applies in precedence.

9.9.5 Again, we recommend that this is verified by completion of further, more intensive ground gas monitoring to fully classify this area of the site, particularly in the southern part of Zone 2 and along the boundary between Zone 1 (landfill) and Zones 2 and 3 to assess the potential for localised migration between such areas.

9.10 Flammability

9.10.1 Methane is a flammable gas. When the concentrations of methane in air (oxygen 20.9% by volume) are between the limits of 5% and 15% by volume, then an explosive mixture is formed. The lower explosive limit (LEL) of methane is 5% which is equivalent to 100% LEL. The 15% limit is known as the upper explosive limit (UEL), but concentrations above this level cannot be assumed to represent safe concentrations. The flammability of gas mixtures is affected by their composition, presence of an ignition source, temperature, pressure and nature of the surroundings. The explosive hazard of a flammable mixture arises from the speed of propagation of the flame in a confined space and the ability of the container to absorb the associated shock wave. The flammability range can vary depending upon differing circumstances, for example:

- When carbon dioxide concentrations of greater then 25% are present, methane is rendered non-flammable, and
- If the oxygen concentration is reduced, the limits of flammability are reduced. For example at 13.45% oxygen the LEL and UEL for methane are altered to 6.5% and 7% respectively, whilst at 13.25% oxygen the mixture is incapable of propagating a flame (refer CIRIA report 130)

9.10.2 From measurements taken to date, whilst air, methane and carbon dioxide mixtures are not potentially explosive (typically due to the lack of oxygen in the ground), there is always the possibility that explosive mixtures may occur following gas migration into enclosed spaces. For example, if methane is migrating locally between Zone 1 and Zones 2 and 3. For an explosion to occur, an enclosed space together with an ignition source is required. Clearly a sub-floor void could produce a confined space, and thus in order to minimise risks, the use of a positively pressurised clean air blanket to alter the gas mix, may produce the required solution. Such issues will require consideration following completion of the mitigation measures as described in Section 9.9 above.

9.11 Gas protective measures - construction operatives

9.11.1 Areas near landfill sites, or in carbonate rich deposits (such as limestone present beneath Zones 3 and 4) have the potential to generate both harmfully low oxygen levels and high carbon dioxide levels in confined spaces. The assessment for such situations may therefore require using gas monitors to warn of significant leaks of gas into confined spaces to minimise the risks associated with an oxygen-deficient atmosphere which could lead to asphyxiation, and/or a toxic atmosphere due to high levels of carbon dioxide.

9.11.2 During construction, we recommend any excavations/confined spaces are well ventilated and human entry is avoided. The Workplace Exposure Limits (WELs) for carbon dioxide are 5000 parts per million (ppm by volume), which is equivalent to 0.5%, for the 8-hour time-weighted average (TWA); and 15000 ppm (1.5%) for the 15-minute short-term exposure limit (STEL). Typically, oxygen deficiency alarms on gas detectors are set at 19% volume ratio (v/v). Normal air contains 20.9% oxygen. Therefore should human entry be necessary then we recommend excavations/confined spaces are monitored over short- and long-term exposure periods for both oxygen and carbon dioxide gases prior to entry to ensure levels are within acceptable concentrations or suitable breathing equipment adopted.

9.11.3 We recommend further reference is made to the following documents to minimise the risks to construction workers from ground gases:

- Health and Safety Executive Publication *"Protection of Workers and the General Public during the Development of Contaminated Land"* (HMSO)
- *"A Guide to Safer Working on Contaminated Sites"* (CIRIA Report 132)
- Health and Safety Executive Publication EH40/2005 *''Workplace Exposure Limits''*

9.12 Statement with respect to National Planning Policy Framework

9.12.1 Providing the recommendations described above are satisfactorily completed, we are of the opinion the proposed development will be safe and suitable for use for the purpose for which it is intended, thus meeting the requirements of the National Planning Policy Framework section 178, and compliant with the Building Regulations Part C, '*Site preparation and resistance to contaminants and moisture'*.

10 Effects of ground conditions on building materials

10.1	General
10.2	Concrete – sulphate attack
10.3	Concrete – chloride attack
10.4	Concrete – acid attack
10.5	Concrete – magnesium attack
10.6	Concrete – ammonium attack
10.7	Plastic pipes

10.1 General

10.1.1 Building materials are often subjected to aggressive environments which cause them to undergo chemical or physical changes. These changes may result in loss of strength or other properties that may put at risk their structure integrity or ability to perform to design requirements. Aggressive conditions include:-

- Severe climates
- Coastal conditions
- Polluted atmospheres
- Aggressive ground conditions

10.1.2 This report section only considers aggressive ground conditions in relation to buried concrete and water pipes. Ground conditions may affect other materials but have not been considered here.

10.2 Concrete - Sulphate attack

10.2.1 Hazard

10.2.1.1 Sulphate attack on concrete is characterised by expansion, leading to loss of strength, cracking, spalling and eventual disintegration. There are three principal forms of sulphate attack, as follows:-

- Formation of gypsum through reaction of calcium hydroxide and sulphate ions.
- Ettringite formation through reaction of tricalcium alluminate and sulphite irons.
- Thaumasite formation as a result of reactions between calcium silicate hydrates, carbonate ions (from aggregates) and sulphate ions.

10.2.2 Assessment

10.2.2.1 The hazard of sulphide attack is addressed by reference to procedures described in Building Research Establishment (BRE) Special Digest 1: 2005 '*Concrete in Aggressive Ground*' to establish a design sulphate class (DS) and the '*aggressive Chemical Environment for Concrete*' (ACEC). These procedures have been followed during our investigation and are described in the following paragraphs.

10.2.3 Desk Study Information

10.2.3.1 The first step in the procedure is to consider specific elements of the desk study. These are tabulated below.

Summary of desk study information			
Element	**Interrogation**	**Outcome**	**SD1: 2005 reference**
Geology	Likelihood of soils containing pyrites	**Unlikely**	Box C6
Past industrial uses	Brownfield site	**Yes**	C2.1.2

Table 10.2.3

10.2.3.2 A brownfield site is defined in SD1: 2005 as a site, or part of a site which has been subject to industrial development, storage of chemicals (including for agricultural use) or deposition of waste, and which may contain aggressive chemicals in residual surface materials, or in ground penetrated by leachates. Where the history of the site is not known, it should be treated as brownfield until there is evidence to classify it as natural.

10.2.3.3 Based on the above it is necessary to follow the procedures described in figure C6 (*'locations on brownfield sites except where soils may contain pyrite*') for Zones 2 and 4. For Zone 3, it is necessary to follow the procedures described in figure C4 *('natural ground sites except where soils may contain pyrite').*

10.2.4 Laboratory testing

10.2.4.1 The following table summarises ground conditions and laboratory testing.

Item	Soil type	Outcome
Soil		
Number of samples	Made Ground in (Zone 2)	4
	Weathered Bowland Shale Formation (Zone 2)	2
	Weathered Eyam Limestone Formation (Zones 3 and 4)	3
Characteristic w/s sulphate	Made Ground in (Zone 2)	58
	Weathered Bowland Shale Formation (Zones 2)	270
	Weathered Eyam Limestone Formation (Zones 3 and 4)	19
Characteristic pH	Made Ground in (Zone 2)	6.7
	Weathered Bowland Shale Formation (Zones 2)	7.9
	Weathered Eyam Limestone Formation (Zones 3 and 4)	6.3
Characteristic pH	Made Ground in (Zone 2)	0.27
	Weathered Bowland Shale Formation (Zones 2)	0.22
	Weathered Eyam Limestone Formation (Zones 3 and 4)	0.18
Characteristic sulphur (%)	Made Ground in (Zone 2)	0.33
	Weathered Bowland Shale Formation (Zones 2)	0.13
	Weathered Eyam Limestone Formation	0.14

	(Zones 3 and 4)	
TPS (%SO^4)	Made Ground in (Zone 2)	0.99
	Weathered Bowland Shale Formation (Zones 2)	0.39
	Weathered Eyam Limestone Formation (Zones 3 and 4)	0.42
OS (%SO^4)	Made Ground in (Zone 2)	0.88 Pyrite is probably present.
	Weathered Bowland Shale Formation (Zones 2)	0.308 Pyrite is unlikely to be present.
	Weathered Eyam Limestone Formation (Zones 3 and 4)	0.395 Pyrite is unlikely to be present.
Groundwater and leachate		
Number of samples	Made Ground in (Zone 2)	1
	Weathered Bowland Shale Formation (Zone 2)	1
	Weathered Eyam Limestone Formation (Zones 3 and 4)	1
Characteristic sulphate	Made Ground in (Zone 2)	11mg/l
	Weathered Bowland Shale Formation (Zone 2)	63mg/l
Mobility	All locations	Mobile
Surface water		
Number of samples	Nun Brook	2
Characteristic sulphate	Nun Brook – upstream 1	26 mg/l
	Nun Brook – downstream 1	33 mg/l

Table 10.2.4

10.2.5 Disturbed ground

10.2.5.1 Results indicate that pyrite is likely to be present in Made Ground across the site. Forming foundations by, for instance, cutting a trench through naturally deposited soils or driving pre-cast concrete piles through naturally deposited soils does not, generally, create disturbed ground as defined in BRE SD 1:2005. However, any arisings resulting from replacement piling or spread footing excavations used for bulk filling on site would be classified as disturbed ground.

10.2.6 Assessment of design sulphate class (DC) and aggressive chemical environment for concrete (ACEC)

10.2.6.1 Based on the design sulphate class, characteristic value of pH and assessment of groundwater mobility, and with reference to tables C1 and C2 of SDI: 2005, the ACEC class for each soil type is presented in Table 10.2.6 below.

Summary of concrete classification				
Soil type	**Disturbed ground?**	**Consider TPS?**	**DS class**	**ACEC class**
Made Ground in (Zone 2)	Y	Y	DS-3	AC-3
Weathered Bowland Shale Formation (Zone 2)	Y	N	DS-1	AC-1
Weathered Eyam Limestone Formation (Zones 3 & 4)	Y	N	DS-1	AC-1
Groundwater/leachate samples	N/A	N	DS-1	AC-1
Surface water	N/A	N	DS-1	AC-1
Table reference 10.2.6				

10.2.6.2 Where concrete is in contact with more than one soil/groundwater source, the more onerous of design sulphate class and ACEC class should be adopted.

10.3 Concrete - Chloride attack

10.3.1 Hazards

10.3.1.1 There are a number of ways in which chlorides can react with hydrated cement compounds in concrete. These are as follows: -

- Chlorides react with calcium hydroxide in the cement binder to form soluble calcium chloride. This reaction increases the permeability of the concrete reducing its durability.
- Calcium and magnesium chlorides can react with calcium aluminate hydrates to form chloroaluminates which result in low to medium expansion of the concrete.
- If concrete is subject to wetting and drying cycles caused by groundwater fluctuations, salt crystallisation can form in concrete pores. If pressure produced by crystal growth is greater than the tensile strength of the concrete, the concrete will crack and eventually disintegrate.

10.3.2 Risk assessment

10.3.2.1 Chlorides of sodium, potassium, and calcium are generally regarded as being non-aggressive towards mass concrete; indeed, brine containers used in salt mines have been known to be serviceable after 20 years service. Depending upon the type of concrete, and the cement used up to 0.4% chloride is allowed in BS8110: Part 1.

10.3.2.2 In view of the past use of the site we consider the likelihood of elevated concentrations of chlorides in the ground is not likely to occur and on this basis have not specifically measured concentrations of chlorides and, in our opinion, the risk of buried concrete being affected by chlorides is considered low.

10.4 Concrete - Acid attack

10.4.1 Hazards

10.4.1.1 Concrete being an alkaline material is vulnerable to attack by acids. Prolonged exposure of concrete structures to acidic solutions can result in complete disintegration.

10.4.2 Risk assessment

10.4.2.1 The rate of acid attack on concrete depends upon the following:-

- The type of acid
- The acid concentration (pH)
- The composition of the concrete (cement/aggregate)
- The soil permeability
- Groundwater movement

British Standard BS8110: Part 1 classifies extreme environment as one where concrete is exposed to flowing groundwater that has a pH<4.5. The standard also warns that Portland Cement is not suitable for acidic conditions with a pH of 5.5 or lower.

10.4.2.2 The pH of the soil/groundwater was measured exceeding 5.5 and on this basis the risk of concrete being affected by acidic conditions is considered low.

10.5 Concrete - Magnesium attack

10.5.1 Hazards

10.5.1.1 Magnesium salts (excepting magnesium hydrogen carbonate) are destructive to concrete. Corrosion of concrete occurs from cation exchange reactions where calcium in the cement paste hydrates and is replaced with magnesium. The cement looses binding power and eventually the concrete disintegrates.

10.5.2 Risk assessment

10.5.2.1 In practise 'high' concentrations of magnesium will be found in the UK only in ground having industrial residues. Following BRE Special Digest 1:2005, measurement of the concentration of magnesium is recommended if sulphate concentrations in water extract or groundwater exceed 3000mg/l. Once measured the concentration of magnesium is considered further in BRE Special Digest in establishing the concrete mix to resist chemical attack.

10.5.2.2 We are not aware the site has been subject to any manufacturing processes which would have included magnesium containing compounds, and in addition sulphate concentrations did not exceed 3000mg/l, on this basis we have not measured the concentration of magnesium in soils at the site and would consider the risk of soils at the site promoting attack on concrete is considered low.

10.5.2.3 BS EN 206-1:2000 '*Concrete - Part 1: Specification, performance, production and conformity*' does, however, provide exposure classes for concrete in contact with water, with varying concentrations of magnesium for the design/specification for concrete mixes. Based on groundwater measurements made at the site to date, there is a low risk of concrete for traditional foundations being in contact with groundwater during its life, thus we have not measured the concentration of magnesium in groundwater samples. If piled foundations are utilised onsite it is likely they will come into contact with groundwater, therefore, we recommend that the concentration of magnesium is measured in such areas of the site.

10.6 Concrete - Ammonium attack

10.6.1 Hazards

10.6.1.1 Ammonium salts, like magnesium salts act as weak acids and attack hardened concrete paste resulting in softening and gradual decrease in strength of the concrete.

10.6.2 Risk assessment

10.6.2.1 UK guidance is not available on the concentration of ammonium which may affect concrete. BS EN 206-1: 2000 '*Concrete - Part 1: Specification, performance, production and conformity*' does, however, provide exposure classes for concrete in contact with water with varying concentrations of ammonia for the design/specification for concrete mixes.

10.6.2.2 Based on groundwater measurements made at the site to date, there is a low risk of traditional concrete foundations being in contact with groundwater during its life, thus we have not measured the concentration of ammonia in groundwater samples. In addition, the site has no history which provides evidence of the uses of ammonia on site, and in overall conclusion the risk of concrete being affected by ammonia is considered low. However, if piled foundations are utilised onsite it is likely they will come into contact with groundwater, therefore, we recommend that the concentration of ammonia is measured in such areas of the site.

10.7 Plastic Pipes

10.7.1 Hazards

10.7.1.1 Plastic pipes are predominantly manufactured from PVC and PE but other materials can be used. In general, they perform well but it is known that chemical attack and permeation of contaminants through the pipes can result from use in contaminated land. A published review on plastic pipes reports the following:-

- Polyethylene (PE) - good resistance to solvents, acids and alkalis
- Poly vinyl chloride (PVC) - most common form of pipe. Good general resistance to chemical attack but can be attacked by solvents such as ketones, chlorinated hydrocarbons and aromatic polypropylene (PP) - chemically resistant to acids, alkalis and organic solvents but not recommended for use with storing oxidising acids, chlorinated hydrocarbons and aromatics.

- Poly vinylidene fluoride (PVDF) - inert to most solvents, acids and alkalis as well as chlorine, bromide and other halogens
- Polytetrafluoroethylene (PTFE) - one of the most inert thermoplastics available. PTFE has good chemical resistance to solvents, acids and alkalis

A survey carried out by the Water Research Centre (WRc) on reported incidents of permeation (more than 25), only two involved PVC with these incidents relating to spillages of fuel.

10.7.2 Assessment

10.7.2.1 A survey carried out by the Water Research Centre (WRc) on reported incidents of permeation (more than 25), only two involved PVC with these incidents relating to spillages of fuel.

10.7.2.2 The UK Water Industry research (UKWIR) have published a document entitled *'Guidance for the selection of Water supply pipes to be used in Brownfield sites'.* The publication defines brownfield sites as

> *'Land or premises that have been used or developed. They may also be vacant, or derelict. However, they are not necessarily contaminated'*

10.7.2.3 The subject site has not previously been developed however, it would appear that it has been used, and on this basis could potentially be considered brownfield in accordance with the UKWIR document. Following the preliminary risk assessment procedures described in the UKWIR document however, (paragraph 2.4.2) there is no evidence to indicate that chemicals have ever been used or stored on site or adjacent to the development. However, in Zones 2 and 4 significant deposits of Made Ground have been identified and based on the concentrations of chemical contaminants measured to date, is considered likely that there will be a requirement to use barrier water supply pipes in such areas. We recommend Severn Trent however is consulted on this to gain their opinion and requirements.

11 Landfill issues

11.1	Disposal of soils off site
11.2	Landfill tax
11.3	Reuse of soils – Materials Management Plans

11.1 Disposal of soils off site

11.1.1 Disposal of waste soils must comply with the Landfill Directive and amendments to the *'Landfill (England and Wales) Regulations'.* Essentially, this requires the 'waste producer' to classify soils for off-site disposal to an appropriately licensed landfill facility. Laboratory testing on soils from the site would be required to allow such classification in accordance with current Environment Agency waste acceptance criteria and procedures. We can carry such testing and an assessment of soil classification for disposal on further instructions.

11.2 Landfill tax

11.2.1 Disposal of soils to landfill sites is normally subject to landfill tax with rates varying from year to year based on government policy. Current information on rates of landfill tax can be obtained from the HM Revenue and Customs website. (www.hmrc.gov.uk)

11.3 Reuse of Soils - Materials Management Plans

11.3.1 Where soils are to be moved and reused onsite, or are to be imported to the site, a Waste Exemption or an Environmental Permit is required.

11.3.2 An alternative is the use of a Materials Management Plan (MMP) to determine where soils are and are not considered to be a waste. By following *'The Definition of Waste: Development Industry Code of Practice'* published by CL:AIRE (produced in 2008 and revised in March 2011), soils that are suitable for reuse without the need for remediation (either chemical or geotechnical) and have a certainty of use, are not considered to be waste and therefore do not fall under waste regulations. In addition, following this guidance may present an opportunity to transfer suitable material between sites, without the need for Waste Exemptions or Environmental Permits.

11.3.3 MMPs offering numerous benefits, including maximising the use of soils onsite, minimising soils going to landfill and reducing costs and time involved in liaising with waste regulators.

11.3.4 We can provide further advice on this and provide fees for producing a Materials Management Plan on further instructions.

12 Further investigations

12.1 Further investigations

12.1 At this stage we consider further investigations to be necessary once development proposals have been finalised. Remedial measures (including verification and validation) related to chemical and gaseous contamination of the site are presented in Section 13. We advise that that further investigation should include as a minimum;

- Once development proposals are confirmed, we recommend that more detailed and plot specific investigations are undertaken to validate our foundation/floor slab assessments. Further details are provided in Section 7.
- Should piled foundations be selected then we recommend a supplementary borehole investigation be carried out in such areas to explore ground conditions at depths beyond possible pile lengths and provide geotechnical parameters for the design of the piles.
- During any further investigations within Zone 2, a detailed assessment should be made of the presence of below ground obstructions associated with the historical railway infrastructure where access has not been gained to date.
- Given the access restrictions and variable nature of ground conditions encountered in Zone 4, we recommend that further plot specific intrusive investigations are undertaken to confirm the composition of soils and determine an appropriate foundation strategy.
- Similarly, we recommend that further intrusive investigations are undertaken in Zone 2 where access could not be gained and verify foundation assessments accordingly.
- Non-intrusive geophysical surveys are undertaken by a specialist across the area of Zones 3 and 4 to determine if there are any anomalies near surface which could indicate the presence of dissolution features.
- Assessment and classification for reuse of site won soils onsite, in addition to offsite disposal to landfill.
- It would also be prudent to undertake further testing of Made Ground soils across the site to determine if asbestos is present elsewhere.
- Further area specific gas monitoring is undertaken within Zone 2 particularly to the southwest where the LA recorded refuse tip is present) and Zone 4 to fully classify such locations where significant Made Ground is present and confirm that an Amber 1/CS2 classification is appropriate.
- Where piled foundations are utilised onsite, the concentrations of magnesium and ammonia should be measured in groundwater.
- Further, more intensive, on site infiltration testing should be carried to determine if such systems are viable.
- Reassessment of CBR values is undertaken following finalisation of cut and fill levels across the site.

12.2 We would be happy to provide fee proposals for any of the above identified items on further instruction.

12.3 In addition to the above, we would also recommend that a suitably experienced asbestos specialist is consulted to confirm the precautions that could be taken during groundworks to minimise contact/disturbance and potential release of fibres. Furthermore, such a specialist could provide further advices on the disposal of ACMs identified at the site.

12.4 We recommend that a Japanese Knotweed remedial specialist is contacted for advice and measures to deal with the significant stands of Japanese Knotweed suspected to be present around the site (in Zone 2) prior to construction and commencement any earthworks activities.

13 Remediation strategy and specification

13.1	Introduction
13.2	Summary of results of investigation leading to recommendations for remediation
13.3	Remediation Strategy
13.4	Specification for imported capping materials
13.5	Verification report

13.1 Introduction

13.1.1 This remediation statement has been produced with a view to isolating and clarifying remedial measures outlined in our main ground investigation report for the site. The objective of remediation works described in this report is to render the site '*fit for purpose'* in relation to the proposed development.

13.1.2 We understand the development will comprise the construction of residential houses, with gardens along with landscaped and parking areas. Garden and landscaped areas will be accessible to children resident in the completed development.

13.1.3 This remediation statement only considers the process of remedial action in terms of addressing contamination recognised to date. If during development, contamination not previously identified, is found to be present at the site, then an addendum method statement will be required, and the appropriate measures taken on site.

13.1.4 All sampling and laboratory analysis associated with the recommended remediation will be undertaken following nationally recognised guidelines and standards that are appropriate at the point of investigation. Laboratory analysis must be commissioned with testing houses that are suitably experienced and are MCERTS accredited with a quality assurance system.

13.1.5 This statement has been prepared to assist in the process of the proposed development, and it normally will require distribution to the following parties prior to implementation, although this list may not be exhaustive:

Table summarising parties likely to require information contained in this section of the report

Party	Reason
Client	For information / reference and cost planning
Developer / Contractor / project manager	To ensure procedures are implemented, programmed and costed
Planning department	Potentially to discharge planning conditions
Independent inspectors such as NHBC / Building control	To ensure procedures are implemented and compliance with building regulations
Project design team	To allow for remedial measures in the design
Project landscape consultant	To ensure compatibility of cover system proposed in this document with landscape requirements
Supplier of remediation materials	To ensure compliance with specification.

13.2 Summary of results of investigations leading to recommendations for remediation

13.2.1 Investigations and assessment of chemical contamination is described primarily in section 8. A summary of chemical contamination at the site is detailed below.

13.2.2 Evaluation of contamination - human receptors

13.2.2.1 Current site users

13.2.2.1.1 Providing the site is developed then the risk of harm being caused to current users from identified contamination is clearly a short-term issue and unlikely to require any remediation. If development does not proceed as planned, further consideration should be given to such risks and the requirement for remediation.

13.2.2.2 End users

13.2.2.2.1 Concentrations of chemical contaminants have been measured above guideline values within Made Ground deposits across the site. In such areas, we are of the opinion that the site represents a medium to high risk of causing harm to future end users of the developed site, based on current development proposals. Providing the remedial measures as outlined below are implemented, the risk of harm being caused to the health of end users is considered to be low.

13.2.2.2.2 We also consider that Topsoil/naturally deposited soils at the site are unlikely to cause significant harm to human health and can be reused within the proposed development where necessary.

13.2.2.3 *Construction operatives and other site investigators*

13.2.2.3.1 The risk of damage to health of construction operatives and other site investigators is, in our opinion, medium to high, primarily due to the presence of asbestos in Made Ground soils. Generally, risks would be minimised by taking adequate hygiene precautions on site. Such precautions would be: -

- Wearing protective clothing particularly gloves to minimise ingestion from soil contaminated hands.
- Avoiding dust by dampening the soils during the works.
- Wearing masks if processing produce dust.

13.2.2.3.2 Consideration will need to be given to the presence of asbestos in Made Ground soils onsite and the additional precautions that will need to be taken during groundworks to minimise contact/disturbance and potential release of fibres.

13.2.2.4 *Controlled waters*

13.2.2.4.1 Marginal elevated concentrations of leachable benzo(a)pyrene and copper have been identified in Made Ground soils, with very marginal concentrations of soluble copper identified in groundwater onsite and surface waters downstream of site. Given the marginal exceedances of soluble copper, and based on the conservatism factored into the EQS value for copper, we consider the risk of leachable copper adversely impacting the quality of groundwater and surface waters is low.

13.2.2.5 *Vegetation*

13.2.2.5.1 In our opinion, marginal contamination identified in Topsoil/natural soils across the site is unlikely to present a risk of causing significant harm to vegetation.

13.2.2.5.2 Concentrations of contaminants exceed relevant guidelines within Made Ground deposits across the site. In our opinion, such contamination is likely to present a risk of causing significant harm to vegetation. Providing the remedial measures as outlined below are implemented, the risk of harm being caused to the health of vegetation is considered to be low.

13.2.2.6 *Gaseous contamination*

13.2.2.6.1 In the area of Zone 2, the development will require gas protective measures which would achieve a '*gas protection score'* of 3.5. Lists of protective measures which each produce a score value are produced in Tables 5, 6 and 7 of BS8485:2015. Furthermore, with such areas of the site being classified as 'Amber 1', then following NHBC report No 10627-R01(04) table 14.2, the following 'low level' gas protection measures are required as minimum in Zone 2: -

a) Installation of a suitable gas resistant membrane

b) Ventilated subfloor to facilitate a minimum of one complete volume change per 24 hours.

c) Gas protective measures shall be as presented in Building Research Establishment Report 414

13.2.2.6.2 We recommend that this is verified by completion of further, more intensive ground gas monitoring to fully classify this area of the site, particularly in the south-western part of Zone 2 where significant deposits of Made Ground, consistent with landfill type material, are present. Additionally, perimeter monitoring between Zone 1 (where significant concentrations of gases have been measured), and Zones 2 and 3 should be undertaken to assess the potential for localised migration between such areas.

13.2.2.6.3 Based on monitoring observations to date, development categorisation (Section 9.6) and the site characteristic gas situation (Section 9.8) and with reference to Table 4 of BS8485:2015, the area of Zones 3 and 4 are unlikely to require any gas protective measures. However, as outlined in paragraph 9.8.4, we recommend that this is verified by completion of further, more intensive ground gas monitoring to fully classify these areas.

13.3 Remediation strategy

13.3.1 The provision of buildings and hardstanding areas across the site will sever the pathway to end-users by preventing human access to contaminated soils.

13.3.2 In proposed garden/landscaped areas where Made Ground is present in Zones 2 and 4, an imported capping layer (cover system) of chemically 'clean' soils will be introduced to sever the pathway between contaminants and end-users, thus minimising the risk of human contact with soils containing contaminants which have the potential to cause harm to human health. The capping layer will be a minimum of 600mm thick in any productive garden areas, and areas likely to be accessible to young children (considered the critical human receptor) on a regular (daily basis). In our opinion, this may be reduced to 300mm in landscaped areas.

13.3.3 Whilst the capping solution is widely accepted regulating Local Authorities (Environmental Health Departments) have differing views as to the minimum thickness required which range from 300mm to 600mm. The Building Research Establishment publication *'cover systems for land regeneration - thickness cover for systems for contaminated land'* indicates that 600mm of capping would be required at the site, though in our opinion this could be reduced to 300mm in non-productive garden and landscaped areas, however this needs to be checked with the Local Authority.

13.3.4 Following installation of the cover system described above, the capping thickness will require independent measurement to validate the correct thicknesses have been provided in landscaped/garden areas.

13.3.5 Furthermore, any gas protection measures which are installed within developments will also require independent validation.

13.4 Specification for imported capping materials

13.4.1 General

13.4.1.1 All imported capping materials (cover systems) shall be sampled and tested to demonstrate they are '*fit for purpose*' before being brought onto site.

13.4.2 Capping materials

13.4.2.1 Capping materials shall comprise topsoil to a minimum thickness of 150mm, over subsoil, alternatively the capping can comprise topsoil.

13.4.2.2 Topsoil shall comprise a material which will allow plants to grow healthily. Topsoil shall be general purpose grade in accordance with BS3882:2015 '*Specification for topsoil*' unless otherwise specified by the consultant landscape architect for the project. Testing shall be carried out to demonstrate compliance for general purpose topsoil (or other topsoil specified by others) with test criteria provided in table 2 of BS3882 with at least one sample tested per source. Topsoil shall be stored, handled and place following the recommendations of BS3882.

13.4.2.3 Subsoils shall be granular (sands / gravels) or clays / silts of natural origin, which shall be classified, placed and compacted in accordance with the current Specification for Highway works, Volume 1, 600 series, available on www.standardsforhighways.co.uk.

13.4.3 Rate of testing / sampling

13.4.3.1 If different sources are to be utilised for topsoil/capping, each source shall be investigated.

13.4.3.2 Capping materials shall be from a source where at least 3 representative soil samples have been taken, subject to a minimum rate of at least 1 sample per 250m^3.

13.4.3.3 With reference to Section 8, we can confirm that site won topsoil and naturally deposited soils can also be used as part of any cover system onsite.

13.4.4 Testing regime

13.4.4.1 Human receptors

13.4.4.1.1 The testing regime really is dependent upon the history of the site where the capping materials are sourced. Past historical uses (from a potential chemical contamination viewpoint) of the source site will dictate the required testing regime potentially requiring additional testing to target / investigate concentrations of contaminants used at the source site where they are harmful to human health. At this stage we cannot specify the scope and indeed the need for such site specific testing as the source of the imported fills is not known.

13.4.4.1.2 As a minimum testing shall be scheduled to measure the concentrations of commonly occurring inorganic and organic contaminants (listed in Table 13.4.7 below where guideline values are available).

13.4.4.2 Water receptors

13.4.4.2.1 The materials forming the cover system, may exhibit a degree of permeability, and thus the potential for any chemical contaminants contained in the soils to leach and thus migrate towards groundwater resources, although the risk of this occurring is dependent upon the location of the water table and indeed the permeability of the soils above the water table. Conversely, leachable contaminants could migrate laterally from cover system towards surface water resources. In order to minimise this risk, the soils forming the cover system shall be tested to determine leachable concentrations of potential contaminants. As with testing regimes associated with human health, the testing regime really is dependent upon the history of the site where the capping materials are sourced. At this stage we cannot specify the scope and indeed the need for such site specific testing as the source of the imported fills is not known.

13.4.4.2.2 As a minimum testing shall be scheduled to measure the leachable concentrations of commonly occurring inorganic and organic contaminants where they are considered a risk to harming water receptors (listed in Table 13.4.7 below where leachate guideline values are available).

13.4.5 Maximum concentrations (Human receptors)

13.4.5.1 The Land Quality Management (LQM) and the Chartered Institute of Environmental Health (CIEH) have derived Suitable for Use Levels (S4ULs) which are presented in *'The LQM/CIEH S4ULs for Human Health Risk Assessment'* (2015). S4ULs have been used as a screening tool to assess the risks posed to the health of humans from exposure to soil contamination in relation to appropriate land uses. Where published S4ULs are not available, we have adopted C4SLs (Category 4 Screening Levels) produced by DEFRA or SGVs (Soil Guideline Values) as appropriate. In the absence of any of these criteria we have adopted Soil Screening Values (SSV) derived by Soiltechnics and by Atkins (SSV^{ATK}). The CLEA model used to derive SSVs has been used with toxicology data presented by the EA, LQM/CIEH and Atkins (in that order of preference). SSVs produced by Atkins are presented on their $ATRISK^{SOIL}$ website.

13.4.5.2 S4ULs, C4SLs, SGVs, SSVs and SSV^{ATK}s represent 'intervention values'; indications to an assessor that soil concentrations above these levels might present an unacceptable risk to the health of site users. These guideline values have been produced using conceptual exposure models, which use assumptions and are applied to differing end uses of land. If the values are exceeded, it does not necessarily imply there is an actual risk to health and site-specific circumstances should be taken into account. Conversely, where a critical pathway or chemical form of the contaminant has not been evaluated, a risk may be present even if the adopted guideline value has not been exceeded.

13.4.5.3 For evaluation of test data in relation to polycyclic aromatic hydrocarbon (PAH) and phenol contamination, we have compared measured concentrations with corresponding S4ULs. The S4UL fractions are dependent on the Soil Organic Matter (SOM) content of the soils. We have adopted the lowest S4UL (1% SOM) as an initial screening value.

13.4.6 Maximum concentrations (water receptors)

13.4.6.1 For interpretation of test data in relation to water receptors measured concentrations of leachable contaminants shall be directly compared with the Environmental Quality Standards (EQS) as published by the Environment Agency. In the absence of EQS UK Drinking Water Standards shall be adopted.

13.4.7 Maximum concentrations (summary)

13.4.7.1 The following table summarises the maximum concentrations of chemical contaminants which shall not be exceeded in imported capping materials.

Table summarising maximum concentration of contaminants in soils used for capping

Contaminant	Maximum allowable concentration and test criteria (Human Receptors) (Total concentration)		Maximum concentration (µg/l) (leachate concentration)
	C4SL(u) (mg/kg)	S4UL (mg/kg)	
Inorganic contaminants			
Arsenic	-	37	50
Barium	-	-	700
Boron	-	290	2000
Beryllium	-	1.7	-
Cadmium (pH to 7.4)	-	11	0.25
Copper	-	2400	1
Chromium	-	910	32
Cyanide (total)	-	34	50
Lead	210	-	14
Mercury	-	1.2	0.07
Nickel		180	50
Nitrate	-	-	50000
Selenium	-	250	10
Sulfate	-	-	400000
Sulfide	-	-	0.25
Vanadium	-	410	60
Organic contaminants			
Acenaphthene	-	210	
Acenaphthylene	-	170	
Anthracene	-	2400	
Benzo(a)anthracene	-	7.2	
Benzo(a)pyrene	-	2.2	
Benzo(b)fluoranthene	-	2.6	
Benzo(g,h,i)perylene	-	320	
Benzo(k)fluoranthene	-	77	
Chrysene	-	15	
Dibenzo(a,h)anthracene	-	0.24	
Fluoranthene	-	280	
Fluorene	-	170	
Indeno(1,2,3-cd)pyrene	-	27	
Naphthalene	-	2.3	
Phenanthrene	-	95	
Phenols	-	280	
Pyrene	-	620	

Table 13.4.7

13.4.8 Information required

13.4.8.1 It is critically important that the imported capping material will minimise the risks of causing harm to human end users of the site. It is necessary to demonstrate the imported capping materials are 'fit for purpose', and relevant and current test result certificates are an important part of the necessary compliance documentation. Compliance documentation will be provided to other interested parties such as:-

- Local authority planning department to discharge planning permissions
- Checking bodies such a NHBC and Building Control (For compliance with building regulations)
- Potential purchasers of the buildings (and their legal advisors)
- Environment Agency (controlling body for ground / surface water resources)

Based on the above it is important to provide compliance documentation prior to importation to site, thus avoiding abortive works and delays to the construction programme with its potential financial penalties.

13.4.8.2 Compliance documentation shall include the following

- Copies of test result certificates signed by a MCERTS accredited laboratory which is signed and dated.
- Source and supplier of the capping material.
- Delivery notes confirming the material originates from the stated source (will form part of the subsequent validation reporting).

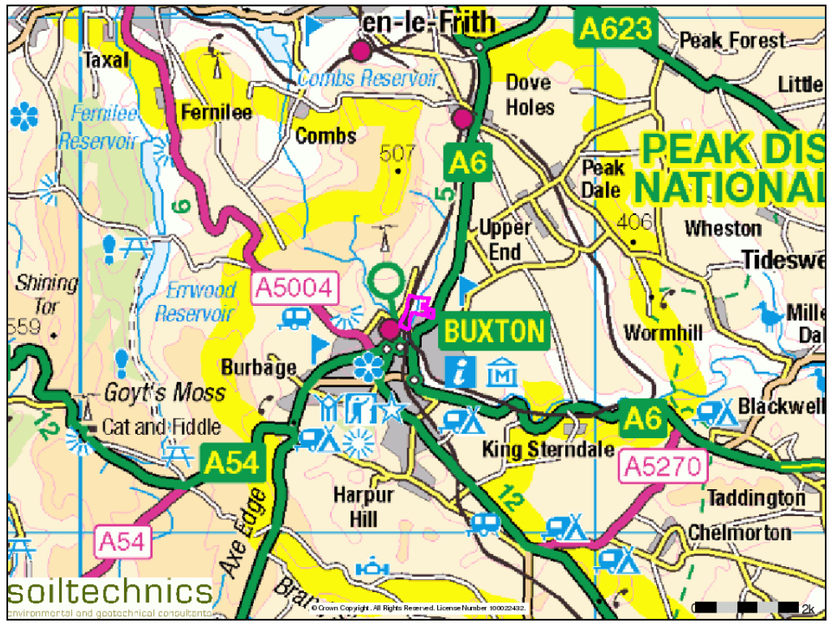
13.5 Verification report

13.5.1 The thickness of the completed cover system will require verification by an independent consultant. We can carry out such investigations on further instructions.

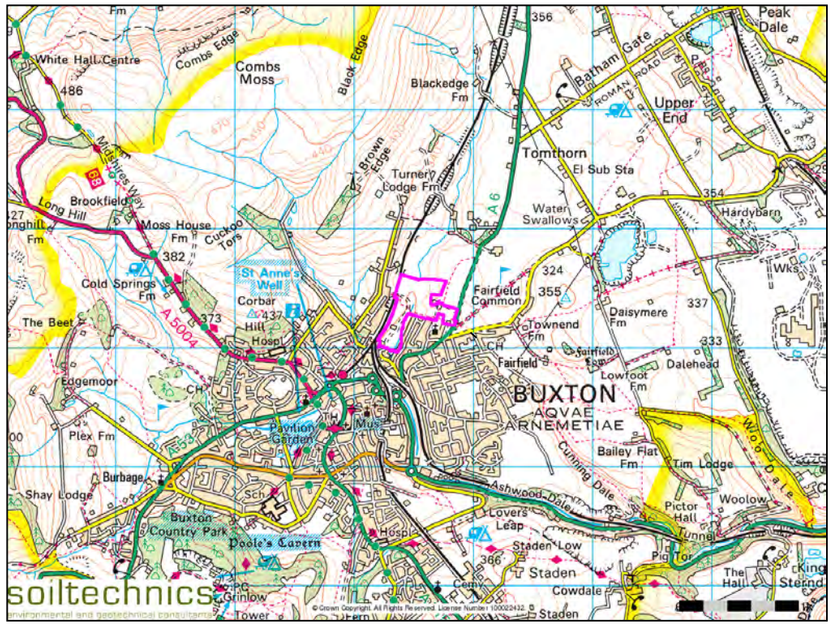
13.5.2 Following completion of remedial works detailed above, a closure report which provides details of all work undertaken as part of the remediation process will have to be prepared. The closure report will include details of imported materials to form the cover system, its thickness and thus verification of its fitness for purpose.

13.5.3 Similarly, any gas protection measures installed at the site will also require verification by an independent consultant.

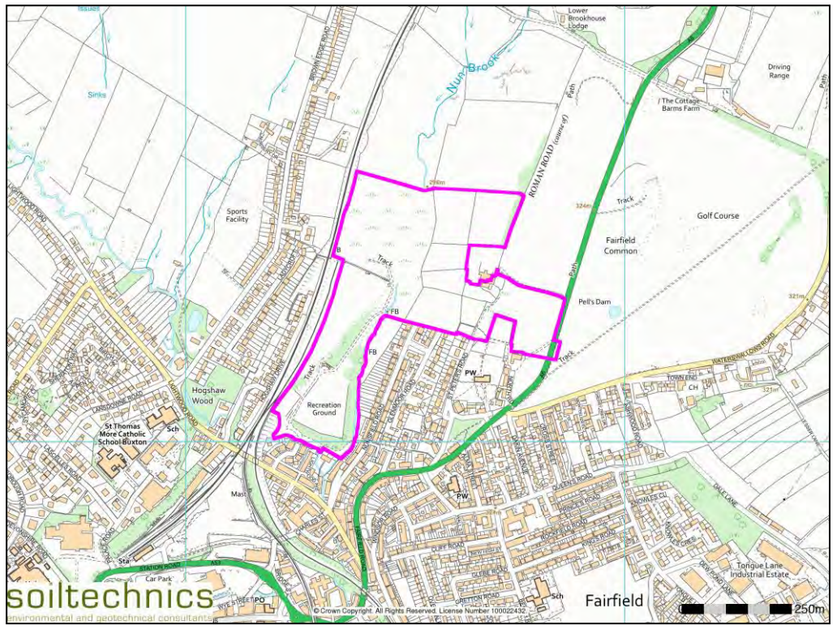
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environmental ▪ geotechnical ▪ building fabric



Neighbourhood extract from Ordnance Survey map



Town extract from Ordnance Survey map



Detail extract from Ordnance Survey map

Title	Scale	Drawing number
Site location plan	Not to scale	01

Proposed residential development
Nunsfield Road, Buxton

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Key

- TP — Approximate location of trial pit formed by machine excavation
- DTS — Approximate location of borehole formed by Driven Tube Sampling techniques
- DTS — Approximate location of borehole formed by Driven Tube Sampling techniques with standpipe installation
- Approximate site boundary
- Potential for ground dissolution stability hazards
- Nestle water pipe easement

Grassed fields
Grassed fields
Golf course
Residential housing
Agricultural supply yard
Agricultural sales building
Grass track
Nunsfield farm
House
Asphaltic concrete track
Disused ground
Dense vegetation
Semi-mature wood
Railway line
A6 Fairfield Road
Golf course
Allotment gardens
Former pub building
Golf course
Open public space
(surfaced in grass)
Residential housing
Residential housing
Residential housing
Residential housing
Residential housing
Residential housing
Play area
Garages
Residential housing

DTS01 DTS02 TP01 DTS03 DTS04 DTS27 TP02 TP03 DTS05 DTS06 TP05 DTS07 DTS12 TP18 DTS09 DTS08 DTS10 TP04 DTS29 DTS28 DTS11 TP06 TP09 DTS16 DTS17 DTS15 TP14 DTS19 TP11 TP15 TP10 TP08 DTS13 DTS18 TP17 DTS20 TP16 TP13 TP07 DTS21 TP19 DTS22 DTS23 TP20 DTS24 TP12 DTS25 DTS26

Title	Scale	Drawing number
Plan showing development proposals and location of exploratory points	1:1250 at A1	03

Report Ref: STG4642M-G01
Revision: 02

August 2019

Proposed residential development
Nunsfield Road, Buxton

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Key

- TP — Approximate location of trial pit formed by machine excavation
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- DTS — Approximate location of borehole formed by Driven Tube Sampling techniques with standpipe installation
- Approximate site boundary
- Inaccessible at time of investigation due to rail construction site
- Access not available at time of investigation
- Zone 1
- Zone 2
- Zone 3
- Zone 4
- Nestle water pipe easement

Grassed fields
Grassed fields
Golf course
Residential housing
Agricultural supply yard
Grass track
Agricultural sales building
Nunsfield farm
House
Asphaltic concrete track
Disused ground
Dense vegetation
Semi mature wood
Railway line
A6 Fairfield Road
Golf course
Allotment gardens
Former pub building
Golf course
Open public space
(surfaced in grass)
Residential housing
Residential housing
Residential housing
Residential housing
Residential housing
Residential housing
Play area
Garages
HOGSHAW

DTS01 DTS02 TP01 DTS03 DTS04 DTS27 TP02 TP03 DTS05 DTS06 TP05 DTS07 DTS12 TP18 DTS08 DTS09 DTS10 TP04 DTS29 DTS28 DTS11 TP06 TP09 DTS16 DTS17 DTS15 TP14 DTS19 TP15 TP11 TP10 TP08 DTS13 TP17 DTS20 DTS18 TP16 TP13 TP07 DTS21 TP19 DTS22 DTS23 TP20 DTS24 TP12 DTS25 DTS26

Title	Scale	Drawing number
Plan showing development proposals, location of exploratory points and zonal assessment	1:1250 at A1	04

Report Ref: ST04642M-G01
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August 2019

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STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
Grass over dark brown SAND with frequent rootlets. (TOPSOIL)									
	0.20	309.40					0.20		D
Medium dense brown slightly clayey silty very sandy GRAVEL with rare cobbles. Gravel and cobbles consist of medium to coarse angular mudstone. (WEATHERED EYAM LIMESTONE FORMATION)							0.50		D
	0.70	308.90							
Soft very low strength brown gravelly slightly sandy CLAY. Gravel consists of medium to coarse angular mudstone. (WEATHERED EYAM LIMESTONE FORMATION)					PP 0.80	PP=17	0.80		D
	1.00	308.60							
Soft light grey gravelly CLAY. Gravel consists of fine to medium angular limestone. (WEATHERED EYAM LIMESTONE FORMATION)									
	1.20	308.40					1.20		D
TRIAL PIT TERMINATED AT 1.20m									

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Trial pit terminated due to obstruction. Backfilled with arisings. Trial pit terminated due to competency of deposits (likely bedrock).

Groundwater observations
No groundwater encountered.

Title Trial pit record	**Dimensions (w x l)** 1.30m x 1.50m	
Method Tracked excavator	**Logged by** TO	**Date(s)** 24/01/2019
Level (m OD) 309.60	**Compiled by** SA	**Sheet number** Sheet 1 of 1
Co-ordinates 406640mE, 374562mN	**Checked by** SD	**TP01**

Report ref: STQ4642M-G01 **Revision:** 0

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STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
Grass onto dark brown SAND with frequent rootlets. (TOPSOIL - MADE GROUND)	0.20	300.39					0.20		D
Medium dense brown slightly gravelly slightly silty SAND. Gravel consists of fine angular limestone. (WEATHERED EYAM LIMESTONE FORMATION)							0.30		D
							0.50		D
							0.80		D
Stiff high strength very dark grey gravelly slightly sandy CLAY. Gravel consists of fine to medium angular mudstone. (WEATHERED EYAM LIMESTONE FORMATION)	1.10	299.49			PP 1.20	PP=100	1.20		D
					PP 1.50	PP=100			
							1.80		D
					PP 1.90	PP=100			
Dense very dark grey slightly sandy GRAVEL. Gravel consists of medium to coarse angular limestone. (WEATHERED EYAM LIMESTONE FORMATION)	2.20	298.39					2.50		D
TRIAL PIT TERMINATED AT 2.60m	2.60	297.99							

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings. Trial pit terminated due to competency of deposits (likely bedrock).

Groundwater observations
No groundwater encountered.

Title Trial pit record	**Dimensions (w x l)** 0.90m x 2.20m	
Method Tracked excavator	**Logged by** TO	**Date(s)** 24/01/2019
Level (m OD) 300.59	**Compiled by** SA	**Sheet number** Sheet 1 of 1
Co-ordinates 406582mE, 374502mN	**Checked by** SD	**TP02**

Report ref: STQ4642M-G01 **Revision:** 0

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STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
Grass over dark brown SAND with frequent rootlets. (TOPSOIL)									
	0.20	318.81					0.20		D
Loose brown very sandy GRAVEL. Gravel consists of medium to coarse angular limestone. (WEATHERED EYAM LIMESTONE FORMATION)							0.50		D
	0.70	318.31							
Soft very low to low strength gravelly slightly sandy CLAY. Gravel consists of medium to coarse angular limestone. (WEATHERED EYAM LIMESTONE FORMATION)					PP 0.80	PP=25	0.80		D
							1.20		D
					PP 1.30	PP=17			
					PP 1.40	PP=17			
TRIAL PIT TERMINATED AT 1.70m	1.70	317.31					1.70		D

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings. Trial pit terminated due competency of deposits (likely bedrock). Collapse of trial pit sides from 0.4m to 0.7m depth on eastern wall widening trial pit by 0.3m.

Groundwater observations
No groundwater encountered.

Title Trial pit record	**Dimensions (w x l)** 1.20m x 2.70m	
Method Tracked excavator	**Logged by** TO	**Date(s)** 24/01/2019
Level (m OD) 319.01	**Compiled by** SA	**Sheet number** Sheet 1 of 1
Co-ordinates 406722mE, 374495mN	**Checked by** SD	**TP03**

Report ref: STQ4642M-G01 **Revision:** 0

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STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
Grass onto dark brown SAND with frequent rootlets. (TOPSOIL)									
	0.20	311.06					0.20		D
Medium dense greyish brown slightly clayey silty sandy GRAVEL with occasional cobbles. Gravel and cobbles consist of coarse angular limestone. (WEATHERED EYAM LIMESTONE FORMATION)							0.50		D
	0.80	310.46					0.80		D
Very weak greyish brown LIMETSONE. (WEATHERED EYAM LIMESTONE FORMATION)									
	1.00	310.26							
TRIAL PIT TERMINATED AT 1.00m									

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings. Trial pit terminated due to competency of deposits.

Groundwater observations
No groundwater encountered.

Title Trial pit record	**Dimensions (w x l)** 1.00m x 2.10m	
Method Tracked excavator	**Logged by** TO	**Date(s)** 24/01/2019
Level (m OD) 311.26	**Compiled by** SA	**Sheet number** Sheet 1 of 1
Co-ordinates 406581mE, 374368mN	**Checked by** SD	**TP04**

Report ref: STQ4642M-G01 **Revision:** 0

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STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
Rough vegetation over loose dark brown very gravelly SAND. Gravel consists of glass, brick, concrete, plastic, plastic bottles, metal, wire, car parts, shoes, paper, timber, ceramic tiles and roof tiles. Hydrocarbon odour observed between 1.9m and 3.4m depth. (MADE GROUND)							0.30		D
							0.50		D
							0.80		D
							1.20		D
							1.80		D
							2.50		D
CONTINUED ON NEXT SHEET									

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings. Collapse of trial pit sides from surface to 1.9m depth on eastern wall widening trial pit by 0.25m.

Groundwater observations
No groundwater encountered.

Title Trial pit record	**Dimensions (w x l)** 1.30m x 3.10m	
Method Tracked excavator	**Logged by** TO	**Date(s)** 23/01/2019
Level (m OD) 301.00	**Compiled by** SA	**Sheet number** Sheet 1 of 2
Co-ordinates 406520mE, 374449mN	**Checked by** SD	**TP05**

Report ref: STQ4642M-G01 **Revision:** 0

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STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
Rough vegetation over loose dark brown very gravelly SAND. Gravel consists of glass, brick, concrete, plastic, plastic bottles, metal, wire, car parts, shoes, paper, timber, ceramic tiles and roof tiles. Hydrocarbon odour observed between 1.9m and 3.4m depth. (MADE GROUND)									
TRIAL PIT TERMINATED AT 3.40m	3.40	297.60					3.40		D

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings. Collapse of trial pit sides from surface to 1.9m depth on eastern wall widening trial pit by 0.25m.

Groundwater observations
No groundwater encountered.

Title Trial pit record	**Dimensions (w x l)** 1.30m x 3.10m	
Method Tracked excavator	**Logged by** TO	**Date(s)** 23/01/2019
Level (m OD) 301.00	**Compiled by** SA	**Sheet number** Sheet 2 of 2
Co-ordinates 406520mE, 374449mN	**Checked by** SD	**TP05**

Report ref: STQ4642M-G01 **Revision:** 0

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STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
Grass onto dark brown very clayey SAND. (TOPSOIL)							0.30		D
	0.40	304.29							
Stiff high strength brown sandy slightly silty CLAY. (WEATHERED BOWLAND SHALE FORMATION)							0.50		D
					PP 0.60	PP=142			
							0.80		D
					PP 0.90	PP=126			
							1.20		D
					PP 1.50	PP=117			
	1.70	302.99							
Medium dense dark brown to dark grey slightly clayey slightly sandy GRAVEL. Gravel consists of fine to coarse angular mudstone. (WEATHERED BOWLAND SHALE FORMATION)							1.80		D
							2.50		D
CONTINUED ON NEXT SHEET									

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings. Collapse of trial pit sides from 0.0m to 1.9m depth widening trial pit by 0.25m each side.

Groundwater observations
No groundwater encountered.

Title Trial pit record	**Dimensions (w x l)** 0.70m x 3.00m	
Method Tracked excavator	**Logged by** TO	**Date(s)** 21/01/2019
Level (m OD) 304.69	**Compiled by** SA	**Sheet number** Sheet 1 of 2
Co-ordinates 406574mE, 374318mN	**Checked by** SD	**TP06**

Report ref: STQ4642M-G01 **Revision:** 0

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STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
Medium dense dark brown to dark grey slightly clayey slightly sandy GRAVEL. Gravel consists of fine to coarse angular mudstone. (WEATHERED BOWLAND SHALE FORMATION)							3.50		D
TRIAL PIT TERMINATED AT 4.00m	4.00	300.69					4.00		D

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings. Collapse of trial pit sides from 0.0m to 1.9m depth widening trial pit by 0.25m each side.

Groundwater observations
No groundwater encountered.

Title Trial pit record	**Dimensions (w x l)** 0.70m x 3.00m	
Method Tracked excavator	**Logged by** TO	**Date(s)** 21/01/2019
Level (m OD) 304.69	**Compiled by** SA	**Sheet number** Sheet 2 of 2
Co-ordinates 406574mE, 374318mN	**Checked by** SD	**TP06**

Report ref: STQ4642M-G01 **Revision:** 0

Proposed residential development
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STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
Grass onto brown slightly clayey SAND. (TOPSOIL - MADE GROUND)									
	0.20	323.80					0.20		D
Medium dense dark brown mottled orangish and reddish brown very gravelly SAND. Gravel consists of fine to coarse glass, brick, plastic, metal pipe, timber, shoes, slag, coal, clinker, tiles, car parts, wire and porcelain. (MADE GROUND)							0.30		D
							0.50		D
							0.80		D
							1.20		D
	1.60	322.40							
Medium dense orangish brown clayey very silty very gravelly SAND. Gravel consists of fine to medium sub-angular limestone and mudstone. (WEATHERED BEE LOW LIMESTONE FORMATION)							1.80		D
...from 2.5m depth, becoming grey.									
							2.60		D
CONTINUED ON NEXT SHEET									

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings. Trial pit terminated due to competency of deposits (likely bedrock).

Groundwater observations
No groundwater encountered.

Title Trial pit record	**Dimensions (w x l)** 1.30m x 2.40m	
Method Tracked excavator	**Logged by** TO	**Date(s)** 24/01/2019
Level (m OD) 324.00	**Compiled by** SA	**Sheet number** Sheet 1 of 2
Co-ordinates 406756mE, 374261mN	**Checked by** SD	**TP08**

Report ref: STQ4642M-G01 **Revision:** 0

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STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
Medium dense orangish brown clayey very silty very gravelly SAND. Gravel consists of fine to medium sub-angular limestone and mudstone. (WEATHERED BEE LOW LIMESTONE FORMATION)									
	3.20	320.80					3.20		D
Medium dense grey GRAVEL. Gravel consists of medium to coarse angular limestone. (WEATHERED BEE LOW LIMESTONE FORMATION)	3.30	320.70							
TRIAL PIT TERMINATED AT 3.30m									

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings. Trial pit terminated due to competency of deposits (likely bedrock).

Groundwater observations
No groundwater encountered.

Title Trial pit record	**Dimensions (w x l)** 1.30m x 2.40m	
Method Tracked excavator	**Logged by** TO	**Date(s)** 24/01/2019
Level (m OD) 324.00	**Compiled by** SA	**Sheet number** Sheet 2 of 2
Co-ordinates 406756mE, 374261mN	**Checked by** SD	**TP08**

Report ref: STQ4642M-G01 **Revision:** 0

Proposed residential development
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STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
Grass onto dark brown very clayey SAND. (TOPSOIL)									
	0.30	308.18					0.30		D
Stiff high strength brown sandy slightly silty CLAY. (WEATHERED EYAM LIMESTONE FORMATION)					PP 0.40	PP=100			
							0.50		D
					PP 0.70	PP=104			
							0.80		D
Medium dense dark brown to dark grey clayey silty slightly sandy GRAVEL with some cobbles. Gravel and cobbles consist of fine to coarse angular limestone and mudstone. (WEATHERED EYAM LIMESTONE FORMATION)	1.00	307.48							
	1.20	307.28					1.20		D
TRIAL PIT TERMINATED AT 1.20m									

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings. Trial pit terminated due to competency of deposits (likely bedrock).

Groundwater observations
No groundwater encountered.

Title Trial pit record	**Dimensions (w x l)** 1.00m x 2.10m	
Method Tracked excavator	**Logged by** TO	**Date(s)** 23/01/2019
Level (m OD) 308.48	**Compiled by** SA	**Sheet number** Sheet 1 of 1
Co-ordinates 406563mE, 374267mN	**Checked by** SD	**TP11**

Report ref: STQ4642M-G01 **Revision:** 0

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STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
Grass onto brown slightly clayey SAND. (TOPSOIL)									
	0.30	322.67					0.30		D
Medium dense orangish brown slightly clayey SAND with frequent cobbles of grey limestone. (WEATHERED BEE LOW LIMESTONE FORMATION)							0.50		D
							0.80		D
TRIAL PIT TERMINATED AT 1.00m	1.00	321.97							

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings. Trial pit terminated due to competency of deposits (likely bedrock).

Groundwater observations
No groundwater encountered.

Title Trial pit record	**Dimensions (w x l)** 1.20m x 2.30m	
Method Tracked excavator	**Logged by** TO	**Date(s)** 24/01/2019
Level (m OD) 322.97	**Compiled by** SA	**Sheet number** Sheet 1 of 1
Co-ordinates 406811mE, 374196mN	**Checked by** SD	**TP13**

Report ref: STQ4642M-G01 **Revision:** 0

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STRATA				WATER STRIKES	IN SITU TESTING		SAMPLING		
DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
Rough vegetation over medium dense dark brown very gravelly SAND. Gravel consists of glass, brick, concrete, plastic, slag, plastic pieces, plastic bottles, metal, metal wire, shoes, paper, timber, ceramic tiles, roof tiles and coal. (MADE GROUND)							0.30		D
							0.50		D
							0.80		D
							1.20		D
							1.40		D
							1.60		D
TRIAL PIT TERMINATED AT 1.80m	1.80	299.90							

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings. Trial pit terminated due to potential asbestos contamination encountered.

Groundwater observations
No groundwater encountered.

Title Trial pit record	**Dimensions (w x l)** 0.70m x 2.10m	
Method Tracked excavator	**Logged by** TO	**Date(s)** 23/01/2019
Level (m OD) 301.70	**Compiled by** SA	**Sheet number** Sheet 1 of 1
Co-ordinates 406492mE, 374420mN	**Checked by** SD	**TP18**

Report ref: STQ4642M-G01 **Revision:** 0

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WELL	STRATA DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND	WATER STRIKES	SPT TESTING TYPE / DEPTH (m)	SPT TESTING RESULT	SPT TESTING CASING DEPTH (m)	SPT TESTING WATER LEVEL (m)	OTHER IN SITU TESTING TYPE / DEPTH (m)	OTHER IN SITU TESTING RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
	Grass over dark brown slightly clayey SAND. (TOPSOIL - MADE GROUND)													
	Stiff high strength brown mottled grey very gravelly very sandy CLAY. Gravel consists of fine to medium angular limestone and sandstone. (MADE GROUND)	0.30	302.47									0.30		D
										PP 0.50	PP=125			
	Soft very low strength dark brown very gravelly CLAY. Gravel consists of textile, plastic and brick. (MADE GROUND)	0.80	301.97									0.80		D
										PP 0.90	PP=17			
	Loose dark grey GRAVEL. Gravel consists of angular glass and bricks. (MADE GROUND)	1.00	301.77			C 1.00-1.45	(6) 4							
	...between 1m and 2m depth, no recovery.													
	...between 2m and 3m depth, 5% recovery and becoming very loose.					C 2.00-2.45	(0) 1							
												2.50		D
	CONTINUED ON NEXT SHEET													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Borehole terminated due to obstruction, possibly timber at 3.5m depth. Backfilled with arisings.

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	70
1.00 - 2.00	0
2.00 - 3.00	5
3.00 - 3.50	0

Method Driven tube sampler	**Logged by** TO	**Date(s)** 06/02/2019
Level (m OD) 302.77	**Compiled by** SA	**Sheet number** Sheet 1 of 2
Co-ordinates 406498mE, 374563mN	**Checked by** SD	**DTS01**

Report ref: STQ4642M-G01 **Revision:** 0

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Loose dark grey GRAVEL. Gravel consists of angular glass and bricks. (MADE GROUND)					C 3.00-3.45	(4) 10							
	...between 3m and 3.5m depth, no recovery and becoming medium dense.													
	BOREHOLE TERMINATED AT 3.50m	3.50	299.27											

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Borehole terminated due to obstruction, possibly timber at 3.5m depth. Backfilled with arisings.

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	70
1.00 - 2.00	0
2.00 - 3.00	5
3.00 - 3.50	0

Method Driven tube sampler	**Logged by** TO	**Date(s)** 06/02/2019
Level (m OD) 302.77	**Compiled by** SA	**Sheet number** Sheet 2 of 2
Co-ordinates 406498mE, 374563mN	**Checked by** SD	**DTS01**

Report ref: STQ4642M-G01 **Revision:** 0

Proposed residential development
Nunsfield Road, Buxton

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Grass over dark brown slightly clayey SAND. (TOPSOIL)													
	Medium dense brown slightly clayey SAND. (WEATHERED EYAM LIMESTONE FORMATION)	0.30	301.69									0.30		D
												0.50		D
												0.80		D
						C 1.00-1.45	(4) 11							
												1.20		D
												1.80		D
	Medium dense brown GRAVEL. Gravel consists of medium angular sandstone. (WEATHERED EYAM LIMESTONE FORMATION)	1.90	300.09			C 2.00-2.45	(3) 12							
	Medium dense dark grey to dark brown GRAVEL. Gravel consists of angular shale. (WEATHERED EYAM LIMESTONE FORMATION)	2.30	299.69									2.50		D
	CONTINUED ON NEXT SHEET													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations

Groundwater encountered at 1.9m depth, filling borehole to 1.3m in 10 minutes.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	30
1.00 - 2.00	80
2.00 - 3.00	80
3.00 - 3.90	80

Method Driven tube sampler	**Logged by** TO	**Date(s)** 08/02/2019
Level (m OD) 301.99	**Compiled by** SA	**Sheet number** Sheet 1 of 2
Co-ordinates 406582mE, 374554mN	**Checked by** SD	**DTS02**

Report ref: STQ4642M-G01 **Revision:** 0

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Medium dense dark grey to dark brown GRAVEL. Gravel consists of angular shale. (WEATHERED EYAM LIMESTONE FORMATION) *...from 3m depth, becoming very dense.*					C 3.00-3.08	(25 blows for 40mm penetration) then 50 blows for 40mm penetration					3.50		D
	BOREHOLE TERMINATED AT 3.90m	3.90	298.09											

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations

Groundwater encountered at 1.9m depth, filling borehole to 1.3m in 10 minutes.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	30
1.00 - 2.00	80
2.00 - 3.00	80
3.00 - 3.90	80

Method Driven tube sampler	**Logged by** TO	**Date(s)** 08/02/2019
Level (m OD) 301.99	**Compiled by** SA	**Sheet number** Sheet 2 of 2
Co-ordinates 406582mE, 374554mN	**Checked by** SD	**DTS02**

Proposed residential development
Nunsfield Road, Buxton

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Grass onto dark brown slightly clayey SAND with occasional gravel of fine angular bricks. (MADE GROUND)													
	Stiff medium strength brown slightly sandy CLAY. (WEATHERED EYAM LIMESTONE FORMATION)	0.30	320.45									0.30		D
										PP 0.50	PP=54	0.50		D
	Brown coarse SAND. (WEATHERED EYAM LIMESTONE FORMATION)	0.80	319.95									0.80		D
	Stiff medium strength brown gravelly sandy CLAY. Gravel of fine to medium angular limestone and sandstone. (WEATHERED EYAM LIMESTONE FORMATION)	1.00	319.75			C 1.00-1.45	(5) 14							
										PP 1.30	PP=58	1.20		D
										PP 1.70	PP=63	1.80		D
						C 2.00-2.21	(16) then 50 blows for 60mm penetration							
										PP 2.20	PP=58			
	BOREHOLE TERMINATED AT 2.30m	2.30	318.45									2.30		D

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations

Groundwater encountered at 2.3m depth, filling borehole to 2.0m in 10 minutes.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	100
1.00 - 2.00	100
2.00 - 2.30	100

Method Driven tube sampler	**Logged by** TO	**Date(s)** 08/02/2019
Level (m OD) 320.75	**Compiled by** SA	**Sheet number** Sheet 1 of 1
Co-ordinates 406734mE, 374550mN	**Checked by** SD	**DTS03**

Report ref: STQ4642M-G01 **Revision:** 0

Proposed residential development
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WELL	STRATA DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND	WATER STRIKES	SPT TESTING TYPE / DEPTH (m)	SPT TESTING RESULT	SPT TESTING CASING DEPTH (m)	SPT TESTING WATER LEVEL (m)	OTHER IN SITU TESTING TYPE / DEPTH (m)	OTHER IN SITU TESTING RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
	Grass over dark brown slightly clayey SAND. (TOPSOIL - MADE GROUND)													
	Stiff very high strength brown mottled grey very gravelly very sandy CLAY. Gravel consists of fine to medium angular limestone and sandstone. (MADE GROUND)	0.30	301.36									0.30		D
										PP 0.50	PP=192	0.50		D
	Very loose to loose dark grey slightly clayey GRAVEL. Gravel consists of plastic, shale, slag, coal, timber, pottery and bricks. (MADE GROUND)	0.70	300.96									0.80		D
	...between 1m and 4m depth, 5% recovery.					C 1.00-1.45	(5) 2							
												1.80		D
						C 2.00-2.45	(3) 3							
												2.50		D
	CONTINUED ON NEXT SHEET													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Combined gas and water monitoring standpipe installed.

Groundwater observations

Groundwater encountered at 3m depth. Water level remained constant.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	90
1.00 - 2.00	5
2.00 - 3.00	5
3.00 - 4.00	5
4.00 - 5.00	30

Method Driven tube sampler	**Logged by** TO	**Date(s)** 06/02/2019
Level (m OD) 301.66	**Compiled by** SA	**Sheet number** Sheet 1 of 2
Co-ordinates 406539mE, 374528mN	**Checked by** SD	**DTS04**

Report ref: STQ4642M-G01 **Revision:** 0

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Very loose to loose dark grey slightly clayey GRAVEL. Gravel consists of plastic, shale, slag, coal, timber, pottery and bricks. (MADE GROUND)				▼	C 3.00-3.45	(1) 5					3.50		D
						C 4.00-4.45	(5) 6					4.50		D
	BOREHOLE TERMINATED AT 5.00m	5.00	296.66			C 5.00-5.45	(0) 5							

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Combined gas and water monitoring standpipe installed.

Groundwater observations

Groundwater encountered at 3m depth. Water level remained constant.

Recovery details

Range (m)	Recovery (%)
0.00 - 1.00	90
1.00 - 2.00	5
2.00 - 3.00	5
3.00 - 4.00	5
4.00 - 5.00	30

Title

Driven tube sampler record

Method
Driven tube sampler

Logged by
TO

Date(s)
06/02/2019

Level (m OD)
301.66

Compiled by
SA

Sheet number
Sheet 2 of 2

Co-ordinates
406539mE, 374528mN

Checked by
SD

DTS04

Report ref: STQ4642M-G01

Revision: 0

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Grass over dark brown slightly clayey SAND. (TOPSOIL - MADE GROUND)													
	Medium dense light brown sandy GRAVEL. Gravel consists of medium angular sandstone. (MADE GROUND)	0.30	302.47									0.30		D
												0.50		D
	Very loose dark brown very clayey sandy GRAVEL. Gravel consists of fine to medium angular glass, timber, plastic, slag, paper and textile. (MADE GROUND)	0.60	302.17									0.80		D
						C 1.00-1.45	(3) 3							
												1.20		D
												1.80		D
						C 2.00-2.45	(3) 6							
												2.50		D
	CONTINUED ON NEXT SHEET													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings.

Groundwater observations

Groundwater encountered at 3m depth. Water level remained constant.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	70
1.00 - 2.00	60
2.00 - 3.00	40
3.00 - 4.00	40
4.00 - 5.00	60

Method: Driven tube sampler
Logged by: TO
Date(s): 06/02/2019
Level (m OD): 302.77
Compiled by: SA
Sheet number: Sheet 1 of 2
Co-ordinates: 406505mE, 374478mN
Checked by: SD

DTS05

Report ref: STQ4642M-G01 **Revision:** 0

Proposed residential development
Nunsfield Road, Buxton

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Very loose dark brown very clayey sandy GRAVEL. Gravel consists of fine to medium angular glass, timber, plastic, slag, paper and textile. (MADE GROUND)				▼	C 3.00-3.45	(1) 7					3.50		D
						C 4.00-4.45	(3) 7					4.50		D
	BOREHOLE TERMINATED AT 5.00m	5.00	297.77			C 5.00-5.45	(3) 8							

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings.

Groundwater observations

Groundwater encountered at 3m depth. Water level remained constant.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	70
1.00 - 2.00	60
2.00 - 3.00	40
3.00 - 4.00	40
4.00 - 5.00	60

Method Driven tube sampler	**Logged by** TO	**Date(s)** 06/02/2019
Level (m OD) 302.77	**Compiled by** SA	**Sheet number** Sheet 2 of 2
Co-ordinates 406505mE, 374478mN	**Checked by** SD	**DTS05**

Report ref: STQ4642M-G01 **Revision:** 0

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WELL	STRATA DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND	WATER STRIKES	SPT TESTING TYPE / DEPTH (m)	SPT TESTING RESULT	SPT TESTING CASING DEPTH (m)	SPT TESTING WATER LEVEL (m)	OTHER IN SITU TESTING TYPE / DEPTH (m)	OTHER IN SITU TESTING RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
	Grass over dark brown slightly clayey SAND. (TOPSOIL)													
	Firm medium strength brown gravelly CLAY. Gravel consists of medium to coarse angular limestone. (WEATHERED EYAM LIMESTONE FORMATION)	0.30	308.79									0.30		D
										PP 0.50	PP=50	0.50		D
												0.80		D
						C 1.00-1.45	(0) 0			PP 1.00	PP=54			
										PP 1.20	PP=0	1.20		D
										PP 1.40	PP=50			
										PP 1.80	PP=50	1.80		D
						C 2.00-2.45	(13) 27							
										PP 2.20	PP=63			
												2.50		D
										PP 2.70	PP=50			
	CONTINUED ON NEXT SHEET													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Combined gas and water monitoring standpipe installed. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	100
1.00 - 2.00	30
2.00 - 3.20	60

Method Driven tube sampler	**Logged by** TO	**Date(s)** 08/02/2019
Level (m OD) 309.09	**Compiled by** SA	**Sheet number** Sheet 1 of 2
Co-ordinates 406639mE, 374479mN	**Checked by** SD	**DTS06**

Report ref: STQ4642M-G01 **Revision:** 0

Proposed residential development
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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Firm medium strength brown gravelly CLAY. Gravel consists of medium to coarse angular limestone. (WEATHERED EYAM LIMESTONE FORMATION)					S 3.00-3.21	(25) then 50 blows for 60mm penetration							
	BOREHOLE TERMINATED AT 3.20m	3.20	305.89											

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Combined gas and water monitoring standpipe installed. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	100
1.00 - 2.00	30
2.00 - 3.20	60

Method Driven tube sampler	**Logged by** TO	**Date(s)** 08/02/2019
Level (m OD) 309.09	**Compiled by** SA	**Sheet number** Sheet 2 of 2
Co-ordinates 406639mE, 374479mN	**Checked by** SD	**DTS06**

Report ref: STQ4642M-G01 **Revision:** 0

Proposed residential development
Nunsfield Road, Buxton

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Grass over dark brown slightly clayey SAND. (TOPSOIL)													
	Stiff medium strength brown gravelly CLAY. Gravel consists of medium to coarse angular limestone. (WEATHERED EYAM LIMESTONE FORMATION)	0.30	301.69							PP 0.40	PP=50	0.30		D
										PP 0.60	PP=54	0.50		D
						C 0.80-0.88	(25 blows for 60mm penetration) then 50 blows for 20mm penetration					0.80		D
	BOREHOLE TERMINATED AT 0.88m	0.88	301.11											

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations
No groundwater encountered.

Title
Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 0.80	100

Method
Driven tube sampler

Logged by
TO

Date(s)
08/02/2019

Level (m OD)
301.99

Compiled by
SA

Sheet number
Sheet 1 of 1

Co-ordinates
406569mE, 374447mN

Checked by
SD

DTS07

Report ref: STQ4642M-G01

Revision: 0

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Rough vegetation over loose dark brown to brown very clayey sandy GRAVEL. Gravel consists of fine to medium angular bricks, slag, coal, wood, glass, textile, sandstone and shale. (MADE GROUND)											0.30		D
												0.50		D
												0.80		D
						C 1.00-1.45	(3) 7							
												1.20		D
												1.80		D
						C 2.00-2.45	(1) 1							
												2.50		D
	CONTINUED ON NEXT SHEET													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Borehole terminated due to obstruction.

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	40
1.00 - 2.00	40
2.00 - 3.00	60
3.00 - 4.00	60
4.00 - 5.00	70

Method: Driven tube sampler
Logged by: TO
Date(s): 29/01/2019
Level (m OD): 300.57
Compiled by: SA
Sheet number: Sheet 1 of 2
Co-ordinates: 406513mE, 374408mN
Checked by: SD

DTS08

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Rough vegetation over loose dark brown to brown very clayey sandy GRAVEL. Gravel consists of fine to medium angular bricks, slag, coal, wood, glass, textile, sandstone and shale. (MADE GROUND)					C 3.00-3.45	(25) 36					3.50		D
	...between 3m and 4m depth, becoming dense.					C 4.00-4.45	(4) 15					4.50		D
	BOREHOLE TERMINATED AT 5.00m	5.00	295.57											

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Borehole terminated due to obstruction.

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	40
1.00 - 2.00	40
2.00 - 3.00	60
3.00 - 4.00	60
4.00 - 5.00	70

Method: Driven tube sampler
Logged by: TO
Date(s): 29/01/2019
Level (m OD): 300.57
Compiled by: SA
Sheet number: Sheet 2 of 2
Co-ordinates: 406513mE, 374408mN
Checked by: SD

DTS08

Report ref: STQ4642M-G01 **Revision:** 0

Proposed residential development
Nunsfield Road, Buxton

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Grass onto firm dark brown slightly CLAY. (TOPSOIL)											0.30		D
	Stiff dark grey CLAY. (WEATHERED EYAM LIMESTONE FORMATION)	0.50	313.33			S 0.50-0.52	(25 blows for 20mm penetration)					0.50		D
	BOREHOLE TERMINATED AT 0.60m	0.60	313.23									0.60		D

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations
No groundwater encountered.

Title
Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 0.60	100

Method
Driven tube sampler

Logged by
TO

Date(s)
08/02/2019

Level (m OD)
313.83

Compiled by
SA

Sheet number
Sheet 1 of 1

Co-ordinates
406629mE, 374422mN

Checked by
SD

DTS09

Report ref: STQ4642M-G01

Revision: 0

Proposed residential development
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WELL	STRATA DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND	WATER STRIKES	SPT TESTING TYPE / DEPTH (m)	SPT TESTING RESULT	SPT TESTING CASING DEPTH (m)	SPT TESTING WATER LEVEL (m)	OTHER IN SITU TESTING TYPE / DEPTH (m)	OTHER IN SITU TESTING RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
	Vegetation over dark brown very clayey SAND. (TOPSOIL)													
	Stiff medium strength brown very sandy CLAY. (WEATHERED BOWLAND SHALE FORMATION)	0.30	301.18									0.30		D
										PP 0.50	PP=71	0.50		D
	Medium dense dark grey GRAVEL. Gravel consists of fine angular mudstone. (WEATHERED BOWLAND SHALE FORMATION)	0.80	300.68									0.80		D
						C 1.00-1.45	(6) 17							
												1.20		D
												1.80		D
	...below 2m depth, becoming dense.					C 2.00-2.45	(11) 33							
												2.50		D
	Very weak dark grey thickly laminated MUDSTONE.	2.80	298.68											
	CONTINUED ON NEXT SHEET													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations

Groundwater encountered at 1m depth. Water level remained constant.

Recovery details

Range (m)	Recovery (%)
0.00 - 1.00	100
1.00 - 2.00	80
2.00 - 3.00	100

Title

Driven tube sampler record

Method Driven tube sampler	**Logged by** TO	**Date(s)** 06/02/2019
Level (m OD) 301.48	**Compiled by** SA	**Sheet number** Sheet 1 of 2
Co-ordinates 406524mE, 374385mN	**Checked by** SD	**DTS10**

Report ref: STQ4642M-G01 **Revision:** 0

Proposed residential development
Nunsfield Road, Buxton

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Very weak dark grey thickly laminated MUDSTONE. (WEATHERED BOWLAND SHALE FORMATION)	3.00	298.48			C 3.00-3.45	(15) 40					3.00		D
	BOREHOLE TERMINATED AT 3.00m													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations

Groundwater encountered at 1m depth. Water level remained constant.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	100
1.00 - 2.00	80
2.00 - 3.00	100

Method
Driven tube sampler

Logged by
TO

Date(s)
06/02/2019

Level (m OD)
301.48

Compiled by
SA

Sheet number
Sheet 2 of 2

Co-ordinates
406524mE, 374385mN

Checked by
SD

DTS10

Report ref: STQ4642M-G01

Revision: 0

Proposed residential development
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WELL	STRATA DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND	WATER STRIKES	SPT TESTING TYPE / DEPTH (m)	SPT TESTING RESULT	SPT TESTING CASING DEPTH (m)	SPT TESTING WATER LEVEL (m)	OTHER IN SITU TESTING TYPE / DEPTH (m)	OTHER IN SITU TESTING RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
	Grass over dark brown slightly sandy CLAY. (TOPSOIL)											0.30		D
	Stiff medium strength brown to grey very gravelly slightly sandy CLAY. Gravel consists of fine to coarse angular limestone. (WEATHERED EYAM LIMESTONE FORMATION)	0.50	316.51									0.50		D
										PP 0.80	PP=58	0.80		D
						S 1.00-1.45	(6) 19							
										PP 1.20	PP=63	1.20		D
						S 1.50-1.72	(17) then 50 blows for 75mm penetration							
	BOREHOLE TERMINATED AT 1.72m	1.72	315.29											

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	100
1.00 - 1.50	100

Method
Driven tube sampler

Logged by
TO

Date(s)
08/02/2019

Level (m OD)
317.01

Compiled by
SA

Sheet number
Sheet 1 of 1

Co-ordinates
406660mE, 374339mN

Checked by
SD

DTS11

Report ref: STQ4642M-G01

Revision: 0

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Grass over dark brown slightly clayey SAND. (TOPSOIL)											0.30		D
	Stiff medium strength brown gravelly slightly sandy CLAY. Gravel consists of medium to coarse angular limestone. (WEATHERED EYAM LIMESTONE FORMATION)	0.40	317.61									0.50		D
						S 1.00-1.45	(6) 19			PP 1.00	PP=50	0.80		D
										PP 1.40	PP=54	1.20		D
										PP 1.80	PP=50	1.80		D
	Stiff brown gravelly slightly sandy CLAY. Gravel consists of medium to coarse angular limestone. (WEATHERED EYAM LIMESTONE FORMATION) *...between 1.9m and 2.2m depth, very weak light grey limestone cobble encountered.*	1.90	316.11			S 2.00-2.45	(17) then 50 blows for 446mm penetration							
	BOREHOLE TERMINATED AT 2.44m	2.45	315.56									2.40		D

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	90
1.00 - 2.00	40
2.00 - 2.40	60

Method Driven tube sampler	**Logged by** TO	**Date(s)** 08/02/2019
Level (m OD) 318.01	**Compiled by** SA	**Sheet number** Sheet 1 of 1
Co-ordinates 406691mE, 374450mN	**Checked by** SD	**DTS12**

Report ref: STQ4642M-G01 **Revision:** 0

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WELL	STRATA DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND	WATER STRIKES	SPT TESTING TYPE / DEPTH (m)	SPT TESTING RESULT	SPT TESTING CASING DEPTH (m)	SPT TESTING WATER LEVEL (m)	OTHER IN SITU TESTING TYPE / DEPTH (m)	OTHER IN SITU TESTING RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
	Grass onto dark brown clayey SAND. (TOPSOIL - MADE GROUND)													
	Loose dark brown mottled orangish brown clayey very gravelly SAND. Gravel consists of fine angular slag, brick, coal and glass. (MADE GROUND)	0.30	322.96									0.30		D
												0.50		D
												0.80		D
						C 1.00-1.45	(3) 3							
												1.20		D
	Stiff high strength orangish brown sandy CLAY. (WEATHERED BEE LOW LIMESTONE FORMATION)	1.30	321.96							PP 1.50	PP=100			
												1.80		D
						S 2.00-2.45	(7) 16			PP 2.00	PP=104			
										PP 2.50	PP=117	2.50		D
	CONTINUED ON NEXT SHEET													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Combined gas and water monitoring standpipe installed.

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	90
1.00 - 2.00	70
2.00 - 3.00	100
3.00 - 4.00	100
4.00 - 5.00	90

Method Driven tube sampler	**Logged by** TO	**Date(s)** 31/01/2019
Level (m OD) 323.26	**Compiled by** SA	**Sheet number** Sheet 1 of 2
Co-ordinates 406827mE, 374235mN	**Checked by** SD	**DTS13**

Report ref: STQ4642M-G01 **Revision:** 0

Proposed residential development
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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Stiff high strength orangish brown sandy CLAY. (WEATHERED BEE LOW LIMESTONE FORMATION)					S 3.00-3.45	(8) 15			PP 3.00	PP=85			
										PP 3.50	PP=92	3.50		D
						S 4.00-4.45	(10) 11			PP 4.00	PP=96			
										PP 4.50	PP=96	4.50		D
						S 5.00-5.45	(9) 16							
	BOREHOLE TERMINATED AT 5.45m	5.45	317.81											

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Combined gas and water monitoring standpipe installed.

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	90
1.00 - 2.00	70
2.00 - 3.00	100
3.00 - 4.00	100
4.00 - 5.00	90

Method Driven tube sampler	**Logged by** TO	**Date(s)** 31/01/2019
Level (m OD) 323.26	**Compiled by** SA	**Sheet number** Sheet 2 of 2
Co-ordinates 406827mE, 374235mN	**Checked by** SD	**DTS13**

Report ref: STQ4642M-G01 **Revision:** 0

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Grass over dark brown slightly clayey SAND. (TOPSOIL)											0.30		D
	Stiff medium strength brown gravelly CLAY. Gravel consists of medium to coarse angular limestone. (WEATHERED EYAM LIMESTONE FORMATION)	0.50	313.89									0.50		D
										PP 0.80	PP=50	0.80		D
						S 1.00-1.45	(1) 2							
										PP 1.20	PP=50	1.20		D
	BOREHOLE TERMINATED AT 1.50m	1.50	312.89			C 1.50-1.52	(25 blows for 10mm penetration) then 50 blows for 10mm penetration							

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	100
1.00 - 1.52	100

Method
Driven tube sampler

Logged by
TO

Date(s)
08/02/2019

Level (m OD)
314.39

Compiled by
SA

Sheet number
Sheet 1 of 1

Co-ordinates
406643mE, 374289mN

Checked by
SD

DTS15

Report ref: STQ4642M-G01

Revision: 0

Proposed residential development
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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Grass over medium dense dark brown to brown sandy GRAVEL with occasional gravel-sized pockets of soft clay. Gravel consists of fine to medium angular limestone, shale and timber. (MADE GROUND)											0.30		D
												0.50		D
												0.80		D
												1.20		D
	Soft dark grey slightly silty gravelly CLAY. Gravel consists of fine to medium angular to sub-angular shale and limestone. (WEATHERED BOWLAND SHALE FORMATION)	1.50	292.23									1.80		D
												2.50		D
	BOREHOLE TERMINATED AT 2.60m	2.60	291.13											

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations

Groundwater encountered at 1m depth, filling borehole to 0.5m depth in 10 minutes.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	80
1.00 - 2.00	80
2.00 - 2.60	80

Method Driven tube sampler	**Logged by** TO	**Date(s)** 06/02/2019
Level (m OD) 293.73	**Compiled by** SA	**Sheet number** Sheet 1 of 1
Co-ordinates 406445mE, 374305mN	**Checked by** SD	**DTS16**

Report ref: STQ4642M-G01 **Revision:** 0

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WELL	STRATA DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND	WATER STRIKES	SPT TESTING TYPE / DEPTH (m)	SPT RESULT	SPT CASING DEPTH (m)	SPT WATER LEVEL (m)	OTHER IN SITU TESTING TYPE / DEPTH (m)	OTHER IN SITU RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
	Grass over dark brown slightly clayey SAND. (TOPSOIL)													
	Stiff high strength brown gravelly slightly sandy CLAY. Gravel consists of medium to coarse angular limestone. (WEATHERED EYAM LIMESTONE FORMATION)	0.30	296.87									0.30		D
												0.40		D
										PP 0.50	PP=96			
												0.80		D
						S 1.00-1.45	(1) 3			PP 1.00	PP=100			
												1.20		D
										PP 1.30	PP=88			
										PP 1.70	PP=100			
	Stiff high strength brown gravelly sandy CLAY. Gravel consists of medium to coarse angular limestone. (WEATHERED EYAM LIMESTONE FORMATION) *...between 1.8m and 1.9m depth, very weak grey limestone cobble encountered.*	1.80	295.37									1.80		D
						S 2.00-2.45	(25) 41							
										PP 2.10	PP=88			
										PP 2.30	PP=88			
												2.50		D
										PP 2.80	PP=88			
	CONTINUED ON NEXT SHEET													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations

No groundwater encountered.

Recovery details

Range (m)	Recovery (%)
0.00 - 1.00	90
1.00 - 2.00	60
2.00 - 3.00	70
3.00 - 3.60	100

Title

Driven tube sampler record

Method Driven tube sampler	**Logged by** TO	**Date(s)** 06/02/2019
Level (m OD) 297.17	**Compiled by** SA	**Sheet number** Sheet 1 of 2
Co-ordinates 406499mE, 374309mN	**Checked by** SD	**DTS17**

Report ref: STQ4642M-G01 **Revision:** 0

Proposed residential development
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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Stiff high strength brown gravelly sandy CLAY. Gravel consists of medium to coarse angular limestone. (WEATHERED EYAM LIMESTONE FORMATION)					S 3.00-3.45	(4) 13			PP 3.10	PP=96			
										PP 3.40	PP=88	3.50		D
	BOREHOLE TERMINATED AT 3.60m	3.60	293.57			C 3.60-3.66	(25 blows for 20mm penetration) then 50 blows for 40mm penetration							

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	90
1.00 - 2.00	60
2.00 - 3.00	70
3.00 - 3.60	100

Method
Driven tube sampler

Logged by
TO

Date(s)
06/02/2019

Level (m OD)
297.17

Compiled by
SA

Sheet number
Sheet 2 of 2

Co-ordinates
406499mE, 374309mN

Checked by
SD

DTS17

Report ref: STQ4642M-G01

Revision: 0

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Grass over dark brown clayey SAND. (MADE GROUND - REWORKED TOPSOIL)													
	Loose to medium dense dark brown mottled orangish brown dark grey slightly sandy GRAVEL. Gravel consists of fine angular slag, brick, coal and glass. (MADE GROUND)	0.30	323.96									0.30		D
												0.50		D
												0.80		D
						S 1.00-1.45	(4) 13			PP 1.00	PP=96			
												1.20		D
										PP 1.50	PP=100			
												1.80		D
						S 2.00-2.45	(1) 5			PP 2.00	PP=100			
										PP 2.50	PP=92	2.50		D
	CONTINUED ON NEXT SHEET													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings.

Groundwater observations
No groundwater encountered.

Recovery details

Range (m)	Recovery (%)
0.00 - 1.00	80
1.00 - 2.00	90
2.00 - 3.00	90
3.00 - 4.00	50
4.00 - 5.00	30

Title
Driven tube sampler record

Method
Driven tube sampler

Logged by
TO

Date(s)
31/01/2019

Level (m OD)
324.26

Compiled by
SA

Sheet number
Sheet 1 of 2

Co-ordinates
406749mE, 374220mN

Checked by
SD

DTS18

Report ref: STQ4642M-G01

Revision: 0

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Loose to medium dense dark brown mottled orangish brown dark grey slightly sandy GRAVEL. Gravel consists of fine angular slag, brick, coal and glass. (MADE GROUND)	3.00	321.26			S 3.00-3.45	(1) 2			PP 3.10	PP=0			
	Soft low strength orangish brown sandy CLAY. (POSSIBLE REWORKED WEATHERED BEE LOW LIMESTONE FORMATION)									PP 3.60	PP=0	3.50		D
						S 4.00-4.45	(0) 0			PP 4.10	PP=4			
										PP 4.70	PP=4	4.50		D
						S 5.00-5.45	(0) 0							
	BOREHOLE TERMINATED AT 5.45m	5.45	318.81											

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings.

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	80
1.00 - 2.00	90
2.00 - 3.00	90
3.00 - 4.00	50
4.00 - 5.00	30

Method Driven tube sampler	**Logged by** TO	**Date(s)** 31/01/2019
Level (m OD) 324.26	**Compiled by** SA	**Sheet number** Sheet 2 of 2
Co-ordinates 406749mE, 374220mN	**Checked by** SD	**DTS18**

Report ref: STQ4642M-G01 **Revision:** 0

Proposed residential development
Nunsfield Road, Buxton

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Grass over medium dense dark brown to dark grey SAND. Gravel consists of medium angular shale, brick, sandstone and brick. (MADE GROUND)											0.30		D
												0.50		D
												0.80		D
	Loose to medium dense orangish brown slightly clayey GRAVEL. Gravel consists fine to coarse angular shale. (WEATHERED BOWLAND SHALE FORMATION)	1.00	300.79			C 1.00-1.45	(4) 12					1.20		D
												1.80		D
						C 2.00-2.45	(3) 9							
												2.50		D
	CONTINUED ON NEXT SHEET													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Combined gas and water monitoring standpipe installed.

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	90
1.00 - 2.00	90
2.00 - 3.00	90
3.00 - 4.00	90
4.00 - 5.00	50

Method Driven tube sampler	**Logged by** TO	**Date(s)** 30/01/2019
Level (m OD) 301.79	**Compiled by** SA	**Sheet number** Sheet 1 of 2
Co-ordinates 406363mE, 374278mN	**Checked by** SD	**DTS19**

Report ref: STQ4642M-G01 **Revision:** 0

Proposed residential development
Nunsfield Road, Buxton

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Loose to medium dense orangish brown slightly clayey GRAVEL. Gravel consists fine to coarse angular shale. (WEATHERED BOWLAND SHALE FORMATION)					C 3.00-3.45	(2) 8					3.20	3.20	W
	Stiff high strength orangish brown mottled grey slightly silty CLAY. (WEATHERED BOWLAND SHALE FORMATION)	3.50	298.29							PP 3.60	PP=104	3.50 3.50	3.50	D D
						S 4.00-4.45	(8) 17							
										PP 4.20	PP=100			
												4.50		D
										PP 4.70	PP=104			
						S 5.00-5.39	(12) then 50 blows for 240mm penetration							
	BOREHOLE TERMINATED AT 5.39m	5.39	296.40											

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Combined gas and water monitoring standpipe installed.

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	90
1.00 - 2.00	90
2.00 - 3.00	90
3.00 - 4.00	90
4.00 - 5.00	50

Method Driven tube sampler	**Logged by** TO	**Date(s)** 30/01/2019
Level (m OD) 301.79	**Compiled by** SA	**Sheet number** Sheet 2 of 2
Co-ordinates 406363mE, 374278mN	**Checked by** SD	**DTS19**

Report ref: STQ4642M-G01 **Revision:** 0

Proposed residential development
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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Grass over dark brown clayey SAND. (MADE GROUND)													
	Very loose brown to dark grey mottled brown very gravelly slightly clayey SAND. Gravel consists of fine to medium angular bricks, slag, coal and shale. (MADE GROUND)	0.30	297.10									0.30		D
												0.50		D
												0.80		D
						S 1.00-1.45	(1) 0							
												1.20		D
												1.80		D
						S 2.00-2.45	(1) 2							
												2.50		D
	CONTINUED ON NEXT SHEET													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings.

Groundwater observations
No groundwater encountered.

Title
Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	90
1.00 - 2.00	50
2.00 - 3.00	90
3.00 - 4.00	50
4.00 - 5.00	70

Method
Driven tube sampler

Logged by
TO

Date(s)
30/01/2019

Level (m OD)
297.40

Compiled by
SA

Sheet number
Sheet 1 of 2

Co-ordinates
406378mE, 374209mN

Checked by
SD

DTS20

Report ref: STQ4642M-G01

Revision: 0

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Very loose brown to dark grey mottled brown very gravelly slightly clayey SAND. Gravel consists of fine to medium angular bricks, slag, coal and shale. (MADE GROUND)					S 3.00-3.45	(8) 14					3.50		D
	...below 3m depth, becoming loose and medium dense.					S 4.00-4.45	(8) 12					4.50		D
	BOREHOLE TERMINATED AT 5.00m	5.00	292.40			S 5.00-5.45	(5) 8							

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings.

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	90
1.00 - 2.00	50
2.00 - 3.00	90
3.00 - 4.00	50
4.00 - 5.00	70

Method: Driven tube sampler
Logged by: TO
Date(s): 30/01/2019
Level (m OD): 297.40
Compiled by: SA
Sheet number: Sheet 2 of 2
Co-ordinates: 406378mE, 374209mN
Checked by: SD

DTS20

Report ref: STQ4642M-G01 **Revision:** 0

Proposed residential development
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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Grass over loose dark brown to dark grey SAND. Gravel consists of medium angular shale, brick and sandstone. (MADE GROUND)											0.30		D
												0.50		D
												0.80		D
	Firm medium strength brown to grey gravelly slightly sandy CLAY. Gravel consists of fine to medium angular brick, shale, slag, coal, sandstone and timber. (MADE GROUND)	0.90	301.47			C 1.00-1.45	(2) 5			PP 1.00	PP=54			
												1.20		D
										PP 1.50	PP=50			
												1.80		D
						C 2.00-2.45	(2) 5			PP 2.00	PP=63			
	Stiff very high to high strength grey mottled greyish brown CLAY. (WEATHERED BOWLAND SHALE FORMATION)	2.20	300.17											
										PP 2.50	PP=150	2.50		D
	CONTINUED ON NEXT SHEET													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings.

Groundwater observations
No groundwater encountered.

Title
Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	90
1.00 - 2.00	100
2.00 - 3.00	75
3.00 - 4.00	75
4.00 - 5.00	100

Method Driven tube sampler	**Logged by** TO	**Date(s)** 30/01/2019
Level (m OD) 302.37	**Compiled by** SA	**Sheet number** Sheet 1 of 2
Co-ordinates 406261mE, 374158mN	**Checked by** SD	**DTS21**

Report ref: STQ4642M-G01 **Revision:** 0

Proposed residential development
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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Stiff very high to high strength grey mottled greyish brown CLAY. (WEATHERED BOWLAND SHALE FORMATION)					C 3.00-3.45	(2) 5			PP 3.00	PP=142			
										PP 3.50	PP=150	3.50		D
						S 4.00-4.45	(3) 13			PP 4.00	PP=150			
										PP 4.50	PP=146	4.50		D
						S 5.00-5.45	(9) 30							
	BOREHOLE TERMINATED AT 5.45m	5.45	296.92											

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings.

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	90
1.00 - 2.00	100
2.00 - 3.00	75
3.00 - 4.00	75
4.00 - 5.00	100

Method
Driven tube sampler

Logged by
TO

Date(s)
30/01/2019

Level (m OD)
302.37

Compiled by
SA

Sheet number
Sheet 2 of 2

Co-ordinates
406261mE, 374158mN

Checked by
SD

DTS21

Report ref: STQ4642M-G01

Revision: 0

Proposed residential development
Nunsfield Road, Buxton

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WELL	STRATA DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND	WATER STRIKES	SPT TESTING TYPE / DEPTH (m)	SPT TESTING RESULT	SPT TESTING CASING DEPTH (m)	SPT TESTING WATER LEVEL (m)	OTHER IN SITU TESTING TYPE / DEPTH (m)	OTHER IN SITU TESTING RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
	Grass over dark brown clayey SAND. (TOPSOIL - MADE GROUND)													
	Loose dark brown to dark grey mottled brown very gravelly slightly clayey SAND. Gravel consists of bricks, slag, shale and coal. (MADE GROUND)	0.30	295.40									0.30		D
												0.50		D
												0.80		D
						C 1.00-1.45	(1) 5							
												1.20		D
	Stiff medium strength light brown CLAY. (POSSIBLE REWORKED WEATHERED BOWLAND SHALE FORMATION)	1.50	294.20							PP 1.60	PP=50			
												1.80		D
						S 2.00-2.45	(0) 6			PP 2.00	PP=8			
	Stiff medium to high strength dark grey very gravelly CLAY. Gravel consists of fine to medium shale. (WEATHERED BOWLAND SHALE FORMATION)	2.40	293.30							PP 2.50	PP=54	2.50		D
										PP 2.80	PP=100			
	CONTINUED ON NEXT SHEET													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings.

Groundwater observations
No groundwater encountered.

Title
Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	100
1.00 - 2.00	100
2.00 - 3.00	100
3.00 - 4.00	100
4.00 - 5.00	100

Method
Driven tube sampler

Logged by
TO

Date(s)
29/01/2019

Level (m OD)
295.70

Compiled by
SA

Sheet number
Sheet 1 of 2

Co-ordinates
406289mE, 374110mN

Checked by
SD

DTS22

Report ref: STQ4642M-G01

Revision: 0

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Stiff medium to high strength dark grey very gravelly CLAY. Gravel consists of fine to medium shale. (WEATHERED BOWLAND SHALE FORMATION)					S 3.00-3.45	(6) 25							
										PP 3.50	PP=108	3.50		D
						S 4.00-4.45	(11) 35							
						S 5.00-5.42	(17) then 50 blows for 265mm penetration							
	BOREHOLE TERMINATED AT 5.42m	5.42	290.28											

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings.

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	100
1.00 - 2.00	100
2.00 - 3.00	100
3.00 - 4.00	100
4.00 - 5.00	100

Method
Driven tube sampler

Logged by
TO

Date(s)
29/01/2019

Level (m OD)
295.70

Compiled by
SA

Sheet number
Sheet 2 of 2

Co-ordinates
406289mE, 374110mN

Checked by
SD

DTS22

Report ref: STQ4642M-G01

Revision: 0

Proposed residential development
Nunsfield Road, Buxton

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WELL	STRATA DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND	WATER STRIKES	SPT TESTING TYPE / DEPTH (m)	SPT TESTING RESULT	SPT TESTING CASING DEPTH (m)	SPT TESTING WATER LEVEL (m)	OTHER IN SITU TESTING TYPE / DEPTH (m)	OTHER IN SITU TESTING RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
	Grass onto dark brown clayey SAND. (TOPSOIL - MADE GROUND)													
	Very loose dark brown dark grey mottled brown very gravelly slightly clayey SAND. Gravel consists of fine to medium angular brick, slag, shale and coal. (MADE GROUND)	0.30	294.90									0.30		D
												0.50		D
												0.80		D
						C 1.00-1.45	(1) 1							
												1.20		D
												1.80		D
						C 2.00-2.45	(0) 0							
	Stiff medium strength light brown CLAY. (WEATHERED BOWLAND SHALE FORMATION)	2.30	292.90											
										PP 2.50	PP=50	2.50		D
	CONTINUED ON NEXT SHEET	2.90	292.30											

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings.

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	100
1.00 - 2.00	75
2.00 - 3.00	60
3.00 - 4.00	60

Method Driven tube sampler	**Logged by** TO	**Date(s)** 29/01/2019
Level (m OD) 295.20	**Compiled by** SA	**Sheet number** Sheet 1 of 2
Co-ordinates 406350mE, 374092mN	**Checked by** SD	**DTS23**

Report ref: STQ4642M-G01 **Revision:** 0

Proposed residential development
Nunsfield Road, Buxton

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Stiff dark grey very gravelly CLAY. Gravel consists of fine to medium very thinly laminated shale. (WEATHERED BOWLAND SHALE FORMATION)					S 3.00-3.45	(1) 4					3.50		D
						S 4.00-4.45	(2) 19							
	BOREHOLE TERMINATED AT 4.45m	4.45	290.75											

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings.

Groundwater observations
No groundwater encountered.

Title
Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	100
1.00 - 2.00	75
2.00 - 3.00	60
3.00 - 4.00	60

Method
Driven tube sampler

Logged by
TO

Date(s)
29/01/2019

Level (m OD)
295.20

Compiled by
SA

Sheet number
Sheet 2 of 2

Co-ordinates
406350mE, 374092mN

Checked by
SD

DTS23

Report ref: STQ4642M-G01

Revision: 0

Proposed residential development
Nunsfield Road, Buxton

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WELL	STRATA DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND	WATER STRIKES	SPT TESTING TYPE / DEPTH (m)	SPT TESTING RESULT	SPT TESTING CASING DEPTH (m)	SPT TESTING WATER LEVEL (m)	OTHER IN SITU TESTING TYPE / DEPTH (m)	OTHER IN SITU TESTING RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
	Grass over dark brown SAND. (TOPSOIL - MADE GROUND)													
	Very loose dark brown mottled orangish brown clayey gravelly SAND. Gravel consists of fine to medium angular bricks, sandstone and coal. (MADE GROUND)	0.30	294.45									0.30		D
												0.50		D
												0.80		D
	...from 1m depth, becoming dark grey.					C 1.00-1.45	(1) 0							
	Stiff high to very high strength dark grey very gravelly CLAY. Gravel consists of fine to medium angular shale. (WEATHERED BOWLAND SHALE FORMATION)	2.00	292.75			C 2.00-2.45	(1) 7			PP 2.00	PP=150			
										PP 2.50	PP=121	2.50		D
	CONTINUED ON NEXT SHEET													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Combined gas and water monitoring standpipe installed.

Groundwater observations

Groundwater encountered at 3m depth. Water level remained constant upon completion.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	100
1.00 - 2.00	40
2.00 - 3.00	70
3.00 - 4.00	100
4.00 - 5.00	100

Method Driven tube sampler	**Logged by** TO	**Date(s)** 29/01/2019
Level (m OD) 294.75	**Compiled by** SA	**Sheet number** Sheet 1 of 2
Co-ordinates 406261mE, 374067mN	**Checked by** SD	**DTS24**

Report ref: STQ4642M-G01 **Revision:** 0

Proposed residential development
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WELL	STRATA DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND	WATER STRIKES	SPT TESTING TYPE / DEPTH (m)	SPT TESTING RESULT	SPT TESTING CASING DEPTH (m)	SPT TESTING WATER LEVEL (m)	OTHER IN SITU TESTING TYPE / DEPTH (m)	OTHER IN SITU TESTING RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
	Stiff high to very high strength dark grey very gravelly CLAY. Gravel consists of fine to medium angular shale. (WEATHERED BOWLAND SHALE FORMATION)				▼	C 3.00-3.45	(8) 23			PP 3.00	PP=113			
										PP 3.50	PP=138	3.50		D
						C 4.00-4.45	(16) 43			PP 4.00	PP=142			
										PP 4.50	PP=108	4.50		D
	BOREHOLE TERMINATED AT 5.00m	5.00	289.75			C 5.00-5.11	(24 blows for 75mm penetration) then 50 blows for 30mm penetration							

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Combined gas and water monitoring standpipe installed.

Groundwater observations

Groundwater encountered at 3m depth. Water level remained constant upon completion.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	100
1.00 - 2.00	40
2.00 - 3.00	70
3.00 - 4.00	100
4.00 - 5.00	100

Method
Driven tube sampler

Logged by
TO

Date(s)
29/01/2019

Level (m OD)
294.75

Compiled by
SA

Sheet number
Sheet 2 of 2

Co-ordinates
406261mE, 374067mN

Checked by
SD

DTS24

Report ref: STQ4642M-G01

Revision: 0

Proposed residential development
Nunsfield Road, Buxton

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Grass onto dark brown clayey SAND. (TOPSOIL - MADE GROUND)													
	Very loose to loose dark brown dark grey mottled orangish brown very gravelly clayey SAND. Gravel consists of fine to medium angular brick, slag and coal. (MADE GROUND)	0.30	293.62									0.30		D
												0.50		D
												0.80		D
						C 1.00-1.45	(3) 8							
												1.20		D
												1.80		D
						C 2.00-2.45	(0) 1							
												2.50		D
	CONTINUED ON NEXT SHEET													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings.

Groundwater observations
No groundwater encountered.

Title
Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	100
1.00 - 2.00	80
2.00 - 3.00	50
3.00 - 4.00	40
4.00 - 5.44	100

Method
Driven tube sampler

Logged by
TO

Date(s)
29/01/2019

Level (m OD)
293.92

Compiled by
SA

Sheet number
Sheet 1 of 2

Co-ordinates
406325mE, 374016mN

Checked by
SD

DTS25

Report ref: STQ4642M-G01

Revision: 0

Proposed residential development
Nunsfield Road, Buxton

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Very loose to loose dark brown dark grey mottled orangish brown very gravelly clayey SAND. Gravel consists of fine to medium angular brick, slag and coal. (MADE GROUND)	3.00	290.92			S 3.00-3.45	(4) 12							
	Stiff high strength dark grey mottled light brown gravelly CLAY. Gravel consists of medium angular very thinly laminated shale. (WEATHERED BOWLAND SHALE FORMATION)									PP 3.50	PP=100	3.50		D
										PP 3.90	PP=104			
						S 4.00-4.45	(13) 42							
												4.50		D
										PP 4.90	PP=104			
						S 5.00-5.45	(22) then 50 blows for 296 penetration							
	BOREHOLE TERMINATED AT 5.44m	5.44	288.48											

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings.

Groundwater observations
No groundwater encountered.

Title
Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	100
1.00 - 2.00	80
2.00 - 3.00	50
3.00 - 4.00	40
4.00 - 5.44	100

Method
Driven tube sampler

Logged by
TO

Date(s)
29/01/2019

Level (m OD)
293.92

Compiled by
SA

Sheet number
Sheet 2 of 2

Co-ordinates
406325mE, 374016mN

Checked by
SD

DTS25

Report ref: STQ4642M-G01

Revision: 0

Proposed residential development
Nunsfield Road, Buxton

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Grass over dark brown clayey SAND. (TOPSOIL - MADE GROUND)													
	Dark brown to dark grey mottled brown very gravelly slightly clayey SAND. Gravel consists of fine to medium angular bricks, slag, shale and coal. (MADE GROUND)	0.30	288.75									0.30		D
												0.50		D
	Stiff high strength dark grey very gravelly CLAY. Gravel consists of fine to medium angular shale. (POSSIBLE REWORKED WEATHERED BOWLAND SHALE FORMATION)	0.60	288.45							PP 0.80	PP=113	0.80		D
						S 1.00-1.45	(0) 0							
										PP 1.30	PP=108	1.20		D
												1.80		D
	Medium dense to very dense dark grey GRAVEL. Gravel consists of fine to coarse angular shale. (WEATHERED BOWLAND SHALE FORMATION)	1.90	287.15			S 2.00-2.45	(9) 28							
												2.50		D
	CONTINUED ON NEXT SHEET													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	100
1.00 - 2.00	90
2.00 - 3.00	100

Method Driven tube sampler	**Logged by** TO	**Date(s)** 29/01/2019
Level (m OD) 289.05	**Compiled by** SA	**Sheet number** Sheet 1 of 2
Co-ordinates 406285mE, 374011mN	**Checked by** SD	**DTS26**

Report ref: STQ4642M-G01 **Revision:** 0

Proposed residential development
Nunsfield Road, Buxton

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environmental and geotechnical consultants

WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Medium dense to very dense dark grey GRAVEL. Gravel consists of fine to coarse angular shale. (WEATHERED BOWLAND SHALE FORMATION)	3.00	286.05			C 3.00-3.36	(17) then 50 blows for 210mm penetration							
	BOREHOLE TERMINATED AT 3.00m													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	100
1.00 - 2.00	90
2.00 - 3.00	100

Method
Driven tube sampler

Logged by
TO

Date(s)
29/01/2019

Level (m OD)
289.05

Compiled by
SA

Sheet number
Sheet 2 of 2

Co-ordinates
406285mE, 374011mN

Checked by
SD

DTS26

Report ref: STQ4642M-G01

Revision: 0

Proposed residential development
Nunsfield Road, Buxton

soiltechnics
environmental and geotechnical consultants

WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Grass over dark brown slightly clayey SAND. (TOPSOIL - MADE GROUND)													
	Stiff brown mottled grey very gravelly very sandy CLAY. Gravel consists of fine to medium angular limestone and sandstone. (MADE GROUND)	0.30	303.29									0.30		D
	Dark brown very clayey GRAVEL. Gravel consists of fine to medium angular shell, bricks, plastic, timber, slag and coal. (MADE GROUND)	0.50	303.09									0.50		D
												0.80		D
												1.20		D
												1.80		D
												2.50		D
	CONTINUED ON NEXT SHEET													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings.

Groundwater observations
No groundwater encountered.

Title
Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	90
1.00 - 2.00	60
2.00 - 3.00	40
3.00 - 4.00	100

Method
Driven tube sampler

Logged by
TO

Date(s)
06/02/2019

Level (m OD)
303.59

Compiled by
SA

Sheet number
Sheet 1 of 2

Co-ordinates
406486mE, 374505mN

Checked by
SD

DTS27

Report ref: STQ4642M-G01

Revision: 0

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Dark brown very clayey GRAVEL. Gravel consists of fine to medium angular shell, bricks, plastic, timber, slag and coal. (MADE GROUND)											3.50		D
	BOREHOLE TERMINATED AT 4.00m	4.00	299.59											

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes
Backfilled with arisings.

Groundwater observations
No groundwater encountered.

Title
Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	90
1.00 - 2.00	60
2.00 - 3.00	40
3.00 - 4.00	100

Method
Driven tube sampler

Logged by
TO

Date(s)
06/02/2019

Level (m OD)
303.59

Compiled by
SA

Sheet number
Sheet 2 of 2

Co-ordinates
406486mE, 374505mN

Checked by
SD

DTS27

Report ref: STQ4642M-G01

Revision: 0

Proposed residential development
Nunsfield Road, Buxton

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Vegetation over dark brown very clayey SAND. (TOPSOIL)													
	Stiff medium strength brown very sandy CLAY. (WEATHERED BOWLAND SHALE FORMATION)	0.30	299.13									0.30		D
												0.50		D
	Dark grey GRAVEL. Gravel consists of fine angular shale. (WEATHERED BOWLAND SHALE FORMATION)	0.80	298.63									0.80		D
												1.20		D
												1.50		D
	BOREHOLE TERMINATED AT 2.80m	2.80	296.63											

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings. Borehole terminated due to competency of deposits (likely bedrock).

Groundwater observations

No groundwater encountered.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	95
1.00 - 1.50	100

Method
Driven tube sampler

Logged by
TO

Date(s)
06/02/2019

Level (m OD)
299.43

Compiled by
SA

Sheet number
Sheet 1 of 1

Co-ordinates
406514mE, 374343mN

Checked by
SD

DTS28

Report ref: STQ4642M-G01

Revision: 0

Proposed residential development
Nunsfield Road, Buxton

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Grass onto dark brown SAND. (MADE GROUND)													
	Dark brown mottled orangish brown clayey gravelly SAND. Gravel consists of fine to medium angular brick, sandstone, slag and coal. (MADE GROUND)	0.30	294.29									0.30		D
												0.50		D
												0.80		D
												1.20		D
												1.80		D
	Stiff high to very high strength dark grey very gravelly CLAY. Gravel consists of fine to medium angular slag. (MADE GROUND)	2.00	292.59							PP 2.00	PP=150			
										PP 2.50	PP=121	2.50		D
	CONTINUED ON NEXT SHEET													

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings.

Groundwater observations

Groundwater encountered at 3m depth. Water level remained constant.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	100
1.00 - 2.00	40
2.00 - 3.00	70
3.00 - 4.00	100
4.00 - 5.00	100

Method Driven tube sampler	**Logged by** TO	**Date(s)** 29/01/2019
Level (m OD) 294.59	**Compiled by** SA	**Sheet number** Sheet 1 of 2
Co-ordinates 406458mE, 374338mN	**Checked by** SD	**DTS29**

Report ref: STQ4642M-G01 **Revision:** 0

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WELL	STRATA				WATER STRIKES	SPT TESTING				OTHER IN SITU TESTING		SAMPLING		
	DESCRIPTION	DEPTH (m)	REDUCED LVL (m OD)	LEGEND		TYPE / DEPTH (m)	RESULT	CASING DEPTH (m)	WATER LEVEL (m)	TYPE / DEPTH (m)	RESULT	FROM (m)	TO (m)	TYPE
	Stiff high to very high strength dark grey very gravelly CLAY. Gravel consists of fine to medium angular slag. (MADE GROUND)				▼					PP 3.00	PP=113			
										PP 3.50	PP=138	3.50		D
										PP 4.00	PP=142			
										PP 4.50	PP=125	4.50		D
	BOREHOLE TERMINATED AT 5.00m	5.00	289.59											

Key

D Small Disturbed Sample
B Bulk Disturbed Sample
ES Environmental Sample
W Water Sample
C Core sample
UT Undisturbed Sample

S Standard Penetration Test
C Standard Penetration Test (solid cone)

PP Pocket Penetrometer test
SV Shear Vane test
PID Photo Ionisation Detector test

Notes

Backfilled with arisings.

Groundwater observations

Groundwater encountered at 3m depth. Water level remained constant.

Title

Driven tube sampler record

Recovery details	
Range (m)	Recovery (%)
0.00 - 1.00	100
1.00 - 2.00	40
2.00 - 3.00	70
3.00 - 4.00	100
4.00 - 5.00	100

Method: Driven tube sampler
Logged by: TO
Date(s): 29/01/2019
Level (m OD): 294.59
Compiled by: SA
Sheet number: Sheet 2 of 2
Co-ordinates: 406458mE, 374338mN
Checked by: SD

DTS29

Report ref: STQ4642M-G01 **Revision:** 0

BIODIVERSITY NET GAIN DESIGN STAGE ASSESSMENT

JULY 2024

Hogshaw Farm,
Fairfield,
Buxton,
SK17 7HN

URBAN GREEN

QUALITY MANAGEMENT

Project No.:	UG1795				
Project:	Hogshaw Farm				
Location:	Fairfield, Buxton, SK17 7HN				
Title:	Biodiversity Net Gain Design Stage Assessment				
Document Type:	BNG	**Issue No.:**	01		
Date:	27/01/2023				
Prepared By:	Sarah Child	**Signature:**		**Qualifications:**	Biodiversity Net Gain Consultant
Checked By:	Shannon Brady	**Signature:**		**Qualifications:**	Biodiversity Net Gain Consultant

Revision Status:

Rev:	Date:	Issue/Purpose/ Comment:	Prepared:	Checked:
02	21/03/2023	Updates to habitat classifications	SC	SB
03	06/04/2023	Updated to reflect changes to landscape plans	SC	SB
04	29/02/2024	Updated to reflect consultee comments and amended landscape plans	SC	SB
05	19/07/2024	Updates to reflect changes to landscape plans	SC	TM

NON-TECHNICAL EXECUTIVE SUMMARY

Barratt Homes are proposing to develop land at Hogshaw Farm in Fairfield, Buxton (hereafter referred to as 'the site'). The proposals include the construction of approximately 99 residential units with associated hard and soft landscaping.

Urban Green have been appointed to complete a Biodiversity Net Gain Design Stage Assessment in order to assess the change in value to the environment provided by the proposed development.

The Assessment was conducted using the Biodiversity Metric 3.1 to calculate the pre-and post-development biodiversity habitat units of the site for the proposed development. The results of this calculation are summarised in the following table:

		Habitat Unit Change					Net change in Biodiversity	
	On-site baseline	Retained	Lost	Enhanced	Created	On-site post development	Habitat units	%
Area Habitat Units	12.71	-	-12.71	-	+23.73	23.73	+11.03	**+86.76**
Linear Hedgerow Units	0.91	0.91	-	-	+0.18	1.09	+0.18	**+19.85**
Linear River Units	0.51	0.51	-	-	-	0.51	0	**0**

Overall, the current landscape proposals for the development of the site produce an 86.76% net gain in area habitat units, a 19.85% net gain in linear hedgerow units, and no net change in river units. Overall, it demonstrates that the post-development habitats on site will provide more ecological benefit to wildlife than the habitats currently found on site and the development is in line with the relevant National Planning Policy Framework and Local Planning Policies. The proposed development also satisfies the trading rules.

To ensure habitats are maintained at the expected condition, a 30-year management plan should be implemented post-development (Urban Green, 2024a).

CONTENTS

1 Introduction 1

1.1 Background to the Scheme 1

1.2 Site Context 1

1.3 Purpose of this Report 2

1.4 Planning Context 2

1.5 Hogshaw Railway Local Wildlife Site (LWS) 3

1.6 Good Practice Principles 4

2 Previous Surveys 5

2.1 Preliminary Ecological Appraisal (PEA) 5

3 Methods 8

3.1 Sources of Information 8

3.2 Site Mapping 9

3.3 The Biodiversity Metric 3.1 9

3.4 Habitat Scoring 10

3.5 MoRPH River Survey 12

3.6 Constraints to the Survey 13

4 Baseline Habitat Assessment 14

4.1 Area Habitats 14

4.2 Linear Hedgerow Habitats 20

4.3 Linear River Habitats 25

5 Retained Habitats 27

5.1 Linear Hedgerow Habitats 27

5.2 Linear River Habitats 27

6 Lost Habitats 28

6.1 Area Habitats 28

7 Pre-Development Unit Summary 29

8 Habitat Creation 30

8.1 Area Habitats 30

8.2 Linear Hedgerow Habitats 38
9 Post-Development Summary and Conclusion 39
10 References 40
APPENDIX 1 – PRE-DEVELOPMENT HABITAT MAP 41
APPENDIX 2 – PRIMARY AND SECONDARY CODES 42
APPENDIX 3 – PROPOSED LANDSCAPE PLAN 43

1 Introduction

1.1 Background to the Scheme

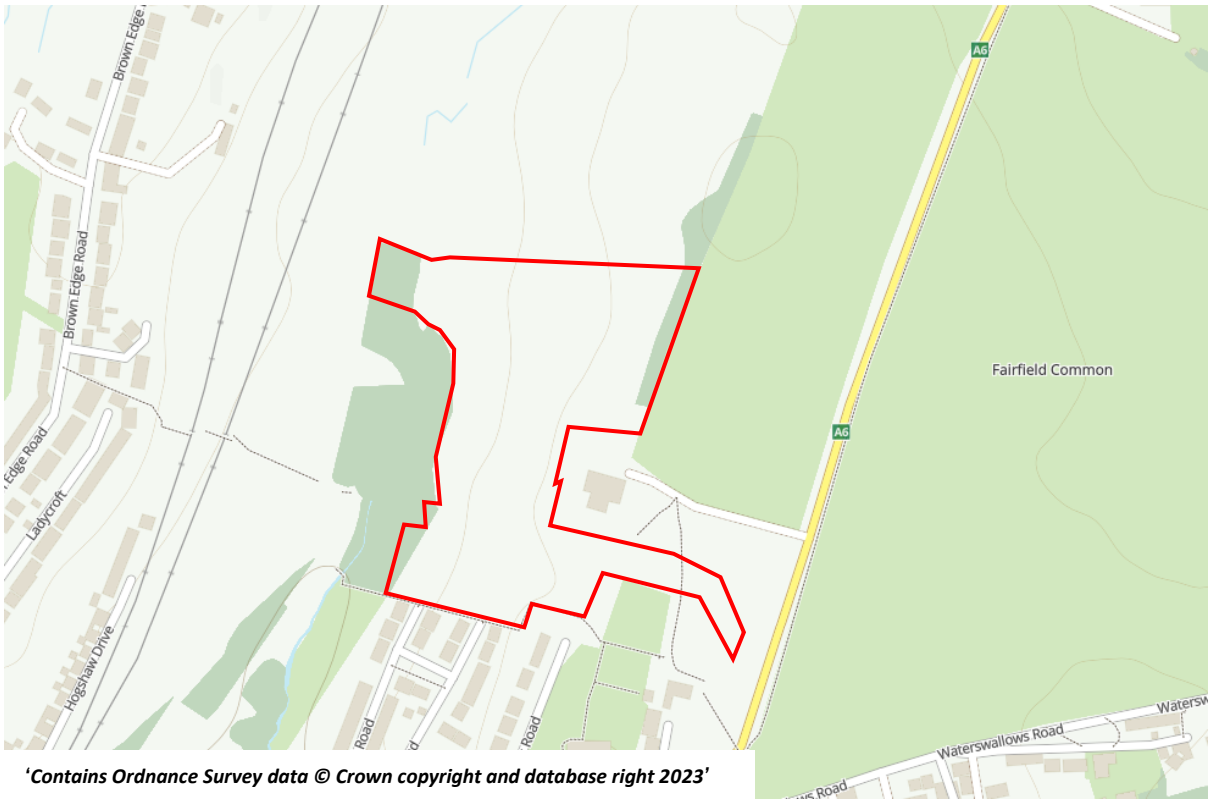
Barratt Homes are proposing to develop land at Hogshaw Farm in Fairfield, Buxton (hereafter referred to as 'the site'). The proposals include the construction of approximately 99 residential units with associated hard and soft landscaping.

Urban Green have been appointed to complete a Biodiversity Net Gain Design Stage Assessment in order to assess the change in value to the environment provided by the proposed development.

The author of the report is Biodiversity Net Gain Consultant, Sarah Child. Sarah has experience providing consulting services in Biodiversity Net Gain for a range of development schemes, both residential and commercial, across the UK.

1.2 Site Context

The site is located at National Grid Reference SK 06584 74409 and comprises a total area of approximately 5.6ha (see Figure 1).



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Figure 1 – Site Extent

The site is located in the rural-urban fringe of Buxton, approximately 1.5km north-east of the town centre. The A6 lies approximately 50m east of the site, with Nun Brook approximately 20m west of the site. Residential housing lies immediately south of the site, with areas of recreational green space to the east and west and agricultural land to the north. An industrial unit is present along the central aspect of the eastern boundary of the site.

1.3 Purpose of this Report

This report has been produced to document the methods, results and conclusions of a BNG Design Stage Assessment that was undertaken on site. The advice herein is based on both desk and field-based studies and intends to fulfil the following purposes:

- Ensure the core principles of Biodiversity Net Gain including the mitigation hierarchy are applied;
- Identify the baseline habitats present on site (pre-development), assess the condition and provide an indication of the ecological value of those habitats;
- Identify the post-development habitats present on site, assess the possible target condition and provide an indication of the likely importance of those habitats;
- Calculate the overall change in biodiversity score from pre- to post-development habitats (measured as habitat units).

1.4 Planning Context

BNG means leaving biodiversity in a better state than it was before. As part of the Government's 25 Year Environment Plan, this requirement is being introduced and mandated for all developments. National planning policy and several Local Plans already require developments to deliver BNG.

Currently the National Planning Policy Framework (NPPF, 2021) details:

Paragraph 174 of the NPPF states:

Planning policies and decisions should contribute to and enhance the natural and local environment by:

d) minimising impacts on and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures;

The High Peak Borough Local Plan was adopted in 2016. Biodiversity Net Gain is not directly mentioned within the documents, however, there are references to biodiversity and conservation throughout and discussed more specifically the local plan under Policy S1:

- Minimising the risk of damage to areas of importance for nature conservation and/or landscape value, both directly and indirectly and ensuring that there is suitable mitigation for a net gain in biodiversity and the creation of ecological networks.

Policy EQ 5 (Biodiversity) also discusses the following:

The biodiversity and geological resources of the Plan Area and its surroundings will be conserved and where possible enhanced by ensuring that development proposals will not result in significant harm to biodiversity or geodiversity interests.

- Conserving and enhancing regionally and locally designated sites. On these sites the Council will not permit any development proposal which would directly or indirectly result in significant harm to geological and biodiversity conservation interests, unless it can be demonstrated that:
    - there is no appropriate alternative site available; and

- all statutory and regulatory requirements relating to any such proposal have been satisfied; and
- appropriate conservation and mitigation measures are provided, such mitigation measures should ensure as a minimum no net loss and wherever possible net gain for biodiversity;
- or if it is demonstrated that this is not possible;
- the need for, and benefit of, the development is demonstrated to clearly outweigh the need to safeguard the intrinsic nature conservation value of the site and compensatory measures are implemented

1.5 Hogshaw Railway Local Wildlife Site (LWS)

The Hogshaw Railway Local Wildlife Site is a 7-hectare non-statutory designated site along a railway line comprising semi-natural grassland and open mosaic habitat, some of which is within the red line boundary of the site. While Local Wildlife Sites have no direct legal protection, they should receive protection through the planning system.

The High Peak Borough Council states in Policy DS 10:

- Development will be subject to compliance with other relevant Local Plan policies, and;
- Woodland corridors within the site which provide linking habitats to the adjacent Local Wildlife Site should also be retained.

The targets for a number of policies, including Policy EQ5 Biodiversity, states:

- To maintain and enhance the quantity and quality of Sites of Special Scientific Interest, Sites of Importance for Nature Conservation and local wildlife sites.

The site includes an area of semi-natural grassland and broadleaved woodland which is part of the Local Wildlife Site (Figure 2).

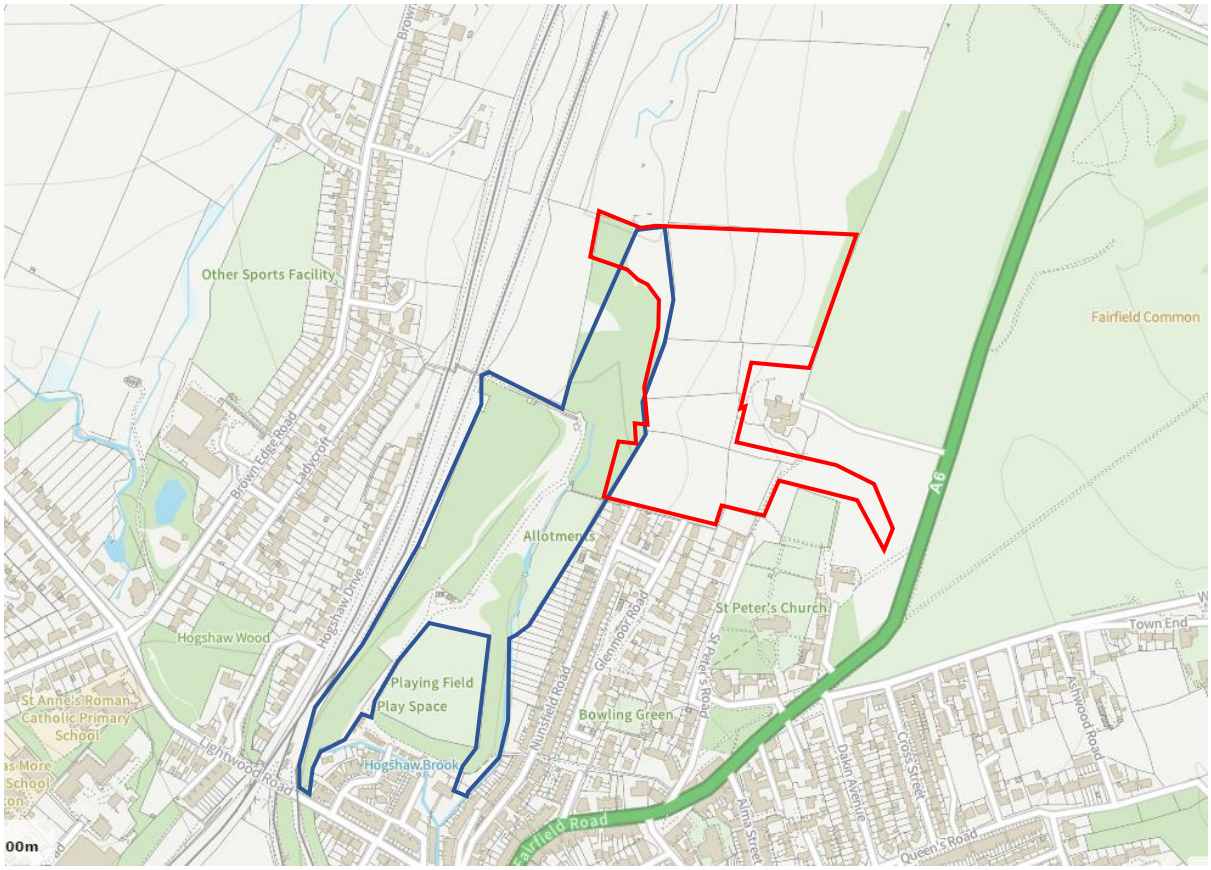


Figure 2 – Site boundary (red polygon) and the Railway Land Hogshaw Local Wildlife Site (LWS) (blue polygon) (Derbyshire Biological Records Centre, 2022)

1.6 Good Practice Principles

To ensure holistic development that makes a lasting positive change to the site's biodiversity, the Good Practice Principles as detailed in Biodiversity Net Gain: Good Practice Principles for Development (Baker *et al.*, 2019) must be followed. Key principles include:

- Following the 'Mitigation Hierarchy':
    - Avoid impacts on biodiversity
    - Minimise impacts on biodiversity
    - Compensate for biodiversity losses on site
    - Compensate for biodiversity loss off site
- Avoid irreplaceable habitats and losing biodiversity that cannot be offset elsewhere;
- Address risks including difficulty and time of habitat creation and enhancement;
- Make a measurable net gain contribution calculated with a suitable metric with limitation and assumptions clearly identified;
- Achieve the best outcome for biodiversity creating lasting long-term benefits that exceed current expectations;

2 Previous Surveys

2.1 Preliminary Ecological Appraisal (PEA)

A preliminary ecological appraisal (PEA) was conducted on the site in October 2022 by Urban Green. This constituted a desk-based study and a field survey. Key information obtained is summarised in Tables 1 and 2; full details can be found within the PEA (Urban Green, 2023). Due to the size and low impact of the proposed development, a 1km Local Data Search was conducted as it is deemed an appropriate distance for the Zone of Influence.

Table 1 – Designated Sites within the Search Areas

Designated Site	Approx. Distance from Site	Details
Statutory designated sites		
Peak District Dales Special Area of Conservation (SAC)	1.3km south-east	A large site with various features that contribute to its designation. Important habitats include Semi-natural dry grasslands and scrubland facies on calcareous substrates (Important orchid sites), Tilio-Acerion forests of slopes, screes and ravines (Priority feature). White-clawed crayfish are present and are also a primary reason for the designation.
South Pennine Moors SAC / Peak District Moors Special Protection Area (SPA)	2.6km west	A large site with a number of important habitats, including European dry heaths, Blanket bogs, Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles.
Non-statutory designated sites		
Railway Land Hogshaw Local Wildlife Site (LWS)	Onsite	A site of 7 hectares comprising a mosaic of habitats along a railway line.

The site also falls within the Impact Risk Zone of the following Statutory Sites, based on consultation with MAGIC:

- Waterswallows Quarry SSSI – Located 1.4km east of the site.
- The Wye Valley SSSI – Located 1.3km south-east of the site.
- Topley Pike and Deep Dale SSSI – Located 3.4km south-east of the site.
- Poole's Cavern and Grin Low Wood SSSI – Located 2.2km south of the site.
- Goyt Valley SSSI – Located 2.6km west of the site.
- Leek Moors SSSI – Located 3.9km south-west of the site.

Table 2 – Summary of the PEA (2023b)

Flora/Fauna	Results
Vascular plants	7 records of notable vascular plant species were returned, which are of local and national importance, including marsh cinquefoil (*Potentilla palustris*), wall whitlow grass (*Draba muralis*), and spring cinquefoil (*Potentilla tabernaemontani*). However, the site holds limited potential for vascular plants and no rare or notable plants were present on site.
Invertebrates	One record of notable invertebrate was received within the data search comprising small heath (*Coenonympha pamphilus*). Suitable habitat for invertebrate species on the site is limited and notable invertebrates are not considered present.
White-clawed crayfish (*Austropotamobius pallipes*)	There were no previous records of white-clawed crayfish returned in the desk search. The presence of Nun Brook on site may provide suitable habitat for white-clawed crayfish. White-clawed crayfish may be present.
Amphibians	Three records of great crested newt (GCN) (*Triturus cristatus*) were returned, with the closest record located approximately 600m south from 2018. GCN are a European Protected Species (EPS) protected through The Conservation of Habitats and Species Regulations (2017), the Wildlife and Countryside Act (1981), Section 41 of the NERC Act (2006) and are a Lancashire BAP species for Derbyshire. No ponds were present on site though there was one pond within 250 m, though this has a below average suitability score for GCN. GCN were not considered present on the site. No other records of amphibians were returned within the data search. The mosaic of grassland, woodland and scrub habitats, and the presence of Nun Brook on site may provide suitable conditions for other common amphibians.
Reptiles	There were no records of reptiles on the site. The majority of habitats on site lack the quality and structure required to support reptiles, however, the woodland and brook may provide suitable habitat for shelter, commuting and foraging.
Birds	A total of 11 records of protected or notable birds were returned within 1km of the site. Of these records, all are listed on either the amber or red lists of Birds of Conservation Concern 2021. The majority are on Section 41 of the NERC Act 2006 and are listed on the Lancashire BAP. The site has limited potential to support ground nesting and wintering birds. Passerine bird species are more likely to use the site, specifically the woodland and scrub. The site provides suitable foraging habitat for birds of prey and nesting potential for barn owls.
Bats	Twenty-four records of bat roosts were returned during the data search relating to three confirmed bat species; common pipistrelle (*Pipistrellus pipistrellus*), soprano pipistrelle (*Pipistrellus pygmaeus*), and noctule (*Nyctalus noctula*), and three unconfirmed species. Two records were related to bat roosts, the closest being approximately 500m south of the site in 1999. All species of bat are EPS protected through The Conservation of Habitats and Species Regulations (2017), the Wildlife and Countryside Act (1981), and soprano pipistrelle and noctule are also listed on Section 41 of the NERC Act (2006) and the Lancashire BAP. There were structures and trees on site which could support roosting bats and the site was considered to have moderate value for foraging and commuting bats.

Flora/Fauna	Results
Hedgehog (*Erinaceus europaeus*)	The data search returned four records of hedgehog within 1km of the site. The broadleaved woodland and scrub and will provide suitable cover and foraging habitats, as well as provide connectivity to habitats of higher value to this species. Hedgehogs are potentially present.
Brown hare (*Lepus europaeus*)	One record of brown hare was returned within the data search located approximately 160m east of the site from 2016. Brown hare are protected through the WCA (1981) and Section 41 of the NERC Act (2006) and the Lancashire BAP. The presence of grassland and woodland edges provide suitable habitat for brown hare, though was no field evidence of their presence.
Water vole (*Arvicola amphibius*)	One record of water vole was returned within the data search located approximately 800m south of the site from 2013. Water vole are protected through the WCA (1981) and on the Lancashire BAP. The section of the brook on the site is considered unsuitable for water vole, and there was no field evidence of the species. Water vole are not considered present.
Fish	Three records of brown trout (*Salmo trutta*) were returned within the data search, all located approximately 750m south of the site with the most recent from 2015. Brown trout are listed on Section 41 of the NERC Act (2006) and the Lancashire BAP. The watercourse on site (Nun Brook) was not considered suitable for fish.
Invasive species	The data search returned records of 31 invasive, non-native plant species listed on Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) within 1km of the site. Species were Japanese knotweed (*Fallopia japonica*), Himalayan balsam (*Impatiens glandulifera*), and Canadian waterweed (*Elodea canadensis*). Himalayan balsam and Japanese knotweed were observed on site during the field survey.

3 Methods

3.1 Sources of Information

Table 3 – Desk Study Sources of Information

Source	Date Consulted	Information Sought
MAGIC website (www.magic.gov.uk)	30/09/2022	Locations of statutory designated sites within 1km of the site boundary. Locations of the designated sites within the National Site Network (Ramsar, SAC and SPA) within 5km of the site boundary. Locations of European Protected Species Licences (EPSL) and Class Licences within 1km.
Natural England (https://designatedsites/.naturalengland.org.uk/)	30/09/2022	Relevant statutory designated site citations.
JNCC (https://jncc.defra.gov.uk/	30/09/2022	Information on European wildlife sites. Details of relevant Section 41 species and habitats.
Derbyshire Biological Records Centre (DerBRC)	03/10/2022	Locally designated wildlife sites within 1km of site boundary. Records of protected and notable species within 1km of the site boundary.
Derbyshire Local Biodiversity Action Plans	03/10/2022	Species and habitats which are given special conservation status at the local level.
Main River Map (Environment Agency)	03/10/2022	The main river map shows which rivers in England are designated as 'main rivers'. Other rivers are called 'ordinary watercourses'.
Preliminary Ecological Appraisal (Urban Green, 2023)	17/10/2022	Notable species, habitats and designations identified on site and within a 1km radius.

Source	Date Consulted	Information Sought
The Biodiversity Metric 3.1 *Natural England Publications (http://nepubprod.appspot.com/publication/6049804846366720)*	19/07/2024	The Biodiversity Metric 3.1, including the tool itself, user guides and reference documentation associated with the tool.

3.2 Site Mapping

3.2.1 Existing Habitat (Baseline)

The site was subject to a field survey on the 5th of October 2022, by Jake Healy, Ecologist, and Shannon Brady, Biodiversity Net Gain Consultant. The weather conditions were 15°c, overcast (8/8 oktas), with a wind speed of 2 on the Beaufort scale and consistent rain throughout.

Habitat types were identified and recorded using the Coreo habitat mapping application (version V3.1) which utilises UKHab classifications (Butcher *et al.* 2020). Habitat types were based on the UKHab guidance provided and the assessor's best judgment while using these guidelines. These habitats were subsequently mapped using ESRI ArcGIS Pro software, and habitat areas and lengths were calculated to demonstrate habitats within the proposed development and the surrounding area. The baseline habitat map is displayed in Appendix 1. Secondary codes were also used to provide additional information which is not covered by the primary code allocated to the habitat; a full list of primary and secondary codes used within this assessment can be found in Appendix 2.

Plant species were identified and recorded and species listed as protected in the *Wildlife and Countryside Act 1981* (as amended) and those which are indicators of important and/or uncommon habitats, were searched for during the survey. Any invasive species, including those listed on the revised (April 2010) Schedule 9 of the *Wildlife and Countryside Act 1981* were also searched for during the field survey.

3.2.2 Post-Development Habitats

The planning layout as provided by Urban Green (2024b) (see Appendix 3) was provided in PDF and DWG format and used to categorise the proposed habitats and calculate the associated areas and lengths.

3.3 The Biodiversity Metric 3.1

The BNG calculation was undertaken utilising The Biodiversity Metric 3.1 from Natural England (full calculation available Urban Green, 2024c) using data obtained from the field survey.

The calculation was performed by a technically competent and experienced person as detailed in British Standard BS8683 - Suitably qualified person –definition in BS8683:2020.

The Biodiversity Metric 3.1 uses habitat features as a proxy measure for capturing the value and importance of nature. The metric considers the size, ecological condition, location and proximity to nearby 'connecting' features. The metric enables assessments to be made of the present and forecast future biodiversity value of a site.

3.4 Habitat Scoring

The Biodiversity Metric 3.1 supplies reference documents and user guides to accurately evaluate and assess the different habitats on site. The methodology for the baseline and post development calculations are demonstrated in the following sections.

3.4.1 Minimum Mapping Units (MMU)

The UKHab classification system can be applied at various levels – fine scale, suitable for smaller sites, and large scale, used for broader landscapes. The fine scale level, which acknowledges areas of minimum 25m^2 and lengths of 5m, is considered appropriate for this site.

3.4.2 Baseline Units

To assess the quality of a habitat, and therefore calculate the units scored, the Biodiversity Metric 3.1 utilises three scoring factors detailed as follows:

Condition

The condition of a habitat is assessed utilising the Condition Sheets provided for each habitat type. These list positive indicators for each habitat and indicate how many of these indicators need to be present to meet certain thresholds of condition. These condition sheets can be found in Biodiversity Metric 3.1 Technical Supplement Part 1a (Natural England, 2022). Condition sheets used within this assessment for pre- and post-development habitats are **Grassland (Low), Grassland (Medium, High, Very High), Scrub, Woodland and forest, Pond, Urban, Hedgerows, Line of trees and Other rivers and streams (MoRPh assessment)** (Table 4).

Nun Brook, which is categorised as 'other rivers and streams', was assessed using the MoRPH River Survey method (Section 3.5).

Table 4 – Conditions Sheets for Habitat Assessment

Condition Sheet	Habitats Assessed
Area Habitats	
Grassland (Medium, High, Very High)	Other neutral grassland
Grassland (Low)	Modified grassland
Pond	Pond (Non-Priority)
Scrub	Mixed Scrub
Woodland and forest	Other woodland; broadleaved
Pond	Ponds (Non-priority habitat)
Urban Tree	Urban trees
Linear Habitats	

Condition Sheet	Habitats Assessed
Line of trees	Line of trees
MoRPh River Survey	Other rivers and streams

Distinctiveness

The distinctiveness of each habitat is automatically assigned by the tool, based upon national records of the occurrence and rarity of each habitat. Table 5 provides the basis of the distinctiveness assessment for area habitats.

Table 5 – Distinctiveness Assessment

Distinctiveness Categories		
Category	**Scores**	**Description**
Very High	8	Priority habitats as defined in Section 41 of the Natural Environment and Rural Communities (NERC) Act that are highly threatened, internationally scarce and require conservation action e.g. blanket bog.
High	6	Priority habitats as defined in Section 41 of the NERC Act requiring conservation action e.g. lowland fens.
Medium	4	Semi-natural habitats not classed as a Priority Habitat.
Low	2	Habitat of low biodiversity value. Temporary grass and clover ley; intensive orchard; rhododendron scrub.
Very Low	0	Little or no biodiversity value e.g. hard standing or sealed surface.

Strategic Significance

The idea of strategic significance works at a landscape scale. It gives additional unit value to habitats that are in preferred locations for biodiversity and other environmental objectives. Strategic significance utilises published local plans and objectives to identify local priorities for targeting biodiversity and nature improvement, such Nature Recovery Areas, local biodiversity plans, National Character Area 14 objectives and green infrastructure strategies (see Table 6).

The Railway Land Hogshaw Local Wildlife Site (LWS) is considered High Strategic Significance as it is a non-statutory designated site.

Table 6 – Strategic Significance Assessment

Strategic Significance Categories	
Category	**Score**
High strategic significance High potential & within area formally identified in local policy	1.15
Medium strategic significance Good potential but not in area defined in local policy	1.1

Strategic Significance Categories	
Category	**Score**
Low Strategic Significance Low potential and not in area defined in local policy	1

3.4.3 Post-Development

Post-development habitats are subject to the same condition assessments as baseline habitats, based on information provided by the proposed landscape layout and planting proposals (Appendix 3). Two additional factors are considered within post-development landscapes which are detailed below.

Temporal Multiplier

For post development habitat creation or enhancement, a risk multiplier will be automatically applied by the tool to account for the period of diminished ecological value while the habitat reaches the targeted post development condition. This time and therefore risk multiplier differs between habitat types, if the habitat is being created or enhanced and how the habitat is to be managed. The predetermined multiplier is based on the average time to meet targeted condition assuming good practice principles and appropriate management strategies are applied.

Difficulty Multipliers

A risk multiplier will be automatically applied by the tool to account the 'difficulty' of habitat-specific enhancement or creation. There are two separate difficulty multipliers assigned to each habitat, one for creation and one for enhancement/restoration, recognising that the technical challenges will not necessarily be the same for both.

3.5 MoRPH River Survey

Condition of the linear river habitat present on site was assessed by a Modular River Physical Survey (MoRPh Survey) undertaken by a certified ecologist. Assessment of linear river habitats condition is based on the extent and diversity of a number of physical features within in both the river channel and riparian as well as the extent and type of any human modifications. This assessment is implemented in two parts:

- A field based sub-reach scale assessment that captures channel dimensions, physical features / habitats, vegetation structural features, and human interventions to assess the condition of the river at the development site, taking into account the type of river.
- A desk-based reach-scale assessment to define river type of the homogenous reach of the river to be affected by development.

The field element of the assessment included five MoRPh field surveys conducted on contiguous lengths (modules) of river. Each MoRPh module covers a river length that is approximately twice the river width (10m). These five contiguous modules covered a sub reach of the river 50m in length. Due to the small length of the river present within the redline boundary, (approximately 61m) it was not necessary to survey more than one subreach to assess the condition of the river. The subreach sampled extended outside of the red line boundary as, due to a portion of the stream being culverted, there was an

insufficient length within the boundary to produce a condition score via the MoRPh survey method. Despite this, the allocated condition score is still considered to be accurate as the physical and hydrological characteristics of the stream outside of the site boundary remained consistent with the habitat within the boundary.

The River Condition Assessment captures information on sediments, vegetation, morphological and water-related features; and the extent and severity of physical modification within the channel, channel margins, banks, and riparian zone (to 10m from the bank tops).

3.6 Constraints to the Survey

Whilst every effort has been made to provide a comprehensive description of the site, no investigation could ensure the complete characterisation and prediction of the natural environment.

The conclusions and recommendations detailed in this report are based upon the site redline boundary and the development proposals as outlined by the client at the time of writing. Should there be any changes to the site redline boundary or development proposals at a later stage, this assessment should be reviewed to determine whether any amendments or additional survey work is required.

Best possible effort was made during the mapping process to ensure that the habitat map accurately represents the area of habitats present on site. Some margin of error is possible due to the continuous and difficult to define nature of habitat boundaries, however this margin of error has been minimised using professional opinion of two experienced ecologists and up to date aerial imagery. As such this is not expected to be a significant constraint and affect the overall Biodiversity Net Gain Calculation provided within this report.

4 Baseline Habitat Assessment

Baseline habitat condition was assessed following the methodology outlined in Section 3.4. Habitat descriptions and the results of this assessment are provided below. The habitats have been given reference numbers for clarity regarding in-text and the metric calculation (Urban Green, 2024c) illustrates the numerical data. Full habitat descriptions can be found in the PEA (Urban Green, 2023).

4.1 Area Habitats

4.1.1 1) Grassland – Modified grassland (P1)

The majority of the site comprised various areas of modified grassland in use as agricultural grazing land separated by a number of fence lines. There were five parcels of modified grassland on site.

Parcel 1 comprised land grazed by sheep with short sward heights and contained perennial rye grass (*Lolium perenne*), with occasional cock's foot (*Dactylis glomerata*), dandelion (*Taraxacum agg.*), creeping buttercup (*Ranunculus repens*), ribwort plantain (*Plantago lanceolata*), common sorrel (*Rumex acetosa*), and creeping thistle (*Cirsium arvense*). Unmanaged areas at the edges of the fields included common nettle (*Urtica dioica*), curly dock (*Rumex crispus*), Yorkshire fog (*Holcus lanatus*) and occasional broad-leaved dock (*Rumex obtusifolius*). Stands of Japanese knotweed (*Reynoutria japonica*) and Himalayan balsam (*Impatiens glandulifera*) were also present within this parcel along its southern periphery.



Photograph 1 – Modified grassland parcel 1, grazed area

Table 7 – Condition Assessment for Modified Grassland

UK Hab Classification	Modified Grassland				
Condition Sheet	Grassland (Low)				
Condition Criteria 1.	There must be 6-8 species per m2. If a grassland has 9 or more species per m2 it should be classified as a medium distinctiveness grassland habitat type.	Fail	Condition Criteria 5.	Cover of bare ground is between 1% and 10%, including localised areas (for example, a concentration of rabbit warrens).	Pass
Condition Criteria 2.	Sward height is varied (at least 20% of the sward is less than 7 cm and at least 20% is more than 7 cm) creating microclimates which provide opportunities for insects,	Fail	Condition Criteria 6.	Cover of bracken less than 20%.	Pass

	birds and small mammals to live and breed.				
Condition Criteria 3.	Some scattered scrub (including bramble) may be present, but scrub accounts for less than 20% of total grassland area.	Pass	Condition Criteria 7.	There is an absence of invasive non-native species (as listed on Schedule 9 of WCA, 1981).	Fail
Condition Criteria 4.	Physical damage is evident in less than 5% of total grassland area.	Pass			
Condition	Poor	Passes 4 of 7 criteria and fails essential criterion 1.			
Distinctiveness		Low			

4.1.2 2 & 3) Grassland – Modified grassland (P2 and 3)

The second and third parcels are located in the centre of the site and the south of the site and are similar to the grazed section in Parcel 1, exhibiting a short sward height with a similar species composition. These parcels had a large presence of rabbit burrows and droppings.



Photograph 2 – Modified grassland parcel 2



Photograph 3 -Modified grassland parcel 3

Table 8 – Condition Assessment for Modified Grassland

UK Hab Classification	Modified Grassland				
Condition Sheet	Grassland (Low)				
Condition Criteria 1.	There must be 6-8 species per m2. If a grassland has 9 or more species per m2 it should be classified as a medium distinctiveness grassland habitat type.	Fail	Condition Criteria 5.	Cover of bare ground is between 1% and 10%, including localised areas (for example, a concentration of rabbit warrens).	Pass
Condition Criteria 2.	Sward height is varied (at least 20% of the sward is less than 7 cm and at least 20% is more than 7 cm) creating microclimates which provide opportunities for insects, birds and small	Fail	Condition Criteria 6.	Cover of bracken less than 20%.	Pass

	mammals to live and breed.				
Condition Criteria 3.	Some scattered scrub (including bramble) may be present, but scrub accounts for less than 20% of total grassland area.	Pass	Condition Criteria 7.	There is an absence of invasive non-native species (as listed on Schedule 9 of WCA, 1981).	Pass
Condition Criteria 4.	Physical damage is evident in less than 5% of total grassland area.	Pass			
Condition	Poor	Passes 5 of 7 criteria and fails essential criterion 1.			
Distinctiveness		Low			

4.1.3 4) Grassland – Modified grassland (P4)

Parcel 4 was unmanaged with a tall sward height and contained cock's foot, creeping thistle, and Yorkshire fog were also present with occasional creeping buttercup, bramble (*Rubus fruticosus agg.*), greater plantain (*Plantago major*), and cow parsley (*Anthriscus sylvestris*). Scattered trees were also present within the parcel comprising occasional cherry (*Prunus avium*), horse chestnut (*Aesculus hippocastanum*), and spruce (*Picea* spp.). Large stands of Japanese knotweed were also present. This area of grassland also fell within the Railway Land Hogshaw LWS, therefore it has been allocated a high strategic significance.



Photograph 4 – Modified grassland parcel 4

Table 9 – Condition Assessment for Modified Grassland

UK Hab Classification	Modified Grassland				
Condition Sheet	Grassland (Low)				
Condition Criteria 1.	There must be 6-8 species per m2. If a grassland has 9 or more species per m2 it should be classified as a medium distinctiveness grassland habitat type.	Fail	Condition Criteria 5.	Cover of bare ground is between 1% and 10%, including localised areas (for example, a concentration of rabbit warrens).	Pass
Condition Criteria 2.	Sward height is varied (at least 20% of the sward is	Fail	Condition Criteria 6.	Cover of bracken less than 20%.	Pass

	less than 7 cm and at least 20% is more than 7 cm) creating microclimates which provide opportunities for insects, birds and small mammals to live and breed.				
Condition Criteria 3.	Some scattered scrub (including bramble) may be present, but scrub accounts for less than 20% of total grassland area.	Pass	Condition Criteria 7.	There is an absence of invasive non-native species (as listed on Schedule 9 of WCA, 1981).	Fail
Condition Criteria 4.	Physical damage is evident in less than 5% of total grassland area.	Pass			
Condition	Poor	Passes 4 of 7 criteria and fails essential criterion 1.			
Distinctiveness	Low				

4.1.4 5) Grassland – Modified grassland (P5)

Parcel 5 contained an abundance of rosebay willowherb (*Chamaenerion angustifolium*), common nettle and creeping thistle, with occasional Yorkshire fog, perennial rye grass, bramble, and ribwort plantain.



Photograph 5 – Modified grassland parcel 5

Table 10 – Condition Assessment for Modified Grassland

UK Hab Classification	Modified Grassland				
Condition Sheet	Grassland (Low)				
Condition Criteria 1.	There must be 6-8 species per m2. If a grassland has 9 or more species per m2 it should be classified as a medium distinctiveness grassland habitat type.	Fail	Condition Criteria 5.	Cover of bare ground is between 1% and 10%, including localised areas (for example, a concentration of rabbit warrens).	Pass
Condition Criteria 2.	Sward height is varied (at least 20% of the sward is less than 7 cm and at least 20% is more than 7 cm) creating microclimates which provide opportunities	Pass	Condition Criteria 6.	Cover of bracken less than 20%.	Pass

	for insects, birds and small mammals to live and breed.				
Condition Criteria 3.	Some scattered scrub (including bramble) may be present, but scrub accounts for less than 20% of total grassland area.	Fail	Condition Criteria 7.	There is an absence of invasive non-native species (as listed on Schedule 9 of WCA, 1981).	Pass
Condition Criteria 4.	Physical damage is evident in less than 5% of total grassland area.	Pass			
Condition Poor	Passes 5 of 7 criteria and fails essential criterion 1.				
Distinctiveness	Low				

4.1.5 6) Woodland - Other Woodland; Broadleaved

The north-western corner of the site comprised successional broadleaved woodland, which was an extension of an established area of woodland to the south. Species composition includes occasional ash (*Fraxinus excelsior*), goat willow (*Salix caprea*), wych elm (*Ulmus glabra*), cherry, sycamore (*Acer pseudoplatanus*), crack willow (*Salix fragilis*), and silver birch (*Betula pendula*). The ground layer included frequent bramble and rosebay willowherb and rare Japanese knotweed. This area of woodland was also within the Railway Land Hogshaw LWS, therefore it has been allocated a high strategic significance.



Photograph 6 – Other woodland, broadleaved

Table 11 – Condition Assessment for other woodland, broadleaved

UK Hab Classification	Other woodland; Broadleaved		
Condition Sheet	Woodland		
Indicator 1. Age distribution of trees	One age class present (Poor – 1 Point)	Indicator 8. Tree health	Tree mortality less than 10%, no pests or diseases and no crown dieback (Good – 3 Points)
Indicator 2. Wild, domestic, and feral herbivore damage	No significant browsing damage evident in woodland (Good – 3 Points)	Indicator 9. Vegetation and ground flora	No recognisable NVC community (Poor – 1 Point)
Indicator 3. Invasive plant species	Rhodendron or laurel not present, rosebay willowherb and Japanese knotweed covers <10% (Moderate – 2 Points)	Indicator 10. Woodland vertical structure	One or less storey across all survey plots (Poor - 1 Point)

Indicator 4. Number of native tree species	Five or more native tree or shrub species across woodland parcel (Good – 3 Points)	Indicator 11. Veteran trees	No veteran trees present in woodland (Poor - 1 Point)
Indicator 5. Cover of native tree and shrub species	>80% of canopy trees and >80% of understory shrubs are native (Good – 3 Points)	Indicator 12. Amount of deadwood	Between 25% and 50% of all survey plots within the woodland parcel have standing deadwood, large dead branches/ stems and stumps (Moderate - 2 Points)
Indicator 6. Open space within woodland	More than 40% of woodland has areas of temporary open space (Poor – 1 Point)	Indicator 13. Woodland disturbance	No nutrient enrichment or damaged ground evident (Good – 3 Points)
Indicator 7. Woodland regeneration	No classes or coppice regrowth present in woodland (Poor – 1 Point)		
Condition Poor	Scores 25 (<26 = Poor)		
Distinctiveness	Medium		

4.1.6 7) Urban – Urban Trees

Four urban trees were present on the site along the western boundary. Three were early-mature goat willow and one was an early-mature silver birch. All four trees were within the Railway Land Hogshaw LWS, therefore they have been allocated a high strategic significance.

Table 12 – Condition Assessment for Urban Trees

UK Hab Classification	Urban tree				
Condition Sheet	Urban tree				
Condition Criteria 1.	The tree is a native species (or more than 70% within the block are native species).	Pass	Condition Criteria 4.	There is little or no evidence of an adverse impact on tree health by anthropogenic activities such as vandalism or herbicide use. There is no current regular pruning regime, so the trees retain >75% of expected canopy for their age range and height.	Pass
Condition Criteria 2.	The tree canopy is predominantly continuous, with gaps in canopy cover making up <10% of total area and no individual gap being >5 m wide (individual trees automatically pass this criterion).	Pass	Condition Criteria 5.	Micro-habitats for birds, mammals and insects are present e.g. presence of deadwood, cavities, ivy or loose bark	Pass
Condition Criteria 3.	The tree is mature or veteran (or more than 50% within the block are mature or veteran).	Fail	Condition Criteria 6.	More than 20% of the tree canopy area is oversailing vegetation beneath.	Pass
Condition Good	Passes 5 of 6 criteria				
Distinctiveness	Medium				

4.1.7 8) Urban - Artificial Unvegetated, Unsealed Surface

A single footpath runs through parcel 5 of the modified grassland and is comprised of compact gravel substrate that classes as artificial unvegetated, unsealed surface. This is classified as artificial unvegetated, unsealed surface, which has a predetermined condition of **N/A** within the metric.



Photograph 8 – Footpath

4.1.8 9) Urban - Buildings (Developed land; sealed surface)

Two sheds used as chicken coops (photograph 9) were present to the east of the site. Buildings are classified as developed land; sealed surface which has a predetermined condition score of **N/A** within the metric.



Photograph 9 – Buildings used as chicken coops

4.2 Linear Hedgerow Habitats

Four lines of trees are present on site associated with the areas of modified grassland and generally confined to field boundaries.

4.2.1 L1) Line of Trees 1

The first line of trees is present within the north of the site adjacent to the eastern boundary, located in Parcel 1 of the modified grassland. It runs north to south for approximately 120m and is comprised of dominant sycamore with occasional ash and hawthorn (*Crataegus monogyna*). The majority of specimens are mature with some young mature trees also present.



Photograph 10 – Line of Trees 1

Table 13 – Condition Assessment for Line of Trees

UK Hab Classification	Line of Trees				
Condition Sheet	Line of Trees				
Condition Criteria 1.	More than 70% of trees are native species.	Pass	Condition Criteria 4.	There is an undisturbed naturally vegetated strip of at least 6 m on both sides to protect the line of trees from farming and other anthropogenic operations.	Fail
Condition Criteria 2.	Tree canopy is predominantly continuous with gaps in canopy cover making up <10% of total area and no individual gap being >5 m wide.	Fail	Condition Criteria 5.	At least 95% of the trees are in a healthy condition (excluding veteran features valuable for wildlife). There is little or no evidence of an adverse impact on tree health by damage from livestock or wild animals, pests or diseases, or human activity.	Pass
Condition Criteria 3.	Includes one or more mature or veteran tree.	Pass			
Condition	Moderate	Passes 3 of 5 criteria.			
Distinctiveness	Low				

4.2.2 L2) Line of Trees 2

The second of line of trees is located in the south-western extent of the site adjacent the field boundary between parcel 2 and parcel 4 of modified grassland. It runs north to south for approximately 35m and is comprised of dominant silver birch and occasional cherry. This line of trees fell within the Railway Land Hogshaw LWS, therefore it has been allocated a high strategic significance.



Photograph 11 – Line of Trees 2

Table 14 – Condition Assessment for Line of Trees

UK Hab Classification		Line of Trees				
Condition Sheet		Line of Trees				
Condition Criteria 1.		More than 70% of trees are native species.	Pass	Condition Criteria 4.	There is an undisturbed naturally vegetated strip of at least 6 m on both sides to protect the line of trees from farming and other anthropogenic operations.	Fail
Condition Criteria 2.		Tree canopy is predominantly continuous with gaps in canopy cover making up <10% of total area and no individual gap being >5 m wide.	Pass	Condition Criteria 5.	At least 95% of the trees are in a healthy condition (excluding veteran features valuable for wildlife). There is little or no evidence of an adverse impact on tree health by damage from livestock or wild animals, pests or diseases, or human activity.	Pass
Condition Criteria 3.		Includes one or more mature or veteran tree.	Pass			
Condition	Moderate	Passes 4 of 5 criteria.				
Distinctiveness		Low				

4.2.3 L3) Line of Trees 3

The third line of trees is located just south of the second line of trees on site and is approximately 20m in length. This line of trees is exclusively comprised of sycamore. This line of trees fell within the Railway Land Hogshaw LWS, therefore it has been allocated a high strategic significance.



Photograph 12 – Line of Trees 3

Table 15 – Condition Assessment for Line of Trees

UK Hab Classification		Line of Trees				
Condition Sheet		Line of Trees				
Condition Criteria 1.		More than 70% of trees are native species.	Pass	Condition Criteria 4.	There is an undisturbed naturally vegetated strip of at least 6 m on both sides to protect the line of trees from farming and other anthropogenic operations.	Fail
Condition Criteria 2.		Tree canopy is predominantly continuous with gaps in canopy cover making up <10% of total area and no individual gap being >5 m wide.	Pass	Condition Criteria 5.	At least 95% of the trees are in a healthy condition (excluding veteran features valuable for wildlife). There is little or no evidence of an adverse impact on tree health by damage from livestock or wild animals, pests or diseases, or human activity.	Pass
Condition Criteria 3.		Includes one or more mature or veteran tree.	Pass			
Condition	Moderate	Passes 4 of 5 criteria.				
Distinctiveness		Low				

4.2.4 L4) Line of Trees 4

The fourth line of trees is located in the central extent of the site adjacent the eastern boundary. It runs north to south for approximately 50m and is comprised exclusively of sycamore.



Photograph 13 – Line of Trees 4

Table 16 – Condition Assessment for Line of Trees

UK Hab Classification		Line of Trees				
Condition Sheet		Line of Trees				
Condition Criteria 1.		More than 70% of trees are native species.	Pass	Condition Criteria 4.	There is an undisturbed naturally vegetated strip of at least 6 m on both sides to protect the line of trees from farming and other anthropogenic operations.	Fail
Condition Criteria 2.		Tree canopy is predominantly continuous with gaps in canopy cover making up <10% of total area and no individual gap being >5 m wide.	Fail	Condition Criteria 5.	At least 95% of the trees are in a healthy condition (excluding veteran features valuable for wildlife). There is little or no evidence of an adverse impact on tree health by damage from livestock or wild animals, pests or diseases, or human activity.	Pass
Condition Criteria 3.		Includes one or more mature or veteran tree.	Pass			
Condition	Moderate	Passes 3 of 5 criteria.				
Distinctiveness		Low				

4.2.5 5) Built linear features

Various built linear features were present on site that form the site boundary and separate the different parcels on site. The features comprise fence lines and dry-stone walls. These features are classified as built linear features, which have a predetermined condition of **N/A** within the metric.



Photograph 14 – Dry-stone wall



Photograph 15 – Fence line

4.3 Linear River Habitats

4.3.1 1) Other rivers and streams (Nun Brook)

Nun Brook is present on site within the south-western extent and the woodland detailed in Section 4.1.6. The brook is culverted through the majority of the woodland and comes to the surface in its southern extent and extends further to the south of the site.

At the time of survey, the water levels within the brook were high and lots of silt was being carried within the brook. Vegetation was present on the embankments either side and within the brook itself comprising occasional pendulous sedge (*Carex pendula*), cock's foot, Yorkshire fog, creeping buttercup, and curly dock. Nun Brook also fell within the Railway Land Hogshaw LWS, therefore it has been allocated a high strategic significance.



Photograph 16 – Nun Brook, culvert



Photograph 17 – Nun Brook

Table 17 – Condition Assessment for Other Rivers and Streams

Name	**Nun Brook**		
UK Hab Classification	**Other Rivers and Streams Type**		
Condition Assessment	**River MoRPH Survey**		
River Category	Other	Reach Valley Gradient	0.011
Braiding Index	1	Bedrock Reach	No
Sinuosity Index	1.04	Coarsest Bed Material	Gravel-Pebble

Anabranching Index	1	Average Bed Material	Cobble
Level of Confinement	Unconfined	Condition Score	Moderate

Condition Score	Fairly Poor
Distinctiveness	High
Extent of watercourse encroachment	Minor
Extent of riparian encroachment	No encroachment

5 Retained Habitats

Using the Biodiversity Metric 3.1, the habitat units of the pre-development habitats to be retained were calculated.

5.1 Linear Hedgerow Habitats

All of the existing lines of trees will be retained. Table 18 shows a summary of the linear hedgerow habitats to be retained on site, their corresponding length (km) and unit score to be retained on site.

Table 18 – Retained Linear Hedgerow Habitat Units

Habitat	Total Length (km)	Total Units	Length Retained (km)	Units Retained
L1) Line of Trees 1	0.11	0.44	0.11	0.44
L2) Line of Trees 2	0.039	0.18	0.039	0.18
L3) Line of Trees 3	0.023	0.11	0.023	0.11
L4) Line of Trees 4	0.046	0.18	0.046	0.18
Total	**0.22**	**0.91**	**0.22**	**0.91**

5.2 Linear River Habitats

The section of stream that is within 10m of the red line boundary, in the Hogshaw Railway Land LWS, will remain untouched. Table 19 shows a summary of the linear river habitats to be retained on site, their corresponding length (km) and unit score to be retained.

Table 19 – Linear River Habitat

Habitat Parcel Reference	Total Length (km)	Total Units	Length Retained (km)	Units Retained
Other Rivers and Streams	0.061	0.51	0.061	0.51

6 Lost Habitats

Using the Biodiversity Metric 3.1, the habitat units of the pre-development habitats to be lost were calculated.

6.1 Area Habitats

Under the current landscape proposals, all habitats present will be lost. Table 20 shows a summary of the area habitats and their corresponding area (ha) and unit score to be lost on site, along with planned mitigation.

Table 20 – Lost Area Habitats

Habitat Parcel Reference	Total Area (ha)	Total Units	Area lost (ha)	Units lost	Planned Mitigation
1–5) Grassland – Modified Grassland	5.28	10.70	5.28	10.70	Overall, this habitat offers limited ecological provision. New areas of wildflower meadow will be created around the periphery of the site and within the public open space which will be more ecologically beneficial.
6) Other woodland; broadleaved	0.29	1.33	0.29	1.33	New areas of woodland will be created within the LWS and additional urban trees will be planted on site, however the loss of this habitat will not be fully compensated for.
7) Urban – Urban Trees	0.049	0.67	0.049	0.67	All four urban trees currently present on site will be lost, however an additional 217 urban trees will be planted to mitigate for those lost.
8) Artificial Unvegetated, Unsealed Surface	0.027	0	0.027	0	This habitat provides no ecological value, therefore no mitigation is necessary.
9) Urban – Developed Land; Sealed Surface (buildings)	0.003	0	0.003	0	This habitat provides no ecological value, therefore no mitigation is necessary.
Total	5.65	12.71	5.65	12.71	

7 Pre-Development Unit Summary

Using the Biodiversity Metric 3.1, the habitat units of the existing site habitats were calculated; the habitat units to be retained within site development were calculated; and the habitat units that are anticipated to be lost in site development were calculated.

The results of these calculations are presented in Table 21.

Table 22 – Pre-Development Unit Summary

	On-site baseline	Retained	Lost
Area Habitat Units	12.71	-	12.71
Linear Hedgerow Units	0.91	0.91	-
Linear River Units	0.67	0.67	-

8 Habitat Creation

8.1 Area Habitats

8.1.1 1 & 2) Urban – Urban Trees

A total of 275 (123 small and 152 medium) trees will be planted across the site. However, 147 trees are classified within separate new habitats. Thirteen urban trees will be plated within the mixed scrub, 56 trees will form new woodland habitats, 12 trees will become part of a new line of trees (see Sections 8.1.3, 8.1.5, 8.1.6 and 8.2 respectively), and 55 trees are within front gardens and do not contribute to the metric as they are at the homeowner's responsibility (see Section 8.1.10).

The remaining 108 (47 small, 61 medium) urban trees will be planted within the public open space. The mix incorporates both native and non-native species, such as silver birch, bird cherry (*Prunus padus*), pedunculate oak, hornbeam 'Frans Fontaine' (*Carpinus betulus* 'Frans Fontaine'), and field maple 'Streetwise' (*Acer campestre* 'Streetwise').

Twenty (10 small, 10 medium) of the proposed urban trees will be planted within the Railway Land Hogshaw LWS, therefore these trees have been allocated a high strategic significance.

Table 23 – Condition Assessment for Urban Trees

Classification within Landscape Designs	Proposed Tree Planting and Proposed Specimen Shrub Planting				
UK Hab Classification	Urban tree				
Condition Sheet	Urban tree				
Condition Criteria 1.	The tree is a native species (or more than 70% within the block are native species).	Fail	Condition Criteria 4.	There is little or no evidence of an adverse impact on tree health by anthropogenic activities such as vandalism or herbicide use. There is no current regular pruning regime, so the trees retain >75% of expected canopy for their age range and height.	Pass
Condition Criteria 2.	The tree canopy is predominantly continuous, with gaps in canopy cover making up <10% of total area and no individual gap being >5 m wide (individual trees automatically pass this criterion).	Pass	Condition Criteria 5.	Micro-habitats for birds, mammals and insects are present e.g. presence of deadwood, cavities, ivy or loose bark	Fail
Condition Criteria 3.	The tree is mature or veteran (or more than 50% within the block are mature or veteran).	Fail	Condition Criteria 6.	More than 20% of the tree canopy area is oversailing vegetation beneath.	Pass
Condition Moderate	Passes 3 of 6 criteria				
Distinctiveness	Medium				
Time to Target Condition	27 years				
Difficulty of Creation	Low				

8.1.2 3) Urban – Introduced Shrub

Areas of introduced shrub containing different species mixes will be created within the public space to improve the visual amenity of the area. Within the landscape proposals, the introduced shrub mixes are classified as 'Proposed Ornamental Shrub and Herbaceous Planting' and 'Proposed Semi-native Shrub Planting,' and include species such as Japanese quince (*Chaenomeles japonica*), creeping willow (*Salix repens*), and spurge-laurel (*Daphne laureola*). Introduced shrub is automatically allocated a condition score of **N/A** by the metric.

8.1.3 4) Heathland and Shrub – Mixed Scrub

Blocks of native mixed scrub habitat will be planted within the areas of wildflower meadows, to the east and west of the site, adding diversity to these habitats. This mix is classified as 'Proposed Native Shrub Planting' in the landscape proposals. Species such as dog wood (*Cornus sanguinea*), elder (*Sambucus nigra*), guelder rose (*Viburnum opulus*) and hazel (*Corylus avellana*) will be planted in mixed groups to create these habitats. As mentioned in section 8.1.1, some of the proposed urban trees will be planted within this habitat. Species will include silver birch, bird cherry and rowan (*Sorbus aucuparia*).

Table 24 - Condition Assessment for Mixed Scrub

Classification within Landscape Designs		Proposed Native Shrub Planting				
UK Hab Classification		Mixed scrub				
Condition Sheet		Scrub				
Condition Criteria 1.		Habitat is representative of UKHab description (where in its natural range). There are at least three woody species, with no one species comprising more than 75% of the cover (except common juniper, sea buckthorn or box, which can be up to 100% cover).	Pass	Condition Criteria 4.	The scrub has a well-developed edge with scattered scrub and tall grassland and/or herbs present between the scrub and adjacent habitat(s).	Fail
Condition Criteria 2.		There is a good age range – all of the following are present: seedlings, young shrubs and mature shrubs.	Fail	Condition Criteria 5.	There are clearings, glades or rides present within the scrub, providing sheltered edges.	Fail
Condition Criteria 3.		There is an absence of invasive non-native species (as listed on Schedule 9 of WCA, 1981) and species indicative of sub-optimal condition make up less than 5% of ground cover.	Pass			
Condition	Poor	Passes 2 of 5 criteria				
Distinctiveness		Medium				
Time to Target Condition		1 year				
Difficulty of Creation		Low				

8.1.4 5) Heathland and Shrub – Mixed Scrub

A block of native scrub will be planted around the existing line of trees (L4) to the east of the site. The scrub will be comprised of elder, wild privet (*Ligustrum vulgare*), guelder-rose, hazel and dogwood (*Cornus sanguinea*).

Table 25 - Condition Assessment for Mixed Scrub

Classification within Landscape Designs		Proposed Woodland Understory Planting				
UK Hab Classification		Mixed scrub				
Condition Sheet		Scrub				
Condition Criteria 1.		Habitat is representative of UKHab description (where in its natural range). There are at least three woody species, with no one species comprising more than 75% of the cover (except common juniper, sea buckthorn or box, which can be up to 100% cover).	Pass	Condition Criteria 4.	The scrub has a well-developed edge with scattered scrub and tall grassland and/or herbs present between the scrub and adjacent habitat(s).	Fail
Condition Criteria 2.		There is a good age range – all of the following are present: seedlings, young shrubs and mature shrubs.	Fail	Condition Criteria 5.	There are clearings, glades or rides present within the scrub, providing sheltered edges.	Fail
Condition Criteria 3.		There is an absence of invasive non-native species (as listed on Schedule 9 of WCA, 1981) and species indicative of sub-optimal condition make up less than 5% of ground cover.	Pass			
Condition	Poor	Passes 2 of 5 criteria				
Distinctiveness		Medium				
Time to Target Condition		1 year				
Difficulty of Creation		Low				

8.1.5 6) Woodland - Other Woodland; Broadleaved

A small area of woodland will be created in the south-western corner of the site, comprising the existing line of trees L3, and with additional native tree specimens being added such as silver birch (*Betula pendula*), pedunculate oak and rowan. The understory of this habitat will be planted with scrub species such as elder, dog wood, hazel and wild privet. This habitat is classified as 'Proposed Woodland Understory Planting' within the landscape plans.

This area of proposed woodland will fall within the Railway Land Hogshaw LWS, therefore this habitat has been allocated a high strategic significance.

Table 26 – Condition Assessment for other woodland, broadleaved

Classification within Landscape Designs	Proposed Tree Planting and Proposed Woodland Understory Species		
UK Hab Classification	Other woodland; Broadleaved		
Condition Sheet	Woodland		
Indicator 1. Age distribution of trees	Two age classes present (Moderate – 2 Points)	Indicator 8. Tree health	Tree mortality less than 10%, no pests or diseases and no crown dieback (Good – 3 Points)
Indicator 2. Wild, domestic, and feral herbivore damage	No significant browsing damage evident in woodland (Good – 3 Points)	Indicator 9. Vegetation and ground flora	No recognisable NVC community (Poor – 1 Point)
Indicator 3. Invasive plant species	No invasive species present in woodland (Good – 3 Points)	Indicator 10. Woodland vertical structure	Two storeys across all survey plots (Moderate - 2 Points)
Indicator 4. Number of native tree species	Five or more native tree or shrub species across woodland parcel (Good - 3 Points)	Indicator 11. Veteran trees	No veteran trees present in woodland (Poor - 1 Point)
Indicator 5. Cover of native tree and shrub species	>80% of canopy trees and >80% of understory shrubs are native (Good – 3 Points)	Indicator 12. Amount of deadwood	Between 25% and 50% of all survey plots within the woodland parcel have standing deadwood, large dead branches/ stems and stumps (Moderate - 2 Points)
Indicator 6. Open space within woodland	21- 40% of woodland has areas of temporary open space (Moderate - 2 Points)	Indicator 13. Woodland disturbance	No nutrient enrichment or damaged ground evident (Good – 3 Points)
Indicator 7. Woodland regeneration	No classes or coppice regrowth present in woodland (Poor – 1 Point)		
Condition: Moderate	Scores = 29 points		
Distinctiveness	Medium		
Time to Target Condition	15 years		
Difficulty of Creation	Low		

8.1.6 7 & 8) Woodland - Other Woodland; Broadleaved

A second area of woodland will be created along the northern and upper eastern boundaries, which will contain native tree species such as silver birch, rowan, oak and goat willow, and an understory of scrub species, including elder, hazel, beech, and hawthorn.

A 1164m² section of proposed woodland will fall within the Railway Land Hogshaw LWS, and has been allocated a high strategic significance.

Table 27 – Condition Assessment for other woodland, broadleaved

Classification within Landscape Designs	Proposed Tree Planting, Proposed Woodland Understory Planting, and Proposed Woodland Mix Planting		
UK Hab Classification	Other Woodland; Broadleaved		
Condition Sheet	Woodland		
Indicator 1. Age distribution of trees	Two age classes present (Moderate – 2 Points)	Indicator 8. Tree health	Tree mortality less than 10%, no pests or diseases and no crown dieback (Good – 3 Points)
Indicator 2. Wild, domestic, and feral herbivore damage	No significant browsing damage evident in woodland (Good – 3 Points)	Indicator 9. Vegetation and ground flora	No recognisable NVC community (Poor – 1 Point)
Indicator 3. Invasive plant species	No invasive species present in woodland (Good – 3 Points)	Indicator 10. Woodland vertical structure	Two storeys across all survey plots (Moderate - 2 Points)
Indicator 4. Number of native tree species	Five or more shrub species across woodland parcel (Good – 3 Points)	Indicator 11. Veteran trees	No veteran trees present in woodland (Poor - 1 Point)
Indicator 5. Cover of native tree and shrub species	>80% of canopy trees and >80% of understory shrubs are native (Good – 3 Points)	Indicator 12. Amount of deadwood	Between 25% and 50% of all survey plots within the woodland parcel have standing deadwood, large dead branches/ stems and stumps (Moderate - 2 Points)
Indicator 6. Open space within woodland	21- 40% of woodland has areas of temporary open space (Moderate - 2 Points)	Indicator 13. Woodland disturbance	No nutrient enrichment or damaged ground evident (Good – 3 Points)
Indicator 7. Woodland regeneration	No classes or coppice regrowth present in woodland (Poor – 1 Point)		
Condition / Moderate	Scores = 29 points		
Distinctiveness	Medium		
Time to Target Condition	15 years		
Difficulty of Creation	Low		

8.1.7 9 & 10) Grassland – Other Neutral Grassland (Wildflower meadow)

Areas of wildflower meadow will be created in public areas along all boundaries of the site, buffering the site from the adjacent woodland and arable land. Meadow habitat will be created by firstly removing all current vegetation, digging over the earth (to at least 15cm), and raking to produce a tilth over 2.5cm deep which is left for 2-3 weeks to allow all weeds in the seed bank to germinate. After 2-3 weeks, any additional weeds will be removed and then ground raked again. Seed sowing must be undertaken immediately with the EM2 standard general purpose meadow mixture (from Emorsgate Seeds) which contains a mix of 85% slow growing grasses and 15% wildflowers. Species within the mix include musk mallow (*Malva moschata*), black medic (*Medicago lupulina*), ribwort plantain (*Plantago lanceolata*), common bent (*Agriostis capillaris*) and crested dogs-tail (*Cynosurus cristatus*).

A 4519m^2 section of proposed wildflower meadow to the west of the site will fall within the Railway Land Hogshaw LWS, therefore this area has been allocated a high strategic significance.

Table 28 - Condition Assessment for Other Neutral Grassland

Classification within Landscape Designs	Proposed Seeded Species Rich Wildflower Meadow				
UK Hab Classification	Other Neutral Grassland				
Condition Sheet	Grassland (Medium, High & Very High)				
Condition Criteria 1.	The appearance and composition of the vegetation closely matches characteristics of the specific grassland habitat type (see UKHab definition). Wildflowers, sedges and indicator species for the specific grassland habitat type are very clearly and easily visible throughout the sward. NB - This criterion is essential for achieving moderate condition for non-acid grassland types only.	Pass	Condition Criteria 4.	Cover of bracken less than 20% and cover of scrub (including bramble) less than 5%.	Pass
Condition Criteria 2.	Sward height is varied (at least 20% of the sward is less than 7 cm and at least 20 per cent is more than 7 cm) creating microclimates which provide opportunities for insects, birds and small mammals to live and breed.	Fail	Condition Criteria 5.	There is an absence of invasive non-native species (as listed on Schedule 9 of WCA, 1981). Combined cover of species indicative of sub-optimal condition1 and physical damage (such as excessive poaching, damage from machinery use or storage, damaging levels of access, or any other damaging management activities) accounts for less than 5% of total area.	Pass
Condition Criteria 3.	Cover of bare ground between 1% and 5%, including localised areas, for example, rabbit warrens.	Fail	Condition Criteria 6.	There are greater than 9 species per metre squared. NB - This criterion is essential for achieving good condition (non-acid grassland types only).	Pass
Condition Moderate	Passes 4 of 6 criteria				
Distinctiveness	Medium				
Time to Target Condition	10 years				
Difficulty of Creation	Low				

8.1.8 11) Grassland – Modified Grassland

Germinal grade A19 grass seed containing 5 grass species, including perennial ryegrass (*Lolium perenne*) and strong creeping red fescue (*Festuca rubra rubra*), will be sown within the residential areas, adjacent

to roads and driveways, forming verges. This grassland is expected to contain a low species richness and be heavily managed by mowing, resulting in a low sward height. It will also buffer the wildflower meadow habitat from the roads.

Table 29 - Condition Assessment for Modified Grassland

Classification within Landscape Designs		Proposed Seeded Amenity Grass				
UK Hab Classification		Modified Grassland				
Condition Sheet		Grassland (Low)				
Condition Criteria 1.		There must be 6-8 species per m². If a grassland has 9 or more species per m² it should be classified as a medium distinctiveness grassland habitat type. NB - Essential for achieving moderate condition.	Fail	Condition Criteria 5.	Cover of bare ground is between 1% and 10%, including localised areas (for example, a concentration of rabbit warrens).	Pass
Condition Criteria 2.		Sward height is varied (at least 20% of the sward is less than 7 cm and at least 20% is more than 7 cm) creating microclimates which provide opportunities for insects, birds and small mammals to live and breed.	Fail	Condition Criteria 6.	Cover of bracken less than 20%.	Pass
Condition Criteria 3.		Some scattered scrub (including bramble) may be present, but scrub accounts for less than 20% of total grassland area. Note - patches of shrubs with continuous (more than 90%) cover should be classified as the relevant scrub habitat type.	Fail	Condition Criteria 7.	There is an absence of invasive non-native species (as listed on Schedule 9 of WCA, 1981).	Pass
Condition Criteria 4.		Physical damage is evident in less than 5% of total grassland area. Examples of physical damage include excessive poaching, damage from machinery use or storage, erosion caused by high levels of access, or any other damaging management activities.	Pass			
Condition	Poor	Passes 4 of 7 criteria but fails essential criteria 1				
Distinctiveness		Low				
Time to Target Condition		1 year				
Difficulty of Creation		Low				

8.1.9 12) Lakes – Ponds (Non-Priority Habitat)

A non-priority pond will be created to the west of the site and will act as a drainage feature. Native reeds will be planted within this habitat, including species such as lesser pond sedge (*Carex acutiformis*), yellow

iris (*Iris pseudacorus*), and branched bur reed (*Sparganium erectum*). There will also be an area of wet meadow surrounding the pond which is classified within the pond habitat. The wet meadow will be seeded using the Wet Wildflower Meadow Seed mix from Habitat Aid, which contains a mix of 30% native wildflower species and 70% grasses. Wildflower species include yellow rattle (*Rhinanthus minor*), meadow buttercup (*Ranunculus acris*), and red campion (*Silene dioica*), and grass species include meadow foxtail (*Alopecurus pratensis*) and creeping red fescue (*Festuca rubra*).

The pond falls within the Railway Land Hogshaw LWS, therefore this habitat has been allocated a high strategic significance.

Table 30 – Condition Assessment for Pond

Classification within Landscape Designs	Pond Water, Native Reeds Mix, and Proposed Wet Meadow				
UK Hab Classification	Pond (Non-Priority Habitat)				
Condition Sheet	Pond				
Condition Criteria 1.	The pond is of good water quality, with clear water (low turbidity) indicating no obvious signs of pollution. Turbidity is acceptable if the pond is grazed by livestock.	Pass	Condition Criteria 6.	There is an absence of non-native plant and animal species	Pass
Condition Criteria 2.	There is semi-natural habitat (i.e. moderate distinctiveness or above) for at least 10 m from the pond edge.	Pass	Condition Criteria 7.	The pond is not artificially stocked with fish. If the pond naturally contains fish, it is a native fish assemblage at low densities	Pass
Condition Criteria 3.	Less than 10% of the pond is covered with duckweed or filamentous algae.	Pass	Condition Criteria 8.	In non-woodland ponds, plants, be they emergent, submerged or floating (excluding duckweeds), should cover at least 50% of the pond area that is less than 3 m deep.	Pass
Condition Criteria 4.	The pond is not artificially connected to other waterbodies, either via streams, ditches or artificial pipework.	Fail	Condition Criteria 9.	The surface of non-woodland ponds is no more than 50% shaded by woody bankside species.	Pass
Condition Criteria 5.	Pond water levels should be able to fluctuate naturally throughout the year. No obvious dams, pumps or pipework.	Pass			
Condition Moderate	Passes 8 of 9 criteria				
Distinctiveness	Medium				
Time to Target Condition	3 years				
Difficulty of Creation	Low				

8.1.10 13 & 14) Urban – Developed Land; Sealed Surface & Vegetated Gardens

Areas of hard surfacing will be created across the development as new access roads, driveways for houses and footpaths. Buildings are also categorised within this habitat. Hard surfacing and buildings are categorised as developed land; sealed surface and has a predetermined condition of **N/A** within the metric.

The areas of 'Proposed Turf Grass', 'Proposed Groundcover Planting' 'Proposed Hedge Planting' and 'Proposed Ornamental Shrub & Herbaceous Planting' are all within the front and back gardens of houses.

As there are no areas included within the landscape designs (CAD file) for the hard landscaping or areas, the developed residential area of the site, including houses, roads and gardens, has been classified as 70% developed land; sealed surface and 30% vegetated garden, following guidance in the Biodiversity Metric 3.1 Technical Supplement (Natural England, 2022).

8.2 Linear Hedgerow Habitats

8.2.1 1) Line of trees

An 80m line of trees will be created in the north-western area of the site next to the pond, comprised of alder, silver birch, goat willow, and small-leaved lime (*Tilia cordata*). This line of trees will be within the Railway Land Hogshaw LWS, therefore, it has been allocated a high strategic significance.

Table 31 – Condition Assessment for Line of Trees

Classification within Landscape Designs	Proposed Tree Planting				
UK Hab Classification	Line of Trees				
Condition Sheet	Line of Trees				
Condition Criteria 1.	More than 70% of trees are native species.	Pass	Condition Criteria 4.	There is an undisturbed naturally vegetated strip of at least 6 m on both sides to protect the line of trees from farming and other anthropogenic operations.	Pass
Condition Criteria 2.	Tree canopy is predominantly continuous with gaps in canopy cover making up <10% of total area and no individual gap being >5 m wide.	Pass	Condition Criteria 5.	At least 95% of the trees are in a healthy condition (excluding veteran features valuable for wildlife). There is little or no evidence of an adverse impact on tree health by damage from livestock or wild animals, pests or diseases, or human activity.	Pass
Condition Criteria 3.	Includes one or more mature or veteran tree.	Fail			
Condition: Moderate	Passes 4 of 5 criteria.				
Distinctiveness	Low				
Time to Target Condition	20 years				
Difficulty of Creation	Low				

9 Post-Development Summary and Conclusion

Using the Biodiversity Metric 3.1, the habitat units of the proposed and created habitats were calculated; the habitat units to be retained within site development were calculated; and the habitat units that are anticipated to be lost in site development were calculated.

The results of these calculations are presented in the Table 32.

Table 32 – Post Development Biodiversity Net Gain Calculation

		Habitat Unit Change					Net change in Biodiversity	
	On-site baseline	Retained	Lost	Enhanced	Created	On-site post development	Habitat units	%
Area Habitat Units	12.71	-	-12.71	-	+23.73	23.73	+11.03	**+86.76**
Linear Hedgerow Units	0.91	0.91	-	-	+0.18	1.09	+0.18	**+19.85**
Linear River Units	0.51	0.51	-	-	-	0.52	0	**0**

As illustrated in Table 32, the current landscape proposals for the development of the site produce an 86.76% net gain in area habitat units, a 19.85% net gain in linear hedgerow units, and no net change in river units. Overall, it demonstrates that the post-development habitats on site will provide more ecological benefit to wildlife than the habitats currently found on site and the development is in line with the relevant National Planning Policy Framework and Local Planning Policies. The proposed development also satisfies the trading rules.

To ensure that the habitats proposed as part of the post-development design of this site reach the condition detailed within this report and the full gain in value to the environment is achieved by this site, a long-term management plan (usually 30 years) is required. This length of management plan is required due to the complex nature of the habitats to be enhanced/created on site and the high value they will provide to the environment. This management plan is provided by Urban Green (2024a) as a separate document and covers the recommended management practices for the proposed habitats discussed in this report.

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Urban Green (2023). UG_1795_ECO_PEA_05.

Urban Green (2024a). UG_1795_ECO_BEMP_05.

Urban Green (2024b). UG_1795_LAN_GA_DRW_01 P08.

Urban Green (2024c). UG_1795_ECO_BNG_CALC_05.

Urban Green (2024d). UG_1795_ARB_AIA_01_REV_05_FINAL.

APPENDIX 1 – PRE-DEVELOPMENT HABITAT MAP

URBAN GREEN



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Tree Bat Roost Suitability

N

- High
- Moderate
- Low
- Red Line Boundary
- Fence
- Line of trees
- Other rivers and streams
- Local Wilflide Site
- Dry Stone Wall
- Artificial unvegetated, unsealed surface
- Buildings
- Modified grassland
- Other woodland; broadleaved
- Urban Tree
- Target Note

TN1- Japanese Knotweed
TN2 - Himalayan Balsam
TN3 - Bird Box

0 0.01 0.03 0.05 Kilometers

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Client: **Barratt Homes**

Project: **Hogshaw Farm**

Title: **UKHAB Habitat Map**

Issue: **02**

Drawn:	Checked:	Approved:
CL	MG	JH

Project:	Scale @ A3:	Date:
UG1795	1:1250	31/03/2023

Dwg No:	Revision:
UG_1795_ECO_HM_02	01

APPENDIX 2 – PRIMARY AND SECONDARY CODES

Hierarchical code	Code	Definition
Primary Code	g4	Modified grassland
	r2b	Other rivers and streams
	u1b5	Buildings
	u1c	Artificial unvegetated, unsealed surface
	u1e	Built linear features
	w1g6	Line of trees
Secondary Code	11	Scattered Trees
	16	Tall herb
	47	Native
	58	Grazed
	60	Sheep grazed
	75	Active management
	80	Unmanaged
	86	Accessible natural greenspace

APPENDIX 3 – PROPOSED LANDSCAPE PLAN

URBAN GREEN

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Graphical representations of equipment on this drawing have been co-ordinated, but are approximations only. Please refer to the specifications and / or details for actual sizes and / or specific contractor construction information.

Notes:-

Drainage pond as a draft indicative layout and subject to a full basin design by engineers

AGRICULTURAL LAND

LOCAL WILDLIFE AREA

Buxton FP 2

Nestle Water Main 5m

Nestle Water

connection to remain open

remain open

PLAY AREA (LAP) (refer to drawing 2402.)

Buxton FP 1

m 0 5 10 15 20 25 30 35 40 45 50
SCALE
1:500

KEY

Site Red Line Boundary

Soft Works

Existing Tree
To be retained.
Refer to arboricultural drawings.

Existing Tree
To be removed / pruned.
Refer to arboricultural drawings.

Existing Woodland
To be retained.
Refer to arboricultural drawings.

Existing Hedge
To be retained.
Refer to arboricultural drawings.

Proposed Tree Planting
Clear stem heavy standard tree.

Proposed Hedge Planting
To plot gardens.

Proposed Groundcover Planting
Ornamental planting mix. 98.3739 m²

Proposed Ornamental Shrub & Herbaceous Planting
Ornamental shrub and herbaceous perennials mixes. 526.2877 m²

Proposed Semi-Native Shrub Planting
Ornamental and native shrub mix. 244.2309 m²

Proposed Native Shrub Planting
Native shrub mix. 1518.7563 m²

Proposed Woodland Understory Planting
Native mix. 2793.7021 m²

Proposed Woodland Mix Planting
Native whips and feathers mix. 1686.1201 m²

Proposed Turf Grass
To front gardens. 1176.2858 m²

Proposed Seeded Amenity Grass
To public areas. 1369.2721 m²

Proposed Seeded Species Rich Wildflower Meadow
To public areas. 12054.9751 m²

Proposed Wet Meadow
To pond area. 1142.6080 m²

Native Reeds Mix
To pond area. 32.2571 m²

Pond Water
Approx 117.6260 m²

Rear gardens to be grass seeded
Slopes/ level differences and steps to engineer's details

REV.	DATE	DESCRIPTION	DRAWN	CHK'D
P10	09/07/24	UPDATED LAYOUT	TH	SA
P09	01/07/24	UPDATED LAYOUT	TH	SA
P08	26/02/24	UPDATED LAYOUT	IG	SA
P07	14/02/24	UPDATED LAYOUT	RS	SA
P06	05/04/23	UPDATED LAYOUT - SUB STATION	RS	SA
P05	21/03/23	UPDATED POND LAYOUT AND RED LINE BOUNDARY	RS	SA
P04	31/01/23	HARD LANDSCAPE OMITTED	RS	SA
P03	25/01/23	UPDATED LAYOUT	RS	SA

Client:	Project:	Drawn:	Checked:	Approved:	Date:
BARRATT HOMES	HOGSHAW FARM, BUXTON	RS	SA	ME	29/11/22

Issue:	Title:	Dwg No:	Scale @ A0:	Revision:
PLANNING	GENERAL ARRANGEMENT PLAN	UG_1795_LAN_GA_DRW_01	1:500	P10

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Plant Schedule

QTY	UNIT	CODE	PLANT NAME	STOCK	FORM	GIRTH/HEIGHT
Trees						
23	No.	ACE STR xhs18	Acer campestre "Streetwise"	RB	STD	18-20cm
22	No.	ACE PB XHS18	Acer pseudoplatanus "Brilliantissimum"	RB	STD	18-20cm
18	No.	ALN GLU hs	Alnus glutinosa	RB	STD	12-14cm
17	No.	AME RbH hs	Amelanchier 'Robin Hill'	RB	STD	12-14cm
48	No.	BET PEN hs12	Betula pendula	RB	STD	12-14cm
14	No.	BET PEN xhs18	Betula pendula	RB	STD	18-20cm
21	No.	CAR FRA hs	Carpinus betulus "Frans Fontaine"	RB	STD	12-14cm
5	No.	Ile Nel	Ilex aquipernyi 'Nellie Stevens'	C 45L	STD	12-14cm
6	No.	Lig jap	Ligustrum japonicum	C 45L	STD	12-14cm
6	No.	PHO Red	Photinia fraserii 'Red Robin'	C 45L	STD	14-14cm
17	No.	Pru pad hs	Prunus padus	RB	STD	12-14cm
10	No.	PRU Ros hs	Prunus subhirtella 'Autumnalis Rosea'	RB	STD	12-14cm
4	No.	PYR CHA xhs18	Pyrus calleryana "Chanticleer"	RB	STD	18-20cm
15	No.	QUE ROB12	Quercus robur	RB	STD	12-14cm
9	No.	SAL CAP hs	Salix caprea	RB	STD	12-14cm
22	No.	SOR AUC hs	Sorbus aucuparia	RB	STD	12-14cm
18	No.	TIL COR hs	Tilia cordata	RB	STD	12-14cm

QTY	UNIT	CODE	PLANT NAME	STOCK	SIZE
Hedges					
	m	Laurel hedge	Prunus lusitanica	7.5L	100-120cm
	No.	Plants spaced @ 3/m in a Single Row		To spine road gardens	
	m	Choisya hedge	Choisya ternata 'Sundance'	7.5L	80-100cm
	No.	Plants spaced @ 4/m in a Single Row		To street gardens	
	m	Euonymus hedge	Euonymus japonicus 'Green Rocket'	7.5L	80-100cm
	No.	Plants spaced @ 4/m in a Single Row		To street gardens	

PERCENT	QTY	UNIT	PLANT NAME	STOCK	SIZE
Plant Mixes					
GROUNDCOVER MIX planted @ 5/m2					
20%		No.	Skimmia 'Magic Marlot'	C 5L	30-40cm
20%		No.	Pachysandra terminalis 'Green Carpet'	C 5L	30-40cm
20%		No.	Liriope muscari	C 5L	Full pot
20%		No.	Heuchera 'Palace Purple'	C 5L	Full pot
20%		No.	Carex oshimensis 'Evergold'	C 5L	Full pot
Individual varieties to be planted in groups of approximately 3 or 5.					
SUN SHRUB/HERB. MIX planted @ 4/m2					
10%		No.	Potentilla fruticosa 'Abbotswood'	C 5L	30-40cm
10%		No.	Skimmia confusa 'Kew Green'	C 5L	30-40cm
10%		No.	Pinus mugo 'Mops'	C 5L	30-40cm
10%		No.	Lavandula angustifolia 'Grosso'	C 5L	30-40cm
10%		No.	Hypericum 'Hidcote'	C 5L	30-40cm
10%		No.	Hebe 'Mrs Winder'	C 5L	30-40cm
15%		No.	Carex oshimensis 'Evergold'	C 5L	Full pot
15%		No.	Erysimum 'Bowles' Mauve'	C 5L	Full pot
10%		No.	Cornus alba 'Aurea'	C 5L	30-40cm
Individual varieties to be planted in groups of 3.					
SHADE SHRUB/HERB. MIX planted @ 4/m2					
20%		No.	Sarcococca humilis	C 5L	30-40cm
10%		No.	Viburnum davidii	C 5L	30-40cm
10%		No.	Euonymus fortunei 'Emerald Gaiety'	C 5L	30-40cm
10%		No.	Skimmia japonica 'Rubella'	C 5L	30-40cm
20%		No.	Helleborus x hybridus 'White Lady'	C 5L	Full pot
10%		No.	Carex oshimensis 'Evergold'	C 5L	Full pot
10%		No.	Polystichum munitum	C 5L	Full pot
10%		No.	Polystichum polyblepharum	C 5L	Full pot
Individual varieties to be planted in groups of 3.					
NATIVE SHRUB MIX 6 planted @ 1m centres					
20%		No.	Corylus avellana	B Trans	60-80cm
20%		No.	Viburnum opulus	B Trans	60-80cm
15%		No.	Cornus sanguinea	B Trans	60-80cm
15%		No.	Prunus padus	B Trans	60-80cm
10%		No.	Crataegus monogyna	B Trans	60-80cm
10%		No.	Malus sylvestris	B Trans	60-80cm
10%		No.	Sambucus nigra	B Trans	60-80cm
Individual varieties to be planted in groups of approximately 3-7					
NATIVE UNDERSTORY SHRUB MIX planted @ 3/m2					
20%		No.	Viburnum opulus	B Trans	60-80cm
20%		No.	Sambucus nigra	B Trans	60-80cm
20%		No.	Cornus sanguinea	B Trans	60-80cm
20%		No.	Corylus avellana	B Trans	60-80cm
20%		No.	Ligustrum vulgare	C 3L	40-60cm
MEDIUM SEMI-NATIVE SHRUB MIX planted @ 4/m2					
5%		No.	Chaenomeles japonica	C 3L	40-60cm
5%		No.	Chaenomeles speciosa	C 3L	40-60cm
15%		No.	Hebe 'Midsummer Beauty'	C 3L	30-40cm
15%		No.	Skimmia japonica 'Rubella'	C 2L	30-40cm
10%		No.	Daphne laureola	C 3L	20-30cm
10%		No.	Hypericum androsaemum	C 3L	30-40cm
10%		No.	Salix repens	C 3L	40-60cm
10%		No.	Cornus sanguinea	B Trans	60-80cm
10%		No.	Rosa canina	B Trans	60-80cm
10%		No.	Ligustrum vulgare	B Trans	60-80cm
Individual varieties to be planted in groups of approximately 3-5. Chaenomeles and Rosa canina to be positioned furthest from pathways.					
NATIVE WOODLAND MIX 1 planted @ 1.5m centres					
20%		No.	Crataegus monogyna	B TRANS	60-80cm
20%		No.	Viburnum opulus	B TRANS	60-80cm
20%		No.	Corylus avellana	B TRANS	60-80cm
10%		No.	Viburnum lantana	C 3L	40-60cm
10%		No.	Betula pendula	B TRANS	60-80cm
5%		No.	Sorbus aucuparia	B TRANS	60-80cm
10%		No.	Fagus Sylvatica	B FTH	125-150cm
5%		No.	Quercus robur	B FTH	125-150cm
Individual varieties to be planted in groups of approximately 5. Feathers to be planted at 4.5m centres with in the mix.					
GENERAL WILDFLOWER MEADOW MIX seeded @ 4g/m2					
100%		No.	No. EM2 Standard General Purpose Meadow Mixture	Seed	
Seeded at 4g m2 over prepared ground					
WET MEADOW MIX seeded @ 4g/m2					
100%		No.	No. Wet Wildflower Meadow Seed Mix	Seed	
Seeded at 4g m2 over prepared ground from Habitat Aid					
NATIVE REEDS MIX planted @ 3/m2					
15%		No.	Carex acutiformis	C 1L	
15%		No.	Iris pseudacorus	C 1L	
15%		No.	Sparganium erectum	C 1L	
15%		No.	Scirpoides holoschoenus	C 1L	
10%		No.	Juncus articulatus	C 1L	
10%		No.	Lythrum salicaria	C 1L	
10%		No.	Ranunculus lingua	C 1L	
5%		No.	Phragmites australis	C 1L	
5%		No.	Typha latifolia	C 1L	
Individual varieties to be planted in groups of approximately 5-7.					

Notes and Abbreviations

B	=	Bare root (bagged).
C	=	Container (or pot) grown, followed by size of the container (or pot).
FORM	=	Shape of tree as supplied by the nursery.
QTY	=	Quantity
RB	=	Rootballed (balled and wrapped).
SIZE	=	Height or Spread of juvenile plant.
Std	=	(clear stem) Standard.
STOCK	=	Root condition/protection method eg Bare root.
Trans	=	Transplant (or undercut seedling).

- Refer to specification for further information.
- All plants to be completely hardened off
- Substitutions to be agreed with Landscape Architect.



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Notes:-

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To be retained.
Refer to arboricultural drawings.

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Refer to arboricultural drawings.

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To pond area. 32.2571 m²

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Approx 117.6260 m²

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Slopes/ level differences and steps to engineer's details

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P06	09/07/24	UPDATED LAYOUT	TH	SA
P05	01/07/24	UPDATED LAYOUT	TH	SA
P04	14/02/24	UPDATED LAYOUT	RS	SA
P03	05/04/23	UPDATED LAYOUT - SUB STATION	RS	SA
P02	21/03/23	UPDATED POND LAYOUT AND RED LINE BOUNDARY	RS	SA

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Client: BARRATT HOMES

Project: HOGSHAW FARM, BUXTON

Title: SOFT LANDSCAPE PLAN 2/4

Issue: PLANNING

Drawn:	Checked:	Approved:
RS	SA	ME
Project: UG1795	**Scale @ A0:** 1:250	**Date:** 25/01/23
Dwg No: UG_1795_LAN_SL_DRW_03		**Revision:** P06

BIODIVERSITY ENHANCEMENT MANAGEMENT PLAN

JULY 2024

Hogshaw Farm,
Fairfield,
Buxton,
SK17 7HN

URBAN GREEN

QUALITY MANAGEMENT

Project No.:	UG1795				
Project:	Hogshaw Farm				
Location:	Fairfield, Buxton, SK17 7HN				
Title:	Biodiversity Enhancement Management Plan				
Document Type:	BEMP	**Issue No.:**	01		
Date:	27/01/2023				
Prepared By:	Sarah Child	**Signature:**		**Qualifications:**	Biodiversity Net Gain Consultant
Checked By:	Shannon Brady	**Signature:**		**Qualifications:**	Biodiversity Net Gain Consultant

Revision Status:

Rev:	Date:	Issue/Purpose/ Comment:	Prepared:	Checked:
02	21/03/2023	Updates to habitat classifications	SC	SB
03	06/04/2023	Updated to reflect changes to landscape plans	SC	SB
04	29/02/2024	Updated to reflect consultee comments and amended landscape plans	SC	SB
05	19/07/2024	Updates to reflect changes to landscape plans	SC	TM

CONTENTS

1 Introduction 1

1.1 Background to the Scheme 1

1.2 Site Context 1

1.3 Purpose of this Management Plan 2

1.4 Aims of this Management Plan 2

2 Development Proposals 3

3 Management Considerations 4

3.1 Management Responsibilities 4

3.2 Controlling Authority 4

3.3 Health and Safety 4

3.4 Monitoring and Review 4

3.5 General Measures 5

4 Ecological Baseline 6

5 Biodiversity Enhancements 10

5.1 Bat Boxes 10

5.2 Bird Boxes 11

5.3 Hedgehog 13

5.4 Work Schedule 15

6 Ecological Strategy 16

6.1 Retained Linear Hedgerow Habitats 16

6.2 Created Area Habitats 17

6.3 Linear Habitats 29

6.4 Five Year Work Programme 30

7 References 39

APPENDIX 1 - BIODIVERSITY ENHANCEMENTS LOCATION PLAN 41

APPENDIX 2 - SCHEDULE 9 INVASIVE SPECIES 42

1 Introduction

1.1 Background to the Scheme

Barratt Homes are proposing to develop land at Hogshaw Farm in Fairfield, Buxton (hereafter referred to as 'the site'). The proposals include the construction of approximately 99 residential units with associated hard and soft landscaping.

Urban Green have been appointed to provide a Biodiversity Enhancement Management Plan (BEMP) for the site which has been written to accompany the Biodiversity Net Gain Assessment of this site.

The author of the report is Biodiversity Net Gain Consultant, Sarah Child. Sarah has experience providing consulting services in Biodiversity Net Gain for a range of development schemes, both residential and commercial, across the UK.

1.2 Site Context

The site is located at National Grid Reference SK 06584 74409 and comprises a total area of approximately 5.6ha (see Figure 1).

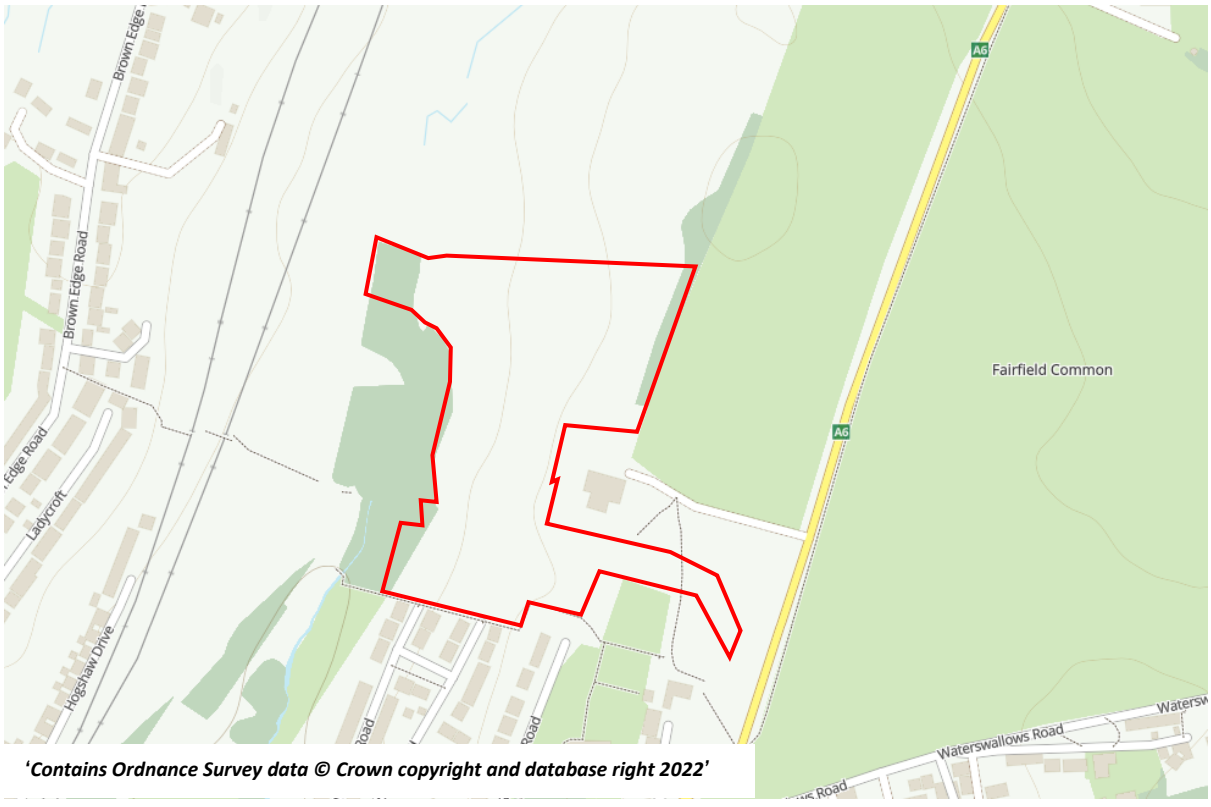


Figure 1 – Site Extent

The site is located in the rural-urban fringe of Buxton, approximately 1.5km north-east of the town centre. The A6 lies approximately 50m east of the site, with Nun Brook approximately 20m west of the site. Residential housing lies immediately south of the site, with areas of recreational green space to the east and west and agricultural land to the north. An industrial unit is present along the central aspect of the eastern boundary of the site.

1.3 Purpose of this Management Plan

The purpose of this management plan is to provide a schedule for the long-term management of habitats on site, ensure that existing and proposed habitats are suitably maintained and ensure good establishment and continued improvement of habitat condition. This allows those responsible for the management and maintenance of the site to understand the existing habitats, the development and ongoing management requirements of the site. Habitats should be maintained under a formal management regime for a minimum of 30 years, in accordance with the Environment Act 2021, with regular assessments during this period to assess the development and condition of habitats.

1.4 Aims of this Management Plan

This management plan covers the habitat creation and enhancement on site, as detailed within the Biodiversity Net Gain (BNG) Assessment (Urban Green, 2024a & 2024b). This report assessed the development as scoring an 86.76% net gain in area habitat units, a 19.85% net gain in linear hedgerow units, and no net change in river units utilising the Biodiversity Metric 3.1.

Appropriate management practices are essential to ensuring that the proposed habitats reach the condition outlined within the Biodiversity Net Gain assessment and that the development achieves the predicted gain in value to the environment. The aim of this management plan is to provide a habitat management plan that:

- Maintains and enhances site biodiversity, through the sustainable management of on-site habitats;
- Promotes the successful establishment and growth of newly created habitats;
- Ensures the health and safety of all site user's post development is protected;
- Outlines a process for the regular monitoring and review of management practices and site habitats; and
- Provide measurable and achievable targets appropriate to each habitat to ensure condition targets are met as set out in Section 6 in accordance with Biodiversity Metric 3.1 habitat condition sheets.

2 Development Proposals

The current landscape proposals for the development of the site produce an 86.76% net gain in area habitat units, a 19.85% net gain in linear hedgerow units, and no net change in river units. Overall, it demonstrates that the post-development habitats on site will provide more ecological benefit to wildlife than the habitats currently found on site and the development is in line with the relevant National Planning Policy Framework and Local Planning Policies. The proposed development also satisfies the trading rules.

3 Management Considerations

3.1 Management Responsibilities

The implementation of this management plan will be the responsibility of the landowner for a minimum of 30 years, based on requirements within the Environment Act (2021). Any transference of responsibility of this plan should be undertaken with the appropriate appointment of a competent organisation capable of delivering the management detailed within the document.

The organisation implementing this plan will be a management company with the necessary certificates of competence to implement landscape management operation on site. The managing organisation will ensure that all site management complies with good practice standards and all relevant health and safety procedures. The managing organisation will also ensure that measures outlined to avoid pollution incidents, comply with protected species and habitats legislation, and ensure overall environmental protection are enforced.

A maintenance specification is provided in Section 6. This sets out the detailed maintenance requirements for the habitats onsite, which must be followed at all times. Any deviations from the management plan must be highlighted to the site owners or management company.

3.2 Controlling Authority

The controlling authority, High Peak Borough Council, should be consulted on any matters relating to the approved landscape proposals for the scheme.

3.3 Health and Safety

The site will be managed to comply with all relevant health and safety legislation, approved codes of practice (ACOP) and Health and Safety Executive (HSE) guidance.

As the managing organisation will be the main company involved in on site works, the managing organisation will fulfil the landowner's role and the work manager's role. This places an obligation on the managing company to ensure that any contractor understands and fulfils their health and safety role and any work undertaken on the site will follow the guidelines of the HSE.

3.4 Monitoring and Review

Regular monitoring of the development against measurable targets (as detailed within Section 6) will be undertaken across all habitats detailed within this management plan during the 30-year period. The outcome of this monitoring will form part of a Monitoring and Audit Report to be submitted to the site owner annually to inform the forthcoming year's work. The report will include management operations undertaken, any unexpected changes or declines in habitat condition and any actions required that fall outside those detailed within this report.

A more in-depth habitat assessment of the created habitats on site should also be undertaken between April and September annually by an experienced ecologist. Results should be reported back and feed into a five-year management plan review, to enable assessment of the management prescriptions against the defined objectives for each habitat. Where objectives are not being adequately met, appropriate action will be put in place, with any refinements incorporated into the updated management plan and annual work programme. This review will enable maintenance operations to evolve in accordance with habitat requirements as they establish, and mature and targeted conditions are met.

3.5 General Measures

Habitat creation on site will follow details set out in the Detailed Planting Plan (Urban Green, 2024c). The following general measures shall be met to ensure successful habitat creation and succession on site.

- All planting is to follow guidance set out in the relevant British Standard or Horticultural Trades Association documents and carried out by a competent person.
- Planting is to remain undamaged, with healthy and vigorous growth, and is to be planted upright and well balanced. Trees and shrubs are to be of good shape and without elongated shoots, grown in a suitable environment and hardened off before being delivered to the site.
- All planting is to be true to name and free from pests, diseases, discoloration, weeds, fungus, and physiological disorders upon planting.
- If plants/trees are unobtainable alternatives are to be agreed with the Ecologist/Landscape Architect in writing prior to ordering.
- After planting ensure that the full depth of topsoil is wetted. Apply water evenly and without damaging or displacing plants or soil. Continue to water as necessary to ensure the successful establishment and continued thriving of planting.
- All tree/shrub/hedgerow works shall be completed outside of nesting bird season (i.e. between October and February inclusive). If works are required within the nesting bird season, a check must be undertaken of all affected trees by a suitably qualified ecologist.
- All tree works shall be carried out by a skilled, qualified and approved Arboricultural Contractor in accordance with BS3998: 2010 'Tree Work – Recommendations'.

4 Ecological Baseline

The ecological baseline for the site was assessed within the Preliminary Ecological Assessment (PEA) (Urban Green, 2023) informed by an extended phase one habitat survey. A summary of designated sites, notable and/or protected species and habitats identified is provided below, with full descriptions of each feature available within the PEA. The baseline habitat map for the site can be found in the Biodiversity Net Gain Report (Urban Green, 2024a).

Table 1 – Identified designated sites relevant to the site.

Designated Site	Considered within Assessment	Rationale for Consideration
Statutory Designated Sites		
Peak District Dales Special Area of Conservation (SAC)	No	Site falls outside of the 1km radius (1.3km south-east of site)
South Pennine Moors SAC / Peak District Moors Special Protection Area (SPA)	No	Site falls outside of the 1km radius (2.6km west of site)
Waterswallows Quarry (SSSI)	Yes	Site falls within the Impact Risk Zone for the SSSI
The Wye Valley (SSSI)	Yes	Site falls within the Impact Risk Zone for the SSSI
Topley Pike and Deep Dale (SSSI)	Yes	Site falls within the Impact Risk Zone for the SSSI
Poole's Cavern and Grin Low Wood (SSSI)	Yes	Site falls within the Impact Risk Zone for the SSSI
Goyt Valley (SSSI)	Yes	Site falls within the Impact Risk Zone for the SSSI
Leek Moors (SSSI)	Yes	Site falls within the Impact Risk Zone for the SSSI
Non-statutory Designated Sites		
Railway Land Hogshaw Local Wildlife Site (LWS)	Yes	The area of woodland to the west of the site lies within the Railway Land Hogshaw LWS.

Table 2 – Identified species relevant to the site.

Species / Species Group	Evidence	Considered within Assessment	Rationale for Consideration
Fauna			
Invertebrates	Limited quality habitats for invertebrates	No	One record of notable invertebrates was found during the data search, but there is limited habitat provision.
Common Amphibians	Suitable linear habitat present	Yes	No records of common amphibian were found, however the habitats present on site have potential to support amphibians.
Great crested newt (*Triturus cristatus*)	None	No	Three records of GCN were returned within the data search, however there is limited habitat provision on site.
Reptiles	None	No	No records returned in the data search and the habitats present on site have potential to support amphibians.
Birds	Suitable habitat present	Yes	11 records of protected/notable bird species were returned from the data search. There is suitable nesting potential for passerine birds and foraging for birds of prey.
Bats (all species)	Suitable habitat present	Yes	24 records of bats and two records of roosts were returned. The site was assessed to have moderate value for roosting, foraging and commuting bats.
Hedgehog (*Erinaceus europaeus*)	Suitable habitat present	Yes	Four records of hedgehog were returned. The hedgerow habitats have potential to support hedgehog and there is connectivity with other suitable habitats.
Brown hare (*Lepus europaeusî*)	Suitable habitat present	Yes	One record of brown hare was returned. No evidence of brown hare was found, however there is suitable habitat present.
Water vole (*Arvicola amphibius*)	None	No	On record returned for water vole, however, there is limited suitable habitat on site.
White-clawed crayfish (*Austropotamobius pallipes*)	Suitable habitat present	Yes	No previous records of white-clawed crayfish, however Nun Brook may provide suitable habitat (surveys not yet completed).

Species / Species Group	Evidence	Considered within Assessment	Rationale for Consideration
Fish	None	No	Three records of brown trout (*Salmo trutta*) were returned, however Nun Brook was not considered suitable for fish.
Flora			
Vascular plants	None	No	Seven records for vascular plants were found during the data search, but the site lacks the characteristics to support notable plant species
Invasive Plant Species	Observed on site	Yes	31 records for invasive plant species were returned, and Japanese knotweed (*Fallopia japonica*) and Himalayan balsam (*Impatiens glandulifera*) were observed on site.

Table 3 – Pre-development Habitats Identified

UK Hab Classification	Dominant Species / Description	Development Actions and Mitigation
Area Habitats		
Grassland – Modified Grassland	Five parcels of modified grassland were present on site, with varied levels of management and species compositions. Species present included perennial rye grass (*Lolium perenne*), with occasional cock's foot (*Dactylis glomerata*), dandelion (*Taraxacum agg.*), and creeping buttercup (*Ranunculus repens*). Some parcels also contained Japanese knotweed.	All parcels of grassland were in poor condition and offer limited habitat provision. New areas of wildflower meadow will be created around the periphery of the site and within the public open space which will be more ecologically beneficial.
Woodland – Other Woodland; Broadleaved	An area of woodland was present along the western site border, which included ash (*Fraxinus excelsior*), goat willow (*Salix caprea*), wych elm (*Ulmus glabra*), and cherry, sycamore (*Acer pseudoplatanus*). This area of woodland forms part of the Railway Land Hogshaw LWS.	While this area of woodland was poor condition, it still provides ecological value, however it will be lost to accommodate for the development. New areas of woodland will be created within the LWS and additional urban trees will be planted on site, however the loss of this habitat will not be fully compensated for.
Urban – Urban Trees	Four urban trees were present on the site along the western boundary – three goat willow and one silver birch (*Betula pendula*). These trees were inside the Railway Land Hogshaw LWS.	All four urban trees will be lost, however an additional 217 urban trees will be planted to mitigate for those lost
Urban – Artificial Unvegetated, Unsealed Surface	A footpath comprised of compact gravel substrate. No species present.	The metric allocates this habitat a condition score of N/A as it has low ecological value.

UK Hab Classification	Dominant Species / Description	Development Actions and Mitigation
Urban – Developed Land; Sealed Surface	Three buildings present on site, with some roosting potential for bats.	The metric allocates this habitat a condition score of N/A as it has low ecological value.
Linear Hedgerow Habitats		
Line of Trees	There are four lines of trees present on site, which predominantly form boundaries between fields and adjacent properties. Species present include ash, hawthorn (*Crataegus monogyna*), silver birch, sycamore, and willow (*Salix spp.*).	All four lines of trees present on the site are in moderate condition. Sections of two lines of trees (L1 and L2) will be lost as part of the development, however an additional eight lines of trees will be created across the site to compensate for this.
Built Linear Features	Dry-stone walls and fence lines were present on site, forming the site boundary and separating different parcels of land.	The metric allocates this habitat a condition score of N/A as it has low ecological value.
Linear River Habitats		
Other Rivers and Streams (Nun Brook)	Nun Brook was culverted through most of the woodland. Vegetation was present on the embankments either side and within the brook itself comprising occasional pendulous sedge (*Carex pendula*), cock's foot, Yorkshire fog (*Holcus lanatus*), and creeping buttercup.	The river was in fairly poor condition and will be retained in the development.

5 Biodiversity Enhancements

5.1 Bat Boxes

A total of 12 bat boxes are to be installed across the site. The bat boxes selected will provide a range of suitable conditions and target pipistrelle species that were confirmed present within the area during the data search for the PEA (Urban Green, 2023).

Externally mounted bat boxes are to be positioned on mature trees or newly constructed houses. Please refer to Table 4 for the bat box specifications examples. A bat box design of similar specification can be selected for the site.

Table 4 - Bat box specification

Bat Box Type	Image	Total Number of Boxes
Greenwoods Ecohabitats Two Crevice Bat Box Dimensions: External: 43 high x 21.5 wide x6.8 deep Internal: 41 x 16.5 x1.8 Weight: 6.75 kg		6
Greenwoods Ecohabitats Medium Hollow Bat Box Dimensions: External: 43 x 21.5 x 13.5 Internal: 41 x 16.5 x 8.5 Weight: 6.75		6

5.1.1 Positioning of Bat Boxes

Bat boxes must be positioned between 4–6m high and are most effective when located on a south-east to south-western facing aspect, as this will provide additional heat throughout the day. Bats prefer to change roosts to benefit from varying ambient temperatures, as such, bat boxes are to be clustered on trees in groups of two, with one box located on the south-western aspect and another on the south-eastern. Please refer to Appendix 1 for the Biodiversity Enhancements Location Plan.

5.1.2 Timing of Installation

As some trees and buildings assessed as having low to moderate potential for roosting bats will be lost as part of the development, it is recommended that bat boxes are to be installed prior to construction commencing, on existing trees.

5.1.3 Maintenance of Bat Boxes

Bat boxes are considered self-cleaning and require minimal maintenance once installed. The boxes are made of hard-wearing material that is generally long-lasting. Bat boxes should be checked periodically (e.g., every two years) to assess their use and the condition of the boxes. Section 2.4 includes the maintenance schedule.

If any boxes are identified as damaged or missing, they are to be replaced with a box of similar specification.

Note only those holding the appropriate Natural England Class 2 bat licence may open and inspect these boxes. It is an offence for anyone without this licence to open a bat box. If a bat box becomes occupied by a bird the nest must be left *in situ* until after the bird nesting season (March to September inclusive).

5.2 Bird Boxes

The development has the potential to enhance bird nesting opportunities through the provision of bird nest boxes. A total of 12 bird boxes are to be installed across the site.

Bird boxes come in several types and sizes, which vary in their suitability from species to species. Table 5 provides details of bird nest box types and the likely species they attract. Bird species that are known to inhabit the local area and readily utilise artificial nest boxes have been selected. Boxes of similar specifications as those detailed in Table 6 can be selected, in the case the example boxes are not available.

Table 5 - Bird nest box hole sizes and associated species

Box entrance hole size	Associated species
28mm	Great tit (*Parus major*), tree sparrow (*Passer montanus*), pied flycatchers (*Ficedula hypoleuca*)
32mm	House sparrow (*Passer domesticus*)
45mm	Starling (*Sturnus vulgaris*)
13cm high x 12cm wide	Barn owl (*Tyto alba*)

Table 6 – Bird nest boxes that can be bought from websites such as nhbs.com, habibat.co.uk or other online retailers

Bird box type	Image	Target Species	Number of boxes
BilBao Woodstone Nest Box Specification Height:210mm Width: 305mm Depth:120mm Entrance Hole Diameter: 28mm Weight: 6kg Material: Woodstone		Coal tit, blue tit, great tit	4
BilBao Woodstone Nest Box Specification Height: 210mm Width: 305mm Depth: 120mm Entrance Hole diameter: Oval 32mm Weight: 6kg Material: Woodstone		House sparrow, tree sparrow, great tit, blue tit, nuthatch	4
Vivara Pro Woodstone Starling Nest Box Specification Height: 385mm Width: 220mm Depth: 215mm Entrance hole diameter: 45mm Weight 7.4kg Material: Woodstone		Starling	2
Barn Owl Nest Box Specification Height: 74cm Width: 59cm Depth: 50cm Depth of enclosed box: 34cm Entrance hole: 13cm high x 12cm width Weight: 8kg approx. Material: FSC certified exterior grade plywood		Barn owl	2

5.2.1 Positioning of Bird Boxes

Bird boxes are most effective when positioned on a north-east to north-west facing aspect to prevent overheating during the summer nesting season. Care should be taken to make sure boxes are not angled in such a manner to allow rain to enter them. Nest boxes are to be affixed to vertical surfaces on retained

trees at a minimum height of 3m. Please refer to Appendix 1 for the Biodiversity Enhancements Location Plan.

5.2.2 Timing of Installation

The bird boxes must be installed at the earliest opportunity in order to compensate for the disturbance of the on-site nesting habitat. Bird boxes can be installed at any time of the year. However, they must remain undisturbed throughout the bird nesting season (March to September inclusive) to avoid disturbing nesting birds and committing an offence under the Wildlife and Countryside Act 1981 (as amended). Section 2.4 includes the Schedule of Works.

5.2.3 Maintenance of Bird Boxes

The boxes are made of Woodstone, which have been selected due to their durability compared traditional softwood boxes.

The following maintenance measures are to be completed, following the installation of the boxes:

- Bird boxes will require periodic checking and cleaning, (e.g., once every two years).
- Unhatched eggs may be removed legally between September and January and must then be disposed of.
- Disused nests must be removed and cleaned using boiling water to remove parasites. Boxes should be left to dry before replacing the lid. Insecticides and flea powders must not be used.
- If any boxes are identified as damaged or missing, they are to be replaced with a box of similar specification.

Note bird boxes must only be opened and cleaned outside the bird nesting season (which is between March to September inclusive).

5.3 Hedgehog

The site is considered to have potential to support hedgehogs, therefore, hedgehog highways are to be installed across the site to improve connectivity. Additionally, hedgehog homes are to be installed within suitable areas for hedgehogs within the site to provide additional hibernation features.

Appendix 1 details the location of the proposed hedgehog homes to be installed within the site. If hedgehog homes are not available, brash/wood piles can be used instead in similar locations.

Specifications for hedgehog enhancements are detailed in Table 7.

Table 7 – Hedgehog enhancements that can be bought from websites such as britishhedgehogs.org.uk, arkwildlife.co.uk or other online retailers

Specification	Image	Number of homes
Hedgehog Home Approximately 23 x 52 x 40cm (9" x 20½ " x 16").		6
Hedgehog Highway Height: 13cm Width: 15cm Image for illustrative purposes only, sign not required		Within garden fences

5.3.1 Hedgehog Homes Locations

A hedgehog house contains a narrow or tunnel-like entrance, which is essential to prevent predators such as foxes and badgers gaining access to the hedgehog house. In addition, camouflaging the top and sides of house with soil and leaves can also help to reduce the chance of predation, ensuring that the entrance remains clear at all times for hedgehog access.

Hedgehog homes are to be placed out of direct sunlight and must not face the north or north-east aspects (to avoid cold winter winds) and where it will not be disturbed, such as against a wall, bank or fence (British Hedgehog Preservation Society, 2018).

To prolong the longevity, hedgehog homes must be emptied (if absent from hedgehog presence) annually in April or October, to reduce the infestation of fleas and ticks that can be transferred through nest use. If hedgehog presence is confirmed within hedgehog homes from initial inspection (upon gently removing the lid), then this hedgehog home must be exempt from the annual clean until the following year (subject to presence of a hedgehog).

If possible, the addition of hay or straw must be added to each hedgehog home for insulation and replaced after an annual clean has been completed. Further information is available on the Hedgehog Street website (https://www.hedgehogstreet.org/cleaning-out-boxes/), and within the Work Schedule located in Section 5.4.

5.3.2 Hedgehog Highway Locations

Hedgehog highways comprise small gaps within fences, approximately 13cm x 13cm. They are to be installed across the site creating a corridor for hedgehogs to commute across the site and into residential gardens. It is recommended that every fence within the development has a hedgehog highway gap included to facilitate full movement of hedgehog across the site.

5.4 Work Schedule

Key

	Recommended times when works can be conducted
	Times to avoid work

5.4.1 During Construction

Works	J	F	M	A	M	J	J	A	S	O	N	D
Erect boxes / Deploy hedgehog houses	Any time of year. All bird/bat/hedgehog boxes to be erected prior to the completion of the scheme.											

5.4.2 Post-Construction

Works	J	F	M	A	M	J	J	A	S	O	N	D
Bird box check and cleaning			Avoid bird nesting season									
Bat box checks												
Annual hedgehog house clean and replacement of bedding (if absent from hedgehog presence)												

Bird and bat box checks should be conducted in October of every other year to ensure that there is sufficient time for any repairs or replacements to be conducted.

6 Ecological Strategy

This section summarises the management strategy for each habitat proposed to be introduced within the final design of the scheme and the recommended management practices for habitats to be retained within the development. Each objective includes a target time for positive assessment provided to enable identification of failing management and trigger early intervention. Management plans have been included detailing management objectives for an initial 5-year period. Regular monitoring of the site against the management objectives will be conducted during the first five years of the project, and a review of the management strategies will be undertaken, with any updates or changes to the program incorporated for the next five years of the management plan.

The proposed landscape layout (Urban Green, 2024c), found in the Biodiversity Net Gain Report (Urban Green, 2024a), displays the final proposed habitats and their location on site. Areas which are classified as 'developed land, sealed surface' offer no ecological benefit and the ecological value of 'vegetated gardens' is highly dependent on how they are used by homeowners. Therefore, both habitats are automatically allocated condition scores of N/A and require no ecologically driven management.

6.1 Retained Linear Hedgerow Habitats

6.1.1 Line of Trees

There were four lines of trees present on the site which will all be retained in their entirety. Detailed management techniques for lines of trees are described within Table 8 along with the corresponding condition criteria. All of these lines of trees are in **moderate** condition; in order to maintain this condition, at least 3 of the condition criteria detailed in Table 8 are expected to be achieved. An annual schedule of works for the first 5 years post-development is detailed in Table 15 in Section 6.5.

Table 8 – Management Objectives for Line of Trees

Condition Assessment Criteria / objective	Management Activities	Benefit to environment	Target time for Positive Assessment
1. More than 70% of trees are native species	• Replace failed trees with new tree planting • Native species should be preferred for replacement planting. Chosen species should be consistent with the local species composition	Native trees are associated with higher overall species diversity and provide resources suited to native wildlife	From year 1
2. Tree canopy is predominantly continuous	• Where gaps in the canopy arise, new trees of appropriate size should be planted to fill these gaps • Only undertake pruning within the canopy, particularly where the crown would be reduced, where necessary	Continuous canopy cover forms an unbroken, linear corridor which facilitates the movement of wildlife between habitats and across landscapes	From year 1
3. Includes one or more mature	• Limit the use of damaging management practices e.g., herbicide use	Promotes healthy growth of trees to mature or veteran status. Mature	From year 1

	or veteran trees	• When trees reach maturity, appropriate corrective surgery may be necessary to sustain good health • Removal of diseased trees to prevent spread • Undertake regular arboricultural assessments based on recommendations in the AIA	and veteran trees offer more ecological niches and ecosystem services than younger trees	
4.	There is an undisturbed, naturally vegetated strip 6m either side	• Leave 6m strips adjacent to the line of trees unmanaged to allow a natural vegetated community to develop • In these areas, avoid activities which would cause disturbance, such as mowing, weeding, applying fertiliser, high levels of footfall • This is not achievable for all lines of trees on site due to location and so some lines of trees will automatically fail this criterion	An additional, natural habitat around the line of trees will act as a buffer between the trees and wider development and as a transition habitat for fauna	From year 1
5.	At least 95% of trees are in healthy condition	• Only undertake management activities where necessary • Limit use of herbicides around trees • Tree works/pruning should be undertaken by a qualified professional • Avoid cutting all specimens across the plot in a single period, particularly where this is likely to remove all flower/fruit interest for wildlife. • Removal of diseased trees to prevent spread • Ensure tree canopy is balanced and consistent with the natural structure for the species	Promotes healthy growth and supports growth to maturity or veteran status	From year 1

6.2 Created Area Habitats

6.2.1 Urban - Urban trees – Proposed Trees

A total of 275 (123 small and 152 medium) trees will be planted across the site, however 147 have been classified within separate habitats. The remaining 108 urban trees will be planted in the public open space, with twenty being within the Railway Land Hogshaw LWS. The mix incorporates both native and non-native species, such as silver birch, bird cherry (*Prunus padus*), pedunculate oak, hornbeam 'Frans Fontaine' (*Carpinus betulus* 'Frans Fontaine'), and field maple 'Streetwise' (*Acer campestre* 'Streetwise').

Detailed management techniques for new urban trees are described within Table 9 along with the corresponding condition criteria. The targeted condition for the new urban trees is **moderate**, with an expected target condition time of 27 years. In order to reach the expected targeted condition, at least 3

of the condition criteria must be achieved. As individual trees automatically pass criterion 2, this is not assessed. An annual schedule of works for the first 5 years post-development is detailed in Table 16 in Section 6.4.

Table 9 – Management Objectives for Urban Trees

Condition Assessment Criteria / objective	Management Activities	Benefit to environment	Target time for Positive Assessment
1. The tree is a native species	Replace failed trees like for like (according to planting scheme and landscapes)	Trees provide biodiverse habitats, with native trees supporting more native species	From year 1
2. The tree canopy is predominantly continuous	N/A	N/A	N/A
3. The tree is mature or veteran	• Limit the use of damaging management practices e.g., herbicide use • After 10-20 years, trees will reach semi-maturity and appropriate corrective surgery may be necessary. • Undertake regular arboricultural assessments based on formal recommendations (Urban Green, 2024d)	Mature and veteran trees are more effective than young trees at providing air filtration services and sequester carbon. Veteran trees provide additional niches for wildlife.	10 years
4. There is little or no evidence of an adverse impact on tree health by anthropogenic activities and no current regular pruning regime so the trees retain >75% of expected canopy	• Only undertake management activities where necessary • Limit use of herbicides around trees • Tree works/pruning should be undertaken by a qualified professional • Avoid cutting all specimens across the plot in a single period, particularly where this is likely to removes all flower/fruit interest for wildlife. • Ensure tree canopy is balanced and consistent with the natural structure for the species	Promotes healthy growth and supports growth to maturity.	From year 1
5. Micro-habitats for birds, mammals and insects are present	• Leave any micro-habitat features, such as ivy and loose bark, in place	Ensures diversity is maintained throughout by allowing the creation of additional habitat niches	By year 5

	• Where it is safe and appropriate, retain areas of dead wood • No management activities to take place during nesting season (February to August) • Avoid undertaking management activities on all trees in a single month period to retain important resources for wildlife. • Installation of bird and bat boxes in suitable locations on trees	which can be exploited by wildlife.	
6. More than 20% of the tree canopy area is oversailing vegetation beneath	• Leave a 2m unmown buffer zone around each tree to allow natural succession of surrounding vegetation • No use of herbicides within this zone • Periodic removal of non-native invasive species (Appendix 2)	Creates a buffer habitat around trees to allow movement of wildlife and increases diversity of flora	From year 1

6.2.2 Urban - Introduced Shrub

Areas of introduced shrub containing different species mixes will be created within the public space to improve the visual amenity of the area. Within the landscape proposals, the introduced shrub mixes are classified as 'Proposed Ornamental Shrub and Herbaceous Planting' and 'Proposed Semi-native Shrub Planting,' and include species such as Japanese quince (*Chaenomeles japonica*), creeping willow (Salix repens), and spurge-laurel (*Daphne laureola*).

Planting will provide a positive visual impact but has limited value as a habitat. Introduced shrub is automatically assigned a condition score of **N/A** within the metric and, due to the ornamental nature and limited ecological value that this habitat type provides, only basic aesthetic management is required.

6.2.3 Heathland and Shrub - Mixed Scrub

Blocks of native mixed scrub habitat will be planted within the areas of wildflower meadows, to the east and west of the site, adding diversity to these habitats. These mixes are classified as 'Proposed Native Shrub Planting' and 'Proposed Woodland Understory Planting' in the landscape proposals. Species such as dog wood (*Cornus sanguinea*), elder (*Sambucus nigra*), guelder rose (*Viburnum opulus*), hazel (*Corylus avellana*), silver birch, bird cherry and rowan (*Sorbus aucuparia*) will be planted in mixed groups to create this habitat.

Detailed management techniques for new mixed scrub are described within Table 11 along with the corresponding condition criteria. The expected condition for all areas of mixed scrub is **poor**, with an expected target condition time of 1 year. Management practices should aim to produce a habitat which

reaches a better condition score of moderate (meets 3 condition criteria) or good (meets all criteria) by following the guidance laid out in Table 10. An annual schedule of works for the first 5 years post-development is detailed in Table 17 in Section 6.4.

Table 10 – Management Objectives for Mixed Scrub

Condition Assessment Criteria / objective	Management Activities	Benefit to environment	Target time for Positive Assessment
1. Habitat is representative of UKHab description and there are at least three woody species	• As many native, shrubby species as possible to be incorporated at design stage • Replace lost plants with another of the same species, size and quality to ensure diversity is maintained and one species cannot dominate.	A wide range of species provides varied foraging, commuting nesting opportunities to birds, invertebrates and small mammals	From year 1
2. There is a good age range	• Allow natural seeding of new shrubs • Appropriate pruning of shrubs to promote health and reach full growth • Replace lost shrubs with young plants, according to the landscape plan	Different life stages provide different foraging and habitat opportunities	From year 4
3. There is an absence of invasive non-native species	• Identification and removal of invasive non-native species as soon as possible. • Where possible, do this by hand. If necessary, application of herbicide should be carried out by an experienced contractor.	Ensure native assemblage of species throughout mixed scrub habitat. Prevents competition from aggressive non-native species.	From year 1
4. The scrub has a well-developed edge with scattered scrub and tall grassland and/or herbs present between the scrub and adjacent habitat(s).	• Limit mowing in the immediate habitat surrounding the areas of mixed scrub to allow succession of natural vegetation • Avoid using fertiliser on site to prevent a small number of species dominating	Creates a gentle habitat gradient to allow movement of fauna and increases diversity around the mixed scrub habitat.	From year 1
5. There are clearings, glades or rides present within the scrub, providing sheltered edges.	• Hand removal of woody species in clearings/rides/glades which would close the open spaces within this habitat • Retain pruned wood on site as hibernacula	Creates edge habitat which provides additional foraging and commuting benefits for birds, invertebrates and small mammals	By year 5

6.2.4 Woodland - Other Woodland; Broadleaved

Two areas of woodland will be created on the site; one will be to the south-west of the site, within the Railway Land Hogshaw LWS, and one will be along the north-eastern boundary of the site, with the north-western section of it falling within the LWS. Both new areas of woodland will include predominantly native tree species, such as silver birch, pedunculate oak, alder (*Alnus glutinosa*), goat willow, and rowan, and an understory of scrub species such as elder, dog wood and hazel.

The targeted condition for the three new woodland habitats are **moderate**, with an expected target condition time of 15 years. Detailed management techniques are described within Table 11 along with the corresponding condition criteria. In order to reach the expected targeted condition of **moderate**, this habitat must achieve a condition score of at least 26 points. An annual schedule of works for the first 5 years post-development is detailed in Table 18 in Section 6.4.

Table 11 – Management objectives for broadleaved woodland

Condition assessment criteria	Management and enhancement activities	Benefit to environment	Target time for positive assessment
1. Age distribution of trees	• Annual visual inspection of trees in high priority areas and undertake arboricultural works where necessary • Supplementary planting of young, native trees in large gaps in canopy • Select species appropriate for the region and existing woodland structure, for example, birch (*Betula* spp.), cherry (*Prunus* spp.) and oak (*Quercus* spp.) • Thinning of poor quality and dense saplings	Provides diverse vertical structure, increase foraging and nesting opportunities, and ensures continuous cover of trees in good health	From year 5
2. Wild, domestic, and feral herbivore damage	• Install fencing or tree guards to protect from grazing if damage is observed • Undertake pruning where excess damage may impact the health of trees	Ensures trees reach full maturity, are free from damage and are in good health	From year 1
3. Invasive plant species	• Identify and remove invasive non-native species as soon as possible (Appendix 11) • Where possible, remove invasive species by hand. If necessary, application of herbicide should be carried out by an experienced contractor	Ensure native assemblage of species throughout habitat. Prevents competition from aggressive non-native species	From year 1
4. Number of native tree species	• Introduction of new, native species where large gaps in the canopy and understory are present or develop • New planting should be native and suitable for the region	Native species within a habitat provide more niches and foraging resources for native wildlife	From year 3

	• Removal of natural regeneration of non-native tree species		
5. Cover of native tree and shrub species	• Supplementary planting of shrub species in the understory to produce minimum 80% cover of native species • Ensure all planting is of native species appropriate for the wider landscape	Native species within a habitat provide more niches and foraging resources for native wildlife and a balance of shrubs and trees provides a diverse vertical structure within woodland	From year 3
6. Open space within woodland	• Human disturbance should be managed to allow natural regeneration in open spaces. This could include creating path networks or restricting access to sensitive spaces • Where cover of open space exceeds 20%, gaps in canopy can be planted with medium to large, native tree species	Ensures continuous tree cover which is important for commuting and nesting wildlife	From year 5
7. Woodland regeneration	• Undertake arboricultural work where required to promote good health of individual trees and encourage growth to maturity • Selective thinning of dense existing growth (no more than 2m spacing) to increase light, water, and nutrient availability for the progression of new generations • Manage anthropogenic influence so areas of natural regeneration are undisturbed	Encourages growth of different age classes which provides varied vertical structure and foraging opportunities	From year 5
8. Tree health	• Continuous monitoring for signs of disease • Implement biosecurity measures if works are taking place within the woodland and there is a risk of cross contamination with other sites • Remove diseased trees when possible • Removal of regeneration of species which are susceptible to disease e.g. ash and elm (*Ulmus* spp.)	Promotes healthy growth and prevents regional and national spread of disease	From year 1
9. Vegetation ground flora	• Selective thinning of dense existing growth to increase water and nutrient levels in soil and light levels reaching the ground	A diverse ground flora layer provides additional habitat opportunities for wildlife and promotes overall floral diversity of the woodland	From year 2

	• Manage anthropogenic influence so areas suitable for regeneration are undisturbed • Create a diverse ground flora community by introducing a seed mix or plugs • Introduced ground flora species should be native and suited to woodland and shade habitats, for example, bluebell (*Hyacinthoides non-scripta*) and foxglove (*Digitalis purpurea*)		
10. Woodland vertical structure	• Supplementary planting of shrub species in the understory, including species such as hazel (*Corylus avellana*) and hawthorn • Appropriate management of trees to promote good health and encourage growth to maturity	Varied vertical structure offers broader nesting, commuting and foraging opportunities to a wider range of birds, invertebrates and small mammals	From year 10
11. Veteran trees	• Continuous monitoring of tree health and undertake appropriate arboricultural work when necessary to promote good health and encourage growth to maturity • Removal of non-native invasive species which could negatively impact growth • Select individual tree specimens to retain and thin surrounding competing stems	Veteran trees provide habitat niches to native wildlife which younger trees lack	From year 10
12. Amount of deadwood	• Retain non-diseased standing deadwood, including branches and trees, where safe and possible • If dead wood is pruned, leave removed limbs in the woodland as hibernacula	Deadwood is a habitat and foraging resource for bird and invertebrate species	From year 1
13. Woodland disturbance	• No use of fertilisers within the woodland • Manage anthropogenic activity within the woodland to limit damage and disturbance e.g. installation of paths	Limiting nutrient enrichment and disturbance prevents a handful of species dominating and ensures healthy growth of natural regeneration	From year 1

6.2.5 Grassland - Other Neutral Grassland – Proposed Wildflower Meadow

Areas of wildflower meadow will be created in public areas along all boundaries of the site, buffering the site from the adjacent woodland and arable land. These areas will be prepared and sown with EM2 standard general purpose meadow mixture which contains a mix of 85% slow growing grasses and 15% wildflowers, including species such as common bent (*Agrostis capillaris*) and black medic (*Medicago lupulina*).

Detailed management techniques for new wildflower meadows are described within Table 12 along with the corresponding condition criteria. The expected condition for this habitat is **good**, with an expected target condition time of 10 years. In order to reach the expected targeted condition, all of the condition criteria detailed in Table 12 must be achieved. An annual schedule of works for the first 5 years post-development is detailed in Table 19 in Section 6.4.

Table 12 – Management Objectives for Other Neutral Grassland

Condition Assessment Criteria / objective	Management Activities	Benefit to environment	Target time for Positive Assessment
1. The appearance and composition of the vegetation closely matches characteristics of the specific grassland habitat type. Indicator species are clearly visible throughout sward	• Remove arisings after mowing to prevent nutrient enrichment of soils and the likelihood of a handful of species dominating • Re-seed areas of bare ground using the same seed mix	Ensures the grassland remains as a medium distinctiveness habitat and contains a high species richness	From year 1
2. Sward height is varied (at least 20% of the sward is less than 7 cm and at least 20 per cent is more than 7 cm)	• Once established, mow wildflower meadows to 50-75mm in spring and autumn to encourage seasonal growth. • Remove arisings to keep nutrient levels low • Stagger mowing of different sections of meadow/groundcover planting to encourage maximum diversity	Varied sward heights provide increased opportunities for commuting and foraging for birds, invertebrates and small mammals	From year 1
3. Cover of bare ground between 1% and 5%, including localised areas, for example, rabbit warrens.	• Ensure adequate seeding of bare ground at 4g/m^2 • Monitor growth and seed areas of bare ground when seasonally appropriate.	Ensures widespread cover of wildflower assemblages and reduces space for more dominant species to colonise	From year 2
4. Cover of bracken less than 20% and cover of scrub (including bramble) less than 5%.	• Regular inspection of meadow area for bracken and scrub growth • Hand removal of bracken and scrub species where cover is approaching 20%	Removing bracken at an early stage prevents species from dominating the habitat and outcompeting other desired species	From year 2
5. There is an absence of invasive non-native species (as listed on	• Identification and removal of invasive non-native species as soon as possible. • Where possible, do this by hand. If necessary,	Ensure native assemblage of species throughout grassland habitat. Prevents competition	From year 1

Schedule 9 of WCA, 1981).	application of herbicide should be carried out by an experienced contractor.	from aggressive non-native species.	
6. There are greater than 9 species per metre squared	• No fertiliser to be used on wildflower areas • Reduce mowing to twice yearly to allow flowers to set seed • Monitoring and removal of non-native invasive species • Monitoring and removal of more dominant shrub species	Ensures high floristic diversity and a wide range of habitat and foraging provisions for pollinator and bird species	From year 1

6.2.6 Grassland – Modified Grassland – Proposed Seeded Amenity Grass

Germinal grade A19 grass seed containing 5 grass species, including perennial ryegrass (*Lolium perenne*) and corail strong creeping red fescue (*Fescuta rubra rubra*), will be sown within the residential areas, adjacent to roads and driveways, forming verges. This grassland is expected to contain a low species richness and be heavily managed by mowing, resulting in a low sward height. It will also buffer the wildflower meadow habitat from the roads.

Detailed management techniques for modified grassland are described within Table 13, along with the corresponding condition criteria. The expected condition of the grassland is **poor**, with an expected target condition time of 1 year, and, due to the low species richness, these areas of modified grassland cannot achieve moderate or good condition. For this reason, criteria 1 has not been assessed. Regardless, consideration should be given to implementing management practices which promote the development of a habitat which still offers value to local wildlife.

Table 13 – Management Objectives for Modified Grassland

Condition Assessment Criteria / objective	Management Activities	Benefit to environment	Target time for Positive Assessment
1. There must be 6-8 species per m^2. If a grassland has 9 or more species per m^2 it should be classified as a medium distinctiveness grassland habitat type.	N/A	N/A	N/A
2. Sward height is varied (at least 20% of the sward is less than 7 cm and at least 20% is more than 7 cm) creating microclimates which provide opportunities for	• Observe periods where mowing is avoided e.g. No Mow May • Leave 1m unmown buffer strips around areas of grassland • Avoid cutting all areas of grass at once to	Varied sward heights provide increased opportunities for commuting and foraging for birds, invertebrates and small mammals	From year 1

	insects, birds and small mammals to live and breed.	provide structural diversity across the site		
3.	Some scattered scrub (including bramble) may be present, but scrub accounts for less than 20% of total grassland area. Note - patches of shrubs with continuous (more than 90%) cover should be classified as the relevant scrub habitat type.	• Consistent monitoring of habitat for growth of shrub species • Hand removal of any growth of woody species	Maintains the characteristic of the habitat and prevents overgrowth by shrub species	From year 2
4.	Physical damage is evident in less than 5% of total grassland area. Examples of physical damage include excessive poaching, damage from machinery use or storage, erosion caused by high levels of access, or any other damaging management activities.	• Ensure areas of bare ground are kept to a minimum to reduce erosion by re-seeding bare ground • Only carry out necessary maintenance activities when specified and at the appropriate time of year • Management activities to be carried out by a suitably qualified person using the correct equipment	Preventing physical damage promotes healthy growth of vegetation and uniformity within the habitat	From year 1
5.	Cover of bare ground is between 1% and 10%, including localised areas (for example, a concentration of rabbit warrens).	• Seed any bare areas with a suitable seed mix	Ensures widespread cover of desired species and reduces space for non-desirable species to colonise	From year 1
6.	Cover of bracken less than 20%.	• Consistent monitoring of the habitat for bracken growth • Hand removal of bracken upon discovery	Removing bracken at an early stage prevents species from dominating the habitat and outcompeting other desired species	From year 2

6.2.7 Lakes – Ponds (Non-Priority Habitat)

A non-priority pond will be created to the west of the site and will act as a drainage feature. Native reeds will be planted within this habitat, including species such as lesser pond sedge (*Carex acutiformis*), yellow iris (*Iris pseudacorus*), and branched bur reed (*Sparganium erectum*). There will also be an area of wet

meadow surrounding the pond which will also be classified within the pond habitat, containing species such as yellow rattle (*Rhinanthus minor*), meadow buttercup (*Ranunculus acris*), and red campion (*Silene dioica*), and grass species include meadow foxtail (*Alopecurus pratensis*) and creeping red fescue (*Festuca rubra*).

Detailed management techniques for the new pond are described within Table 14 along with the corresponding condition criteria. The expected condition for the pond habitat is **moderate**, with an expected target condition time of 3 years. In order to reach the expected targeted condition, at least five of the condition criteria must be achieved. Criteria 4, 5 and 7 are fixed during the installation of the pond, therefore cannot be assessed. An annual schedule of works for the first 5 years post-development is detailed in Table 20 in Section 6.4.

Table 14 – Management objectives for Pond (Non-priority Habitat)

Condition assessment criteria	Management and enhancement activities	Benefit to environment	Target time for positive assessment
1. The pond is of good water quality, with clear water (low turbidity)	• Ensure marginal habitats are suitably maintained to reduce run-off of sediment into the pond • Avoid intensive management activities or excessive human disturbance around the pond edge • Remove large litter regularly	Ensures aquatic vegetation receives adequate light levels	From year 1
2. There is semi-natural habitat for at least 10 m from the pond edge.	• Maintain marginal habitats and re-seed any areas of bare ground within the other neutral grassland habitat • Encourage colonisation of bare ground by managing disturbance by anthropogenic activity around the pond edge i.e. designated walkways/paths, restricted areas	Marginal semi-natural habitat provides a transitional habitat between the pond and other site areas. Valuable area for refuge for amphibious species.	From year 1
3. Less than 10% of the pond is covered with duckweed or filamentous algae.	• Remove duckweed and filamentous algae by hand using a pond net or a rake	Ensures aquatic vegetation receives adequate light levels	From year 1
4. The pond is not artificially connected to other waterbodies, either via streams, ditches or artificial pipework.	N/A	N/A	N/A
5. Pond water levels should be able to fluctuate naturally	N/A	N/A	N/A

throughout the year. No obvious dams, pumps or pipework.			
6. There is an absence of non-native plant and animal species.	• Regular monitoring (monthly) of habitat for invasive species • Identify and remove invasive, non-native species as soon as possible • Where possible, remove invasive species by hand. If more intensive removal is required, this should be carried out by an experienced contractor	Ensure native assemblage of species. Prevents competition from aggressive non-native species.	From year 1
7. The pond is not artificially stocked with fish. If the pond naturally contains fish, it is a native fish assemblage at low densities.	N/A	N/A	N/A
8. In non-woodland ponds, plants, be they emergent, submerged or floating (excluding duckweeds), should cover at least 50% of the pond area that is less than 3 m deep.	• Ensure duckweed is removed to prevent dominant cover • Monitor health of aquatic plants throughout the year and remove dead plant material when necessary • Supplementary introduction of aquatic vegetation, incorporating species reflective of the existing community	Aquatic plants provide foraging and resting opportunities for aquatic and amphibious species	From year 1
9. The surface of non-woodland ponds is no more than 50% shaded by woody bankside species.	• Selective removal of shrub/tree regeneration to thin areas of growth • Prune excess (>50% cover) growth around the periphery of the pond	Allows maximum light levels to reach the pond surface to encourage growth of aquatic vegetation	From year 2

6.2.8 Urban – Vegetated Gardens

The areas of 'Proposed Turf Grass', 'Proposed Groundcover Planting' 'Proposed Hedge Planting' and 'Proposed Ornamental Shrub & Herbaceous Planting' are all within the front and back gardens of houses. Gardens will be the homeowners responsibility, therefore a management plan is not necessary for these habitats.

6.3 Linear Habitats

6.3.1 Line of Trees

An 80m line of trees will be created in the north-western area of the site next to the pond and within the LWS. The line of trees will be comprised of alder, silver birch, goat willow, and small-leaved lime (*Tilia cordata*).

Detailed management techniques are the same as those described for existing lines of trees in Table 8, Section 6.1.1. The targeted condition for the lines of trees is **moderate**, with an expected time to target condition of 20 years. In order to reach the expected targeted condition of **moderate**, at least 3 of the condition criteria must be met. An annual schedule of works for the first 5 years post-development is detailed in Table 15 in Section 6.4.

Appropriate for management

Not appropriate for management

6.4 Five Year Work Programme

Table 15 - Five Year Work Programme for Lines of Trees

Habitat	Action	Frequency Notes	Indicative timing of operation											
			J	F	M	A	M	J	J	A	S	O	N	D
Lines of Trees	Initial and replacement planting – Bare root and root ball	Year 1 then as required to year 5												
	Initial and replacement planting – Containerised	Year 1 then as required to year 5												
	Control and removal of non-native species surrounding trees	As required year 1 to 5												
	Mulching using organic mulch, forming 1m radius around tree, to control weeds • Use organic mulches (leaf litter, rotted hay or grass clippings, manure, wood chips)	Annually years 1 to 3												
	Monitoring throughout growing and dormant period to ensure successful establishment and control browsing and other damage	Every three months years 1 to 5												
	Any required pruning to damaged or diseased trees	As required year 1 to 5												

Habitat	Action	Frequency Notes	Indicative timing of operation											
			J	F	M	A	M	J	J	A	S	O	N	D
	Water twice a month during warmer months	Annually during warmer months or as needed in periods of hot weather												
	Visual inspection of tree health	Based on recommendations made in the tree survey report (Urban Green, 2024d)												

Table 16 – Five Year Work Programme for Urban Trees

Habitat	Action	Frequency Notes	Indicative timing of operation										
			J	F	M	A	M	J	J	A	S	O	N	D
Urban trees	Initial and replacement planting – Bare root and root ball	Year 1 then as required to year 5												
	Initial and replacement planting – Containerised	Year 1 then as required to year 5												
	Control and removal of non-native species surrounding trees	As required year 1 to 5												
	Monitoring throughout growing and dormant period to ensure successful establishment and control browsing and other damage	Every three months years 1 to 5												
	Any required pruning to damaged or diseased trees	As required year 1 to 5												

Habitat	Action	Frequency Notes	Indicative timing of operation											
			J	F	M	A	M	J	J	A	S	O	N	D
	Water twice a month during warmer months	Annually during warmer months or as needed in periods of hot weather												
	Visual inspection of tree health	Based on recommendations made in the tree survey report (Urban Green, 2024d)												

Table 17 – Five Year Work Programme for Mixed Scrub

Habitat	Action	Frequency Notes	Indicative timing of operation											
			J	F	M	A	M	J	J	A	S	O	N	D
Mixed scrub	Initial and replacement planting	As required year 1 to 5												
	Visual inspection to assess plant health	Bi-monthly every year												
	Control and removal of invasive non-native species	As required year 1 to 5												
	Monitoring throughout growing and dormant period to ensure successful establishment and control browsing and other damage	Every three months years 1 to 5												
	Pruning of plants using appropriate methods.	As required year 1 to 5												

Table 18 – Five Year Work Programme for Broadleaved Woodland

Habitat	Action	Frequency Notes	Indicative timing of operation										
			J	F	M	A	M	J	J	A	S	O	N	D
Other Broadleaved Woodland	Initial and replacement planting for failed whips, using the same species – Bare root and root ball	Year 1 then as required to year 5												
	Monitoring of health and viability every 3 years. Visual inspection of trees in high priority areas	Annually and following strong winds												
	Control and removal of non-native, invasive species	As required year 1 to 5. Removal should be carried out as swiftly as possible after identification												
	Pruning of dead and damaged limbs and retention of wood within woodland	Every three months years 1 to 5												
	Thinning of dense woodland growth to 2m spacing	Year 5												
	Thinning of young growth around mature trees	Year 5												

Table 19 – Five Year Work Programme for Other Neutral Grassland/Wildflower Meadow

Habitat	Action	Frequency Notes	Indicative timing of operation										
			J	F	M	A	M	J	J	A	S	O	N	D
Other Neutral Grassland/Wildflower Meadow	Initial and replacement seeding	Year 1 then as required to year 5												
	Control and removal of non-native species	As required year 1 to 5												
	Monitoring throughout growing and dormant period to ensure successful establishment and control browsing and other damage	Every three months years 1 to 5												
	Removal of dense bracken and shrub growth	Annually years 1 to 5, outside of nesting season												
	Mowing of meadow areas	Spring and autumn cut and removal of arisings, annually years 1 to 5												

Table 20 – Five Year Work Programme for Pond (Non-priority Habitat)

Habitat	Action	Frequency Notes	Indicative timing of operation										
			J	F	M	A	M	J	J	A	S	O	N	D
Pond	Re-seeding of other neutral grassland habitat within 10m of pond edge	As required years 1 to 5												
	Cut back excess woody growth around pond edge which is encroaching into pond or shading areas of the pond	Annually years 1 to 5												
	Undertake reed cutting to thin reed beds out	On a 4-year rotation and cut different patches in different years												
	Removal of large litter and debris	Monthly years 1 to 5												
	Control and removal of non-native, invasive species	As required. Removal should be carried out as swiftly as possible after identification												

Habitat	Action	Frequency Notes	Indicative timing of operation											
			J	F	M	A	M	J	J	A	S	O	N	D
	Manual removal of duckweed and extensive algal growth	As required years 1 to 5												

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APPENDIX 1 – BIODIVERSITY ENHANCEMENTS LOCATION PLAN

URBAN GREEN



KEY

Site Red Line Boundary

Soft Works

Existing Tree
To be retained.
Refer to arboricultural drawings.

Existing Tree
To be removed / pruned.
Refer to arboricultural drawings.

Existing Woodland
To be retained.
Refer to arboricultural drawings.

Existing Hedge
To be retained.
Refer to arboricultural drawings.

Proposed Tree Planting
Clear stem heavy standard tree.

Proposed Hedge Planting
To plot gardens.

Proposed Groundcover Planting
Ornamental planting mix. 98.3739 m²

Proposed Ornamental Shrub & Herbaceous Planting
Ornamental shrub and herbaceous perennials mixes. 526.2877 m²

Proposed Semi-Native Shrub Planting
Ornamental and native shrub mix. 244.2309 m²

Proposed Native Shrub Planting
Native shrub mix. 1518.7563 m²

Proposed Woodland Understory Pla
Native mix. 2793.7021 m²

Proposed Woodland Mix Planting
Native whips and feathers mix. 1686.1201 m²

Proposed Turf Grass
To front gardens. 1176.2858 m²

Proposed Seeded Amenity Grass
To public areas. 1369.2721 m²

Proposed Seeded Species Rich Wildflower Meadow
To public areas. 12054.9751 m²

Proposed Wet Meadow
To pond area. 1142.6080 m²

Native Reeds Mix
To pond area. 32.2571 m²

Pond Water
Approx 117.6260 m²

Rear gardens to be grass seeded
Slopes/ level differences and steps to engineer's details

Do not scale this drawing (printed or electronic version)

Contractors must check all dimensions from site

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Graphical representations of equipment on this drawing have been co-ordinated, but are approximations only. Please refer to the specifications and / or details for actual sizes and / or specific contractor construction information.

- Two Crevice Bat Box (in groups of 2)
- Medium Hollow Bat Box (in groups of 2)
- BilBao Woodstone Nest Box (28mm)
- BilBao Woodstone Nest Box (32mm)
- Vivara Pro Woodstone starling Nest Box
- Barn Owl Nest Box
- Hedgehog House

URBAN GREEN

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Deva City Office Park, Trinity Way,
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T: +44 (0) 161 312 3131

Client
Barratt Homes

Project:
Hogshaw Farm

Title:
Biodiversity Enhancements Location Plan

Issue:
05

Drawn:	Checked:	Approved:
SC	SB	MG
Project:	**Scale @ A:3:**	**Date:**
UG1795	1:5,000	19/07/2024

Dwg No:
UG_1795_ECO_BEMP_05 **05**

APPENDIX 2 – SCHEDULE 9 INVASIVE SPECIES

An invasive, non-native species is a species that is present outside of its native range but has established populations after accidental or intentional introduction to a geographical region. These species have negative ecological impacts on the environments in which they are present by outcompeting native flora and fauna for resources, facilitating the spread of disease, and interrupting natural food webs.

Schedule 9 of the Wildlife and Countryside Act 1981 lists the species within the UK which are considered invasive and are damaging to biodiversity. It is the legal responsibility of the landowner to control populations of invasive species and prevent their growth and spread.

The table below details common invasive, non-native species listed on Schedule 9 and the recommended management practices.

Common name (*scientific name*)	Identification		Management
Himalayan balsam (*Impatiens glandulifera*)	• Green or red stems • Serrated oval leaves growing in a whorl round the stem • Bright pink flowers		• Spraying of glyphosate-based herbicides • Application to be carried out by a qualified individual • Herbicide to be applied in spring, before the flowering period but after germination of seeds • Approved herbicides only to be used • Balsam bashing – pulling plants up by the root before seeds are set (before July/August)

Japanese knotweed (*Fallopia japonica*)	• Bamboo like stems with purple flecks • Large, shovel shaped leaved • Cream/white clustered flowers		• Stem injection or spraying with glyphosate in late summer/early autumn (September/October) • Approved herbicides only to be used • Application to be carried out by a qualified individual • Application of herbicide annually (can take 3+ years to effectively combat) • Inform relevant authorities prior to disposal of plant material or use an authorised disposal site/company (GOV.UK, 2022)