

**Peel Park Avenue
Clitheroe**

**Flood risk assessment
for proposed housing**

NGR SD 752 407

Postcode BB7 1LJ

Michael Lambert Associates
1 Partridge Close
Winsford
Cheshire
CW7 1PY

Applethwaite Ltd.
Sceptre House
Sceptre Way
Bamber Bridge
Preston PR5 6AW

T/F 01606 862373
Mobile 07958 964054

Emails floodriskengineer@gmail.com
sudsengineers@gmail.com

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1.0 Introduction.

The Peel Park Avenue site is a field area close to the Little Moor area of Clitheroe and on the southeastern side of the town. The site is rough grass at present with a spring and a ditch on the western side of the site. New housing is proposed and this report covers flood risks from all sources and new drainage.

2.0 Executive summary

The field area for development is floodzone 1 above any local 1 in 1000 year risk levels. It is currently rough grass and 33 bungalows are proposed. The new hard areas of roads and roofs will generate much more surface water runoff and this will be collected and stored on site to enable the peak outflow rate to be limited to 28.8 l/sec in accord with DEFRA's SC030219 guidance document for new surface water flows from developments. This will improve the current situation of the existing field generating unlimited runoff flows to the local surface water systems in storms and this will reduce and lessen runoff flows and downstream flood risk.

New surface water will flow into the western boundary ditch which is part of the site and foul flows will be pumped to the existing public foul sewer network. The site is not at risk from other sources of flood risk and development to housing will lessen downstream flood risk because of the on-site storage as required by DEFRA guidelines.

3.0 Existing site, flood risk, history, existing drainage mode.

The existing site is a field area of approx 2 hectares to the south of Peel Park Avenue and next to playing fields. The site has a level range of 97m to 102m AOD with the lowest level in the northwest corner close to Peel Park Avenue. The general ground slope is downhill from 102 at the east side to 97 at the west side. The field is drained by a ditch which is shown on the site survey and which also is marked as having a spring to the rear of 30 Peel Park Avenue. There is another ditch system to the east of the site which flows southwards and then underneath the site and then southwards again and this joins up with the stream from under the A59 which flows through Higher Standen to join Mearley Brook which flows through Clitheroe. A Roman road is marked along the eastern part of the site.

The site itself is floodzone 1 above any local 1 in 1000 year risk levels and the Environment Agency flood map for planning shows this.

The existing drainage mode of the field is sheet overland flow westwards to the local ditch. The site is part of an area that drains southwards to eventually flow into the Ribble. A local nearby small catchment has an area of 0.61km² and an annual rainfall depth of 1250mm. DPSBAR the average bedslope is 90.1m /km and BFIHOST is 0.346 indicating on average less absorbent soils. The site itself is part of a similar larger catchment of area of 6.38km².

The small Clitheroe catchment has a response time of approx 2.1 hours. Peak rainfall rates are:

- 1 in 2.3 year storm (QBAR)- 17 mm/hr
- 1 in 30 year storm-38 mm/hr
- 1 in 100 year storm- 53 mm/hr

4.0 Proposals, new drainage, sustainable drainage.

The proposals are to build 33 bungalows on the site. The new access will be from Peel Park Avenue. The overall site area is approx 2 ha and the developed area will be approx 1.75 ha with the Roman Road area on the eastern side being public open space. Foul drainage will connect to the public foul network and surface water will be stored on site in accord with current DEFRA guidance and discharged at the QBAR greenfield runoff rate of 28.8 l/sec to the western boundary ditch system. This limiting flow rate is shown as a site discharge rate.

An in principle surface water storage volume of 422m³ is shown by the HR Wallingford spreadsheet printout based on 30% climate change central allowance. In view of the site ground conditions being less absorbent (see below) this will be provided in oversize pipes under roads for up to 1 in 30 year volumes and cellular storage under private areas for volumes from 1 in 30 year to 1 in 100 year plus climate change. All house slab levels will be above back of footpath levels.

The BFIHOST catchment average figure of 0.349 indicates less permeable ground for the catchment. The Cranfield Soils mapping shows Soilscape 17- slowly permeable seasonally wet acid loamy and clayey soils. This is confirmed by the Geo-Environmental investigation report of August 2017 by Robert E Fry and Associates of Wigan. 12 trial pits were dug and the site is generally clay with no scope for soakage and sustainable drainage soakaway techniques. Trial pit logs are attached, and percolation tests were not carried out as the impermeable clay conditions applied to all the trial holes and therefore all of the site. However where feasible house driveway runoff will be collected in channel drains at the back of footpath and will then soak into planted beds either side of the back of footpath boundary, and all houses will be provided with water butts.

5.0 Strategic Flood Risk Assessments

The Lead Local Flood Authority is Lancashire CC and the 2014-2017 report 'Lancashire & Blackpool Local Flood Risk Management Strategy' lists surface water management and sustainable drainage as requirements for developments. In general terms the site is not in a 'Critical Drainage Area' -CDA -and there is no requirement to restrict flows further than as required by SC030219 which is the DEFRA guideline document for managing new surface water runoff from developments.

6.0 The effect of DEFRA surface water guidelines in SC030219

The basis of the former SR744 superseded by SC030219 is to restrict new surface water runoff rates from new developments to prevent an increase in flood risk to anyone or anything downstream. The DEFRA guidelines ensure that new surface water runoff is collected inside the site and stored and released at a specified low flow rate so that new developments lessen flood risk.

Greenfield sites which are developed for buildings or houses or new hard drained areas have to follow DEFRA guidelines and store the new surface water runoff and release it at a low 1 in 2.3 year existing greenfield runoff rate (QBAR) to the local sewers watercourses or rivers. The 2 hectare existing area as it stands (rough grass 42% runoff- SPRHOST) will at present produce an approx peak runoff rate during 2.1 hour length small local catchment storms as follows:-

1 in 2.3 year storm - peak rainfall rate 17mm/hr- 39 l/sec

1 in 30 year storm -38mm/hr- 88 l/sec

1 in 100 year storm -53mm/hr- 135 l/sec

1 in 100 year + climate change 20% central rain intensity allowance- 63.6 mm/hr- 162 l/sec

The above calculations are approx to simulate an overhead storm and use the peak rainfall rates from the ReFSR/FEH spreadsheet routine.

When development is complete and all the surface water storage is constructed plus the limiting flow controller on the site surface water outlet is installed the maximum new peak surface water flow rates to the local stream system from the development area will be as follows

1 in 2.3 year storm 28.8 l/sec

1 in 30 year storm 28.8 l/sec

1 in 100 year storm 28.8 l/sec

1 in 100 year + climate change 28.8 l/sec

This is an improvement on existing present day unlimited greenfield flow rates and will lessen downstream flood risk because the existing field will no longer discharge unlimited flow rates to the local stream system.

7.0 National Planning Policy Framework and Technical Guidance and EA mapping.

The proposed new housing is classed as 'more vulnerable' in Table 2 and is 'appropriate' in floodzone 1 as per Table 3. There is no need for the exception test, or the sequential test.

Types of flooding that could affect the site are:-

1. River- the site is floodzone 1 above any local 1 in 1000 year risk levels
2. Sea- no tidal influence
3. Land- undrained land slopes towards the eastern site boundary and any runoff will flow into the stream adjacent to the site.

4. Groundwater- there is a spring shown on the OS maps and the sewer records and this will be investigated. It is at the lower side of the site and discharges into the existing ditch and may be a spring that only occurs at certain times of the year.
5. Sewers- there are no local internet reports of sewer surcharge.
6. Reservoirs canals- none nearby.

Environment Agency mapping is as follows:-

Flood map for Planning- the site is floodzone 1

Risk of flooding from rivers and sea- this shows the effect of any flood defences.

Flood warning- this is not applicable to the site.

Groundwater- the site is not in a groundwater protection zone.

Risk of flooding from reservoirs- this shows reservoir risk- all utility company reservoirs are maintained to a 1 in 10,000 year risk standard under the Reservoirs legislation and this is a very rare and unlikely risk.

Risk of flooding from surface water- this mapping shows surface water flood risk. Pluvial mapping is the subject of a separate EA paper made public in November 2013 and is useful in locating possible ground low points and depressions. We quote- 'the conveyance effect of ordinary watercourses or drainage channels is not explicitly modelled'- so whilst the EA mapping shows pathways and confirms the stream paths the mapping generally takes little account of any existing drainage and in practice there is a very low risk. The mapping is based on Jflow software and the EA May 2013 notes 'National Scale Surface Water Flood Mapping Methodology'- state that the method does not take account of existing drainage systems except by subtracting an average rain depth from storm profiles.

Existing land to the east of the site slopes towards it and existing grassland runoff collects in the local ditch/ stream system at the eastern and southern boundaries. Jflow mapping is of use here as it shows no risk or spills onto the site under either 1 in 30 year, 1 in 100 year, or 1 in 1000 year simulated design storms.

8.0 Attachments

This report is a copyright email report and can be transmitted in an email series of attachments or it can be transmitted by dropbox or 'we transfer' with joined up pdf's.

Attachments.

Location plans A4

OS plans A3

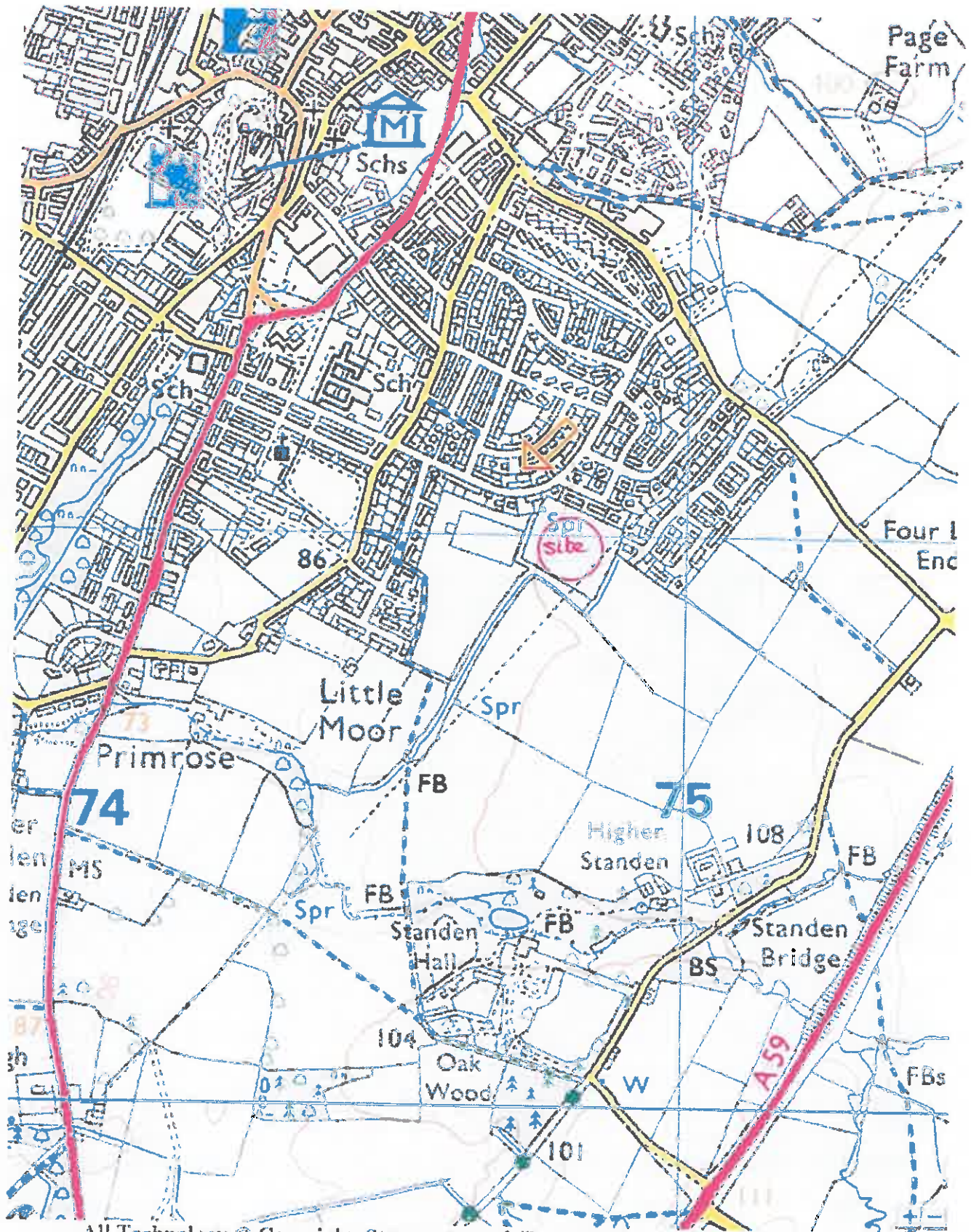
Site survey A3

Sewer records A3

Cranfield soils data A3
Proposals A3
REFA report extracts and trial pit logs A4
Flood Estimation Handbook CD3 data etc for local catchments A4
HR Wallingford limiting runoff report A4
Environment Agency flood risk mapping A4
Lancashire CC LFRMS extracts

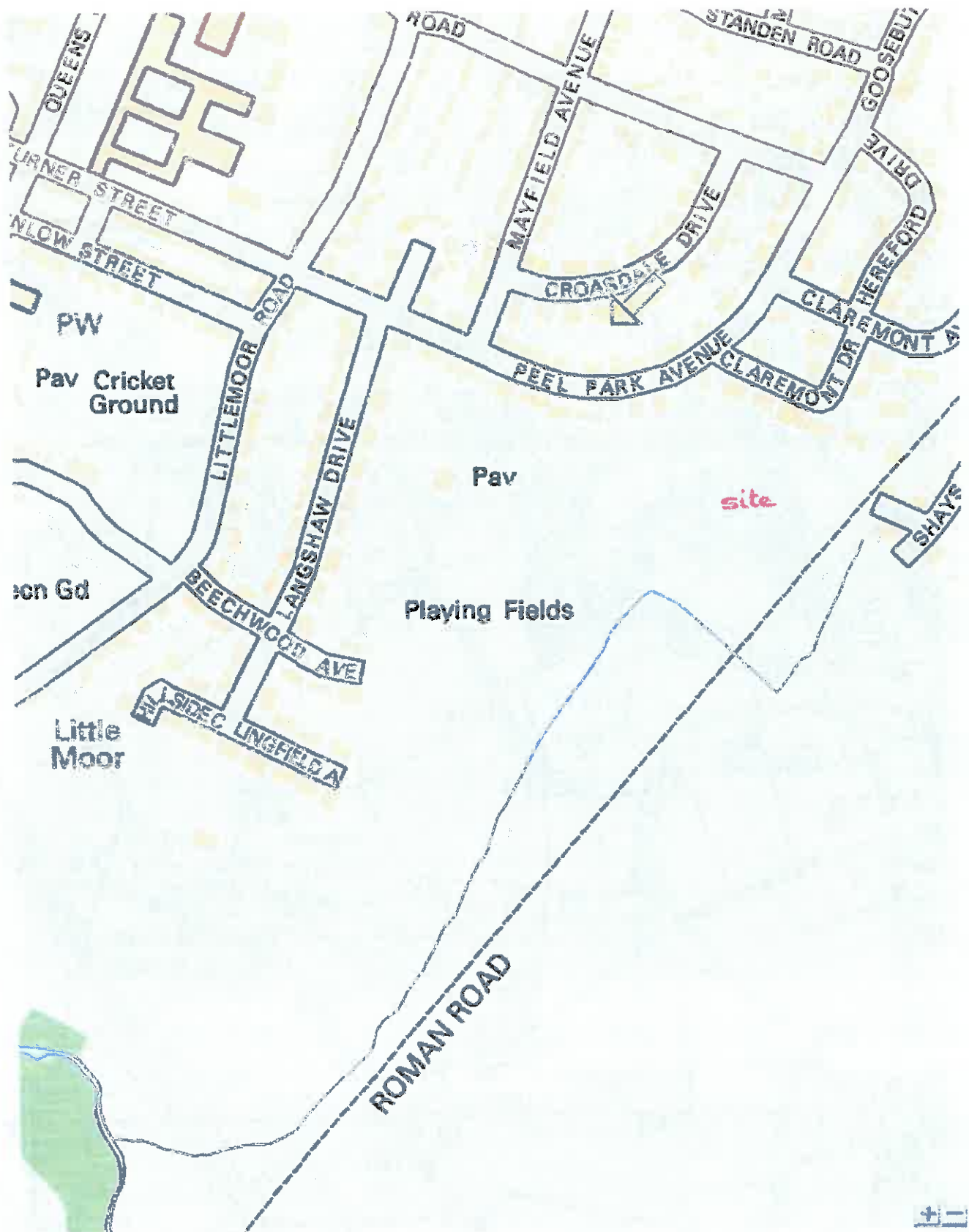
Should you need further data such as survey drawings please email
floodriskengineer@gmail.com

Email files
171207fra02
171207attach1-A4
171207attach2-A4
171207attach3-A3
171207attach4-A3



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CONSULTING ENGINEERS

CIVIL • STRUCTURAL
GEOTECHNICAL • ENVIRONMENTAL

**PROPOSED RESIDENTIAL DEVELOPMENT
PEEL PARK AVENUE,
CLITHEROE
FOR
APPLETHWAITE HOMES**

AUGUST 2017

**GEO-ENVIRONMENTAL INVESTIGATION REPORT
17110/GEIR**

ROBERT E FRY & ASSOCIATES LTD.
45, Bridgeman Terrace
Wigan, WN1 1TT

Telephone: 01942 826020
Fax: 01942 230816
Email: mail@refa.co.uk
Company Registration No. 2436911



EXECUTIVE SUMMARY

Site	The site is roughly square in shape and extends to an area of approximately 1.93 hectares. It is located upon the southern side of Peel Park Avenue within the town of Clitheroe, Lancashire.
NGR	SD 74803 40989
Site History	The site has remained as agricultural land throughout its history. The site contains a Roman Road within the eastern end of the site with a 6m easement.
Investigations	The investigations have extended to:- • Walkover survey • Desk study • Extensive intrusive investigations by trial pit techniques. • Geotechnical & chemical analyses of soil samples
Ground Conditions	The investigation has identified topsoil over the whole site area extending to depths between 0 – 0.4m bgl. The underlying superficial deposits comprise of firm to stiff sandy gravelly clays which have been proven to a maximum depth of 2.5m bgl. Within positions TP05 – TP06 a very clayey gravelly fine to coarse sand has been identified at depths between 0.6 – 1.4m bgl. Bedrock comprising of weak fine grained limestone has been identified within position TP01 at depths between 1.7 – 1.9m bgl.
Groundwater	Groundwater ingress has been identified within all positions at depths between 0.8- 1.7m bgl which is considered to represent perched water within the superficial and bedrock deposits.
Environmental	This investigation has not identified the presence of any elevated concentrations of contaminants and the topsoil material is considered suitable for reuse within the site.
Trees	The walkover survey has identified trees within all the site boundaries and a full arboriculturist report should be conducted.
Foundations	Based upon the results of this ground investigation strip foundations may be formed within the natural strata. The natural clay stratum is considered to offer a safe bearing capacity in the order of 100kN/m ² at a minimum depth of 1.0mbgl. The granular sand deposits within positions TP05 – TP06 are considered to offer a reduced safe bearing capacity of 75kN/m ² at a minimum depth of 0.6m bgl. The natural clay stratum is considered to have a low volume change potential in accordance with NHBC chapter 4.2. The bedrock within locality of TP01 is considered to offer a safe bearing capacity in the order of 300kN/m ² at a minimum depth of 1.7m bgl. If foundations extend to bedrock then all foundations should extend to bedrock to avoid differential settlement.
Slabs	It is recommended that suspended ground floor construction be adopted for all properties located within this site. These floors may be of a pre cast concrete beam and block arrangement or of a suitably designed cast insitu reinforced concrete. In those areas where tree root effects are important it is recommended that a pre cast concrete beam and block type floor is utilised to allow for the provision of a suitable air void below the ground floor construction.
SUDS	It is considered that the site is not capable of adopting a soakaways system of surface water disposal and will need to connect to existing drainage sewers.
Remediation	There is no requirement for remedial works and the topsoil found on site is suitable for reuse.

This brief summary should not be assumed to represent a complete account of all the potential geo-environmental issues that may exist at the site. As such it is strongly recommended that the report be read in its entirety.

3.11 Background Soil Chemistry

3.11.1 The Geo-Insight report includes an estimated geometric mean soil concentration of various elements. Assessment of this information suggests that all determinands listed are at concentrations below the current tier 1 assessment criteria in relation to human health. Therefore the underlying natural strata are not considered to contain naturally occurring contaminants.

3.12 Site History

3.12.1 Table 1 – Review of Historical Maps

Date	Site	Adjacent Land
1848	The site comprises of open fields with a field boundary located centrally within the site. A roman road is shown to enter the site in the north east corner and continues towards the south boundary where it continues outside the site.	Majority of the surrounding land comprises of further agricultural fields.
1912	The site is now shown to be one piece of agricultural land.	An access road is shown adjacent to the northern corner of the site which trends in a northerly direction towards residential property called Goose Buds. Residential development has taken place in excess of 250m to the west.
1932	No significant changes.	A spring is shown to be adjacent to the northern corner of the site and allotment gardens are now shown to be present 190m to the west.
1964	No significant changes.	Significant residential development has taken place to the north west and north east along Peel Park Avenue and Claremont Avenue. The track from Goose Buds no longer extends down towards the development site.
1986	No significant changes.	Further residential development has taken place to the north and a playing field is located immediately adjacent to the western boundary of the site.
1993 - 1995	No significant changes.	No significant changes.
2010 - 2014	No significant changes.	No significant changes.

3.12.2 Careful appraisal of the historical maps has identified that the site has remained in agricultural usage throughout its whole history and has contained roman road within the eastern area of the site. A review of the surrounding land has identified significant residential development to the north along Clitheroe Avenue and Peel Park Avenue. Historical mapping has not illustrated the presence of overhead electricity lines within the central area of the site which we have identified during the site walkover which may indicate that they are relatively modern in age. A review of the historical OS maps has not identified any significant features that may pose a potential source of contamination to the site.

3.13 Anticipated Ground Conditions

3.13.1 Based upon the information obtained during the initial desk study phase, the anticipated ground conditions are expected to comprise of strata as detailed in table 2 below.

Due to the high percentage of gravels, cobbles and boulders within this unit it has not been possible to carry out hand shear vane testing within this unit however visual inspection of this unit has confirmed that it is considered suitable of offering a safe bearing capacity in the order of 100kN/m².

- 5.2.3** *Within position TP05 and TP06 a dark brown very clay gravely fine to coarse sand has been identified at depths found between 0.6 – 1.4m bgl. The assessment of the granular strata indicates that it is capable of offering a reduced safe bearing capacity of 75kN/m² at a minimum depth of 0.6m bgl.*

5.3 Bedrock

- 5.3.1** *Within position TP01 where the bedrock has been identified at depths between 1.7 – 1.9m comprising of dark grey limestone recovered as medium to coarse cobbles and boulders. The weathered bedrock is considered to offer a safe bearing capacity in excess of 300kN/m².*

5.4 Groundwater

- 5.4.1** *Groundwater ingress was identified in all the investigation locations at depths varying between 0.8 – 1.7m bgl. These ground water strikes are considered to represent perched water within the superficial deposit and bedrock.*

- 5.4.2** *The natural strata within this site comprises of cohesive impermeable clays and it is considered that during periods of inclement weather perched water may become present within excavations with the cohesive materials. If localised temporary flooding does occur then standing water may be removed by simple sump pumping operations.*

5.5 Excavations

- 5.5.1** *The natural strata across the site comprises mainly of firm to stiff cohesive clay deposits and during the investigation works no instability of the trial pits were noted therefore the natural clay strata within this site is considered capable of remaining open for significant periods of time. Within locations TP5 and TP6, although no collapses were noted within the granular sand strata, it is considered that this sand strata may not be capable of remaining open for significant periods of time.*

- 5.5.2** *It is essential that personnel should not be allowed to approach or enter any excavation made upon this site unless appropriate precautions have been adopted to ensure that hazardous side instability has been prevented. This is particularly important in relation to foundation and drainage construction where personnel may be specifically required to enter deeper excavations for essential construction purposes. Reference should be made to H.S.E. publication HSG 150 for guidance.*

5.6 Contamination

- 5.6.1** *The intrusive investigations have identified topsoil deposits overlying natural clay deposits, no signs of visual or olfactory evidence have been identified within the topsoil or natural strata. The topsoil material on site represents material capable of reuse within the garden landscaped areas of the proposed developments and therefore samples have been obtained of the topsoil material to determine its suitability for reuse within the proposed residential development.*

Within positions TP5 and TP6 a dark brown clayey sand has been identified at depths between 0.6 – 1.4m bgl, it is considered that this sand material is capable of offering a reduced safe bearing capacity in the order of 75kN/m².

- 9.2.3 The development of the site in close proximity to the existing boundary hedgerows and trees which will require suitable foundation precautions in accordance with NHBC Handbook Chapter 4.2. The depth of foundation required will depend upon the relationship of the tree type and its distance from the proposed structure. The clay material within the site has been identified to have a low volume change potential and based upon this information it is possible that foundations may need locally to extend to depths up to 2.5m or so below existing ground level. A full appraisal of the foundation requirements and precautions should be undertaken by the foundation engineer in conjunction with the detailed arboriculturists report.

9.3 Ground Floor Construction

- 9.3.1 It is recommended that suspended ground floor construction be adopted for all properties located within this site. These floors may be of a pre cast concrete beam and block arrangement or of a suitably designed cast insitu reinforced concrete. In those areas where tree root effects are important it is recommended that a pre cast concrete beam and block type floor is utilised to allow for the provision of a suitable air void and heave precautions below the ground floor construction.

9.4 SUDS

- 9.4.1 Assessment of the ground conditions present within this site in terms of sustainable urban drainage confirms that the superficial deposits throughout the site comprise of impermeable cohesive clay and it is considered that the site will not be capable of a soakaway system of surface water disposal and drainage will have to connect to existing sewers.

9.5 Further Work

- 9.5.1 If any unusual or suspicious strata or ground conditions are encountered during the subsequent site stripping preparation work, it will be necessary for these areas to be brought to the attention of the appropriate authorities so that all necessary inspection, sampling and testing may be undertaken to determine whether these materials present a hazard to human health. It is incumbent upon the site contractors to advise a responsible authority of any unusual findings within the site which may then be further investigated.

10.0 NOTES

- 10.1 All reports are for advisory purposes only and all design decisions are the ultimate responsibility of others.
- 10.2 Unless stated otherwise the investigation has been undertaken in general accordance with the recommendations given in BS 5930 : 1999 "A Code of Practice for site Investigations" and the laboratory testing has been carried out in accordance with BS 1377 : 1990 "Methods of Test for Civil Engineering Purposes".
- 10.3 Soil and rock descriptions are generally based on the scales of strength and relative density within BS 5930 although it should be noted that in certain circumstances descriptions are based on site records or a qualitative assessment without the benefit of in-situ or laboratory test results.

[illegible]

Contract No:	PSL17/3546	Client Ref:	17110
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Trial Pit Log

Trialpit No

TP01

Sheet 1 of 1

Project Name: Peel Park Avenue, Clitheroe

Project No.
17110

Co-ords: -
Level:

Date
19/07/2017

Location: Peel Park Avenue, Clitheroe

Dimensions (m): 2.7

Scale
1:25

Client: Applethwaite Homes

Depth
1.90

Logged
MD

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	ES		0.20			Grass over TOPSOIL: Dark brown clayey fine to medium sand with rootlets.
							Firm brown sandy CLAY
			HVP=113	0.60			Firm to stiff dark brown slightly sandy slightly gravelly CLAY with a low to medium cobble and boulder content of limestone.
			HVP=104				
				1.70			Weak dark grey fine grained LIMESTONE(Recovered as clayey angular gravel)
				1.90			End of pit at 1.90 m

Remarks: Damp strata at 1.70m

Stability: Pit stable



Trial Pit Log

Trialpit No

TP02

Sheet 1 of 1

Project Name: Peel Park Avenue, Clitheroe

Project No.
17110

Co-ords: -
Level:

Date
19/07/2017

Location: Peel Park Avenue, Clitheroe

Dimensions (m): 2.6

Scale
1:25

Client: Applethwaite Homes

Depth
2.00

0.7

Logged
MD

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	ES		0.20			Grass over TOPSOIL: Dark brown clayey fine to medium sand with rootlets.
				0.60			Firm brown slightly sandy slightly gravelly CLAY. Gravel is fine to coarse angular of mudstone.
	1.00	D		2.00			Firm to stiff brown gravelly CLAY with a high cobble and boulder content of limestone. Gravel is fine to coarse angular to subangular of limestone
							End of pit at 2.00 m

Remarks: Damp strata between 0.6 -2.0m. Minor collapse at 0.8m

Stability: Pit unstable

REFA

Trial Pit Log

Trialpit No

TF03

Sheet 1 of 1

Project Name: Peel Park Avenue, Clitheroe

Project No.
17110

Co-ords: -
Level:

Date
19/07/2017

Location: Peel Park Avenue, Clitheroe

Dimensions (m):

2.6

Scale

1:25

Client: Applethwaite Homes

Depth
1.70

0.7

Logged
MD

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	ES		0.20			Grass over TOPSOIL: Dark brown clayey fine to medium sand with rootlets.
							Firm to stiff brown slightly sandy slightly gravelly CLAY with a medium cobble and boulder content of limestone. Gravel is fine to coarse subangular to subrounded of limestone
	1.20	D	HVP-83	1.70			End of pit at 1.70 m

Remarks: Damp strata at 1.2m

Stability: Pit stable



Trial Pit Log

Trialpit No

TP04

Sheet 1 of 1

Project Name: Peel Park Avenue, Clitheroe

Project No.
17110

Co-ords: -
Level:

Date

19/07/2017

Location: Peel Park Avenue, Clitheroe

Dimensions
(m):

2.7

Client: Applethwaite Homes

Depth
2.50

0.7

Scale

1:25

Logged
MD

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20	ES		0.30			Grass over TOPSOIL: Dark brown clayey fine to medium sand with rootlets.
			HVP=80				Firm to stiff brown slightly sandy slightly gravelly CLAY with a medium cobble and boulder content of limestone. Gravel is fine to coarse subangular to subrounded of limestone
			HVP=92				
	2.00			1.90			Stiff dark grey very gravelly CLAY. Gravel is fine to coarse subangular to rounded of limestone (Weathered bedrock)
				2.50			End of pit at 2.50 m

Remarks: Damp strata at 1.3

Stability: Pit stable

AGS

Trial Pit Log

Trialpit No

TP05

Sheet 1 of 1

Project Name: Peel Park Avenue, Clitheroe

Project No.
17110

Co-ords:
Level:

Date
19/07/2017

Location: Peel Park Avenue, Clitheroe

Dimensions
(m):

2.6

Scale
1:25

Client: Applethwaite Homes

Depth
2.00

0.7

Logged
MD

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	ES		0.20			Grass over TOPSOIL. Dark brown clayey fine to medium sand with rootlets.
							Dark brown gravelly very clayey fine to coarse SAND. Gravel is fine to coarse subangular to rounded of mudstone.
	1.50	D	HVP=74	1.30			Stiff dark brown slightly sandy gravelly CLAY with high cobble and boulder content of limestone. (Weathered bedrock)
				2.00			End of pit at 2.00 m

Remarks: Damp strata between 0.6 - 1.3m

Stability: Pit stable



Trial Pit Log

Trialpit No

TP06

Sheet 1 of 1

Project Name: Peel Park Avenue, Clitheroe

Project No.
17110

Co-ords: -
Level:

Date

19/07/2017

Location: Peel Park Avenue, Clitheroe

Dimensions (m):

2.6

Scale

1:25

Client: Applethwaite Homes

Depth
2.50

0.7

Logged
MD

Water Sink	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.20	ES		0.30			Grass over TOPSOIL: Dark brown clayey fine to medium sand with rootlets.
				0.80			Firm stiff brown sandy CLAY
	1.00	D		1.40			Dark brown gravelly very clayey fine to coarse SAND. Gravel is fine to coarse subangular to rounded of mudstone.
				2.50			Stiff dark brown slightly sandy gravelly CLAY with high cobble and boulder content of limestone. (Weathered bedrock)
							End of pit at 2.50 m

Remarks: Damp strata between 0.8 - 1.4m

Stability: Pit stable

Trial Pit Log

Trialpit No

TP07

Sheet 1 of 1

Project Name: Peel Park Avenue, Clitheroe

Project No.
17110

Co-ords: -
Level:

Date
19/07/2017

Location: Peel Park Avenue, Clitheroe

Dimensions (m): 2.1

Scale
1:25

Client: Applethwaite Homes

Depth
2.10

Logged
MD

Water table	Samples and in Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
	Depth	Type	Results					
	0.30	ES		0.40			Grass over TOPSOIL: Dark brown clayey fine to medium sand with rootlets.	
							Firm brown sandy CLAY	
				0.90			Firm to stiff dark brown slightly sandy gravelly CLAY with high cobbles and boulder content of limestone. (Weathered bedrock)	1
	1.50	D		2.10			End of pit at 2.10 m	2
								3
								4
								5

Remarks: Groundwater ingress at 1.4m with a slow flow

Stability: Pit stable



Trial Pit Log

Trialpit No

TP08

Sheet 1 of 1

Project Name: Peel Park Avenue, Clitheroe

Project No.
17110

Co-ords: -
Level:

Date

19/07/2017

Location: Peel Park Avenue, Clitheroe

Dimensions (m):

2.7

Client: Applethwaite Homes

Depth
2.10

0.7

Scale

1:25

Logged
MD

Water Sink	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
▼	2.00	D	HVP=55 HVP=77	0.20			Grass over TOPSOIL: Dark brown clayey fine to medium sand with rootlets.
				0.80			Firm brown sandy CLAY
							Firm to stiff dark brown slightly sandy gravelly CLAY with high cobble and boulder content of limestone. (Weathered bedrock)
				2.10			End of pit at 2.10 m

Remarks: Groundwater ingress at 0.8m with a slow flow

Stability: Pit stable

AGS

Trial Pit Log

Trialpit No

TP09

Sheet 1 of 1

Project Name: Peel Park Avenue, Clitheroe

Project No. 17110

Co-ords: -
Level:

Date
19/07/2017

Location: Peel Park Avenue, Clitheroe

Dimensions (m):

2.8

Scale

1:25

Client: Applethwaite Homes

Depth
2.20

CS

Logged
MD

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	ES	HVP=74	0.20			Grass over TOPSOIL: Dark brown clayey fine to medium sand with rootlets.
							Firm to stiff brown sandy CLAY
	1.50	CS		1.10			Firm dark brown slightly sandy gravelly CLAY with high cobble and boulder content of limestone. (Weathered bedrock)
				2.20			End of pit at 2.20 m

Remarks: Groundwater Ingress at 1.0m with a slow flow

Stability: Pit stable



Trial Pit Log

Trialpit No

TP10

Sheet 1 of 1

Project Name: Peel Park Avenue, Clitheroe

Project No.
17110

Co-ords:
Level:

Date
19/07/2017

Location: Peel Park Avenue, Clitheroe

Dimensions
(m):

1.4

Client: Applethwaite Homes

Depth
1.40

0.7

Scale

1:25
Logged
MD

Water Sink	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
				0.20			Grass over TOPSOIL: Dark brown clayey fine to medium sand with rootlets.
							Firm to stiff brown sandy CLAY
			HVP=98	0.90			Firm to stiff dark brown slightly sandy gravelly CLAY with high cobble and boulder content of limestone. (Weathered bedrock)
				1.40			End of pit at 1.40 m

Remarks: Groundwater ingress at 0.9m with a slow flow

Stability: Pit stable

				Trial Pit Log			Trialpit No TP11 Sheet 1 of 1			
Project Name: Peel Park Avenue, Clitheroe				Project No. 17110		Co-ords: - Level:		Date 19/07/2017		
Location: Peel Park Avenue, Clitheroe				Dimensions (m):		2.6		Scale 1:25		
Client: Applethwaite Homes				Depth 1.70		0.7		Logged MD		
Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description			
	Depth	Type	Results							
	0.10	ES		0.20			Grass over TOPSOIL: Dark brown clayey fine to medium sand with rootlets.			
								Firm to stiff brown sandy CLAY		
	1.00	O	HVP=64 HVP=58	0.80 1.60					Firm grayish brown gravelly CLAY with a high cobble and boulder content. Gravel is fine to coarse angular to subrounded of limestone.	
	End of pit at 1.70m									

Remarks: **Groundwater ingress at 0.8m with slow flow. Boulder obstruction at 1.7m and trial pit terminated.**

Stability: **Pit stable**



Trial Pit Log

Trialpit No

TP12

Sheet 1 of 1

Project Name: Peel Park Avenue, Clitheroe

Project No.
17110

Co-ords: -
Level:

Date
19/07/2017

Location: Peel Park Avenue, Clitheroe

Dimensions (m): 2.7

Client: Applethwaite Homes

Depth
1.80

0.7

Scale
1:25

Logged
MD

Water Strike	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
	Depth	Type	Results				
	0.10	ES		0.20			Grass over TOPSOIL: Dark brown clayey fine to medium sand with rootlets.
				0.80			Firm to stiff brown sandy CLAY
	1.50	D		1.80			Firm greyish brown gravelly CLAY with a high cobble and boulder content. Gravel is fine to coarse angular to subrounded of limestone.
							End of pit at 1.80 m

1

2

3

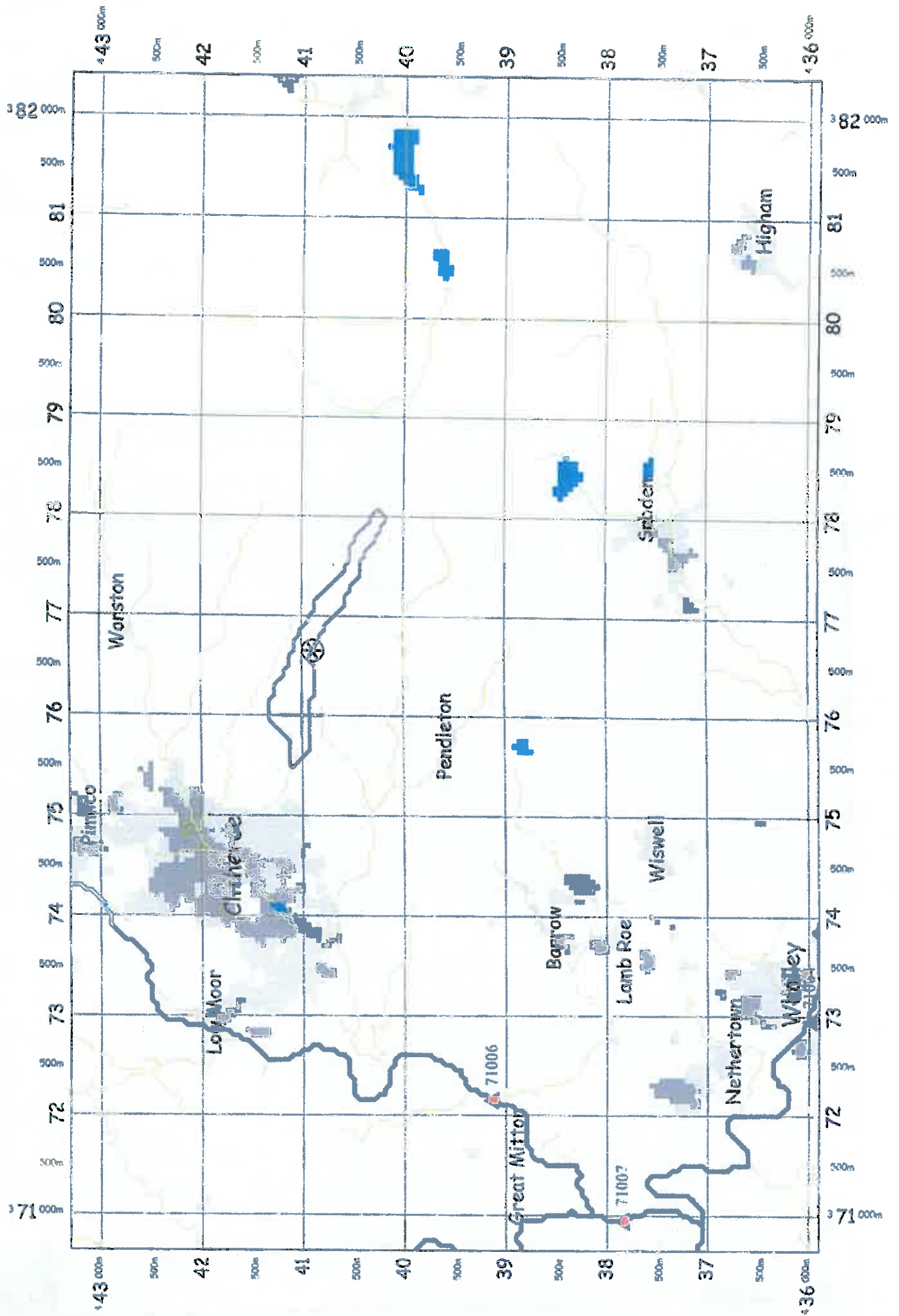
4

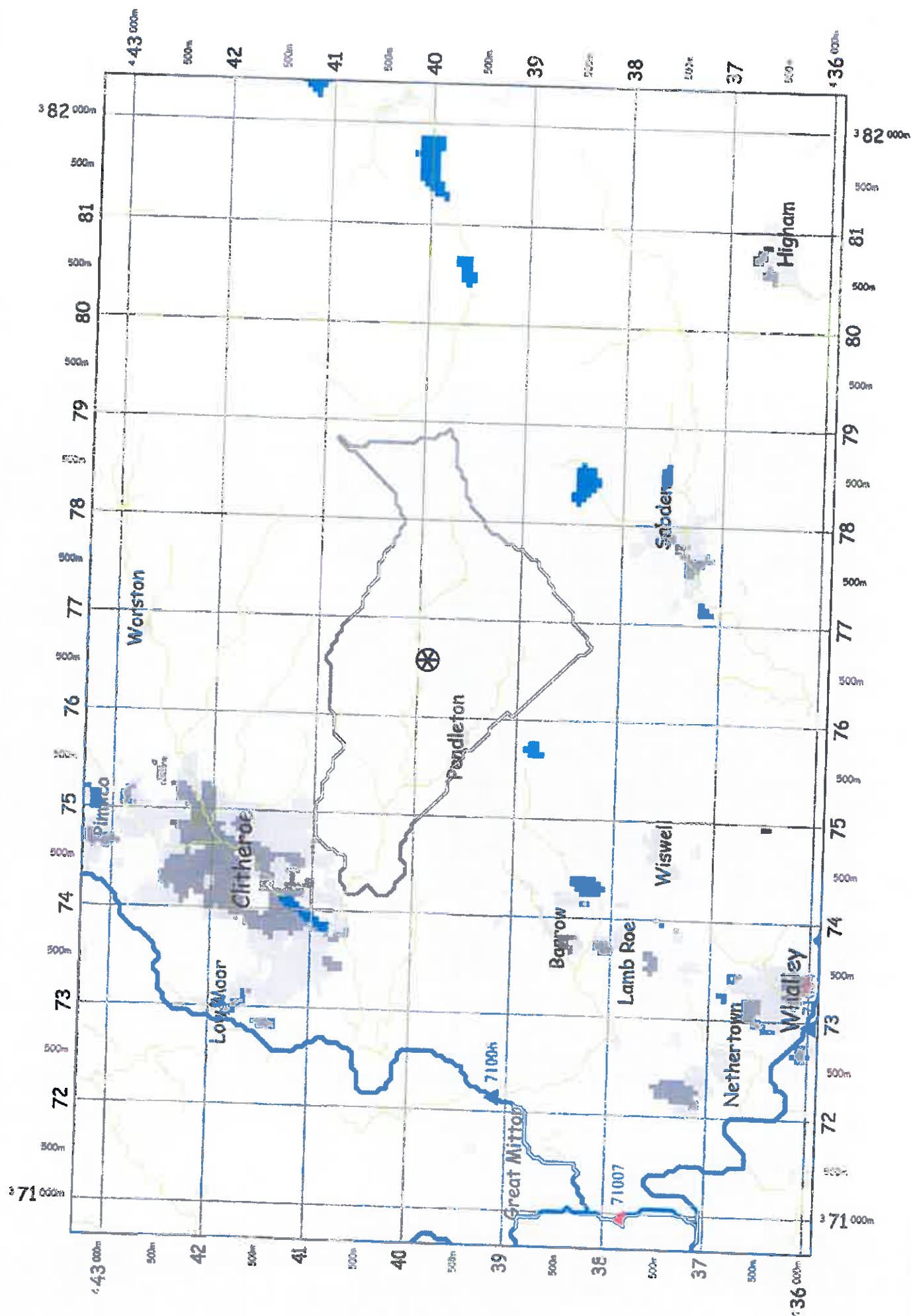
5

Remarks: Groundwater ingress at 1.0m with a slow flow. Boulder obstruction at 1.8m and trial pit terminated.

Stability: Pit stable







Revitalised FSR/FEH rainfall runoff method

Spreadsheet application report

User name: mikel
Company name: mla
Project name: clitheroe small

Catchment name
Catchment easting: 375500
Catchment northing: 441100
Catchment area: 0.81

Datetime modelled: 23-Aug-2017 15:07
Version: 1.4

Summary of model setup

Design rainfall parameters

Return period (yr): 2.3
Duration (hr): 2.1
Timestep (hr): 0.1
Season: Winter

Loss model parameters

C_{max} (mm): 246
 C_{int} (mm): 136
 α factor: 1

Routing model parameters

T_p (hr): 0.97
 U_p : 0.65
 U_s : 0.5

Baseflow model parameters

BL (hr): 21.9
BR: 0.62
 BF_0 (m³/s): 0

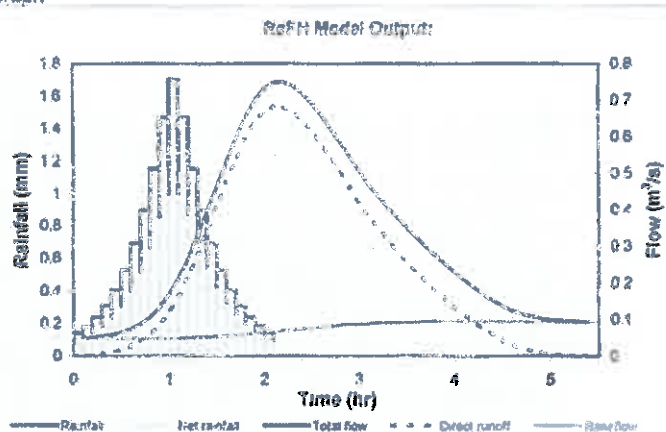
Summary of results

FEH DDF rainfall (mm): 18.7
Design rainfall (mm): 13.7
Peak rainfall (mm): 17
Peak flow (m³/s): 0.8

Results

Series	Design Rainfall	Net rainfall	Direct runoff	Baseflow	Total flow
Unit	mm	mm	m ³ /s	m ³ /s	m ³ /s
0.0	0.1	0.1	0.0	0.0	0.0
0.1	0.2	0.1	0.0	0.0	0.0
0.2	0.2	0.1	0.0	0.0	0.0
0.3	0.3	0.2	0.0	0.0	0.1
0.4	0.4	0.2	0.0	0.0	0.1
0.5	0.5	0.3	0.0	0.0	0.1
0.6	0.7	0.4	0.0	0.0	0.1
0.7	0.9	0.5	0.0	0.0	0.1
0.8	1.2	0.7	0.1	0.0	0.1
0.9	1.5	0.8	0.1	0.0	0.1
1.0	1.7	1.0	0.1	0.0	0.2
1.1	1.5	0.9	0.2	0.0	0.2
1.2	1.2	0.7	0.2	0.0	0.3
1.3	0.9	0.5	0.3	0.0	0.3
1.4	0.7	0.4	0.3	0.1	0.4
1.5	0.5	0.3	0.4	0.1	0.6
1.6	0.4	0.2	0.5	0.1	0.5
1.7	0.3	0.2	0.6	0.1	0.8
1.8	0.2	0.1	0.6	0.1	0.7
1.9	0.2	0.1	0.6	0.1	0.7
2.0	0.1	0.1	0.7	0.1	0.7
2.1	0.0	0.0	0.7	0.1	0.7
2.2	0.0	0.0	0.7	0.1	0.8
2.3	0.0	0.0	0.7	0.1	0.7
2.4	0.0	0.0	0.6	0.1	0.7
2.5	0.0	0.0	0.6	0.1	0.7
2.6	0.0	0.0	0.6	0.1	0.7
2.7	0.0	0.0	0.5	0.1	0.6
2.8	0.0	0.0	0.5	0.1	0.6
2.9	0.0	0.0	0.5	0.1	0.5
3.0	0.0	0.0	0.4	0.1	0.5
3.1	0.0	0.0	0.4	0.1	0.5
3.2	0.0	0.0	0.4	0.1	0.4
3.3	0.0	0.0	0.3	0.1	0.4
3.4	0.0	0.0	0.3	0.1	0.4
3.5	0.0	0.0	0.3	0.1	0.4
3.6	0.0	0.0	0.2	0.1	0.3
3.7	0.0	0.0	0.2	0.1	0.3
3.8	0.0	0.0	0.2	0.1	0.3
3.9	0.0	0.0	0.2	0.1	0.3
4.0	0.0	0.0	0.1	0.1	0.2
4.1	0.0	0.0	0.1	0.1	0.2
4.2	0.0	0.0	0.1	0.1	0.2
4.3	0.0	0.0	0.1	0.1	0.2
4.4	0.0	0.0	0.1	0.1	0.2
4.5	0.0	0.0	0.0	0.1	0.1
4.6	0.0	0.0	0.0	0.1	0.1
4.7	0.0	0.0	0.0	0.1	0.1
4.8	0.0	0.0	0.0	0.1	0.1
4.9	0.0	0.0	0.0	0.1	0.1
5.0	0.0	0.0	0.0	0.1	0.1
5.1	0.0	0.0	0.0	0.1	0.1
5.2	0.0	0.0	0.0	0.1	0.1
5.3	0.0	0.0	0.0	0.1	0.1
5.4	0.0	0.0	0.0	0.1	0.1
5.5	0.0	0.0	0.0	0.1	0.1
Total (mm)	13.7	8.0	8.0	2.4	10.4

Graph



Audit comments

Model run with ReFH dll version: 1.4.0005

Catchment

Catchment descriptors imported from file
Catchment descriptor file = 'clitheroesmall.csv'
Catchment descriptor file exported from C/D ROM version 3
Catchment descriptor file exported on 23-Aug-2017 14:03
BF/HOST value of 0.348 used
PROP/NET value of 0.8 used
SAAR value of 1260 used
DPLBAR value of 1.45 used
DPSBAR value of 80.1 used
URBEXT value of 0 used
C value of -0.02551 used
D1 value of 0.49206 used

Revitalised FSR/FEH rainfall runoff method

Spreadsheet application report

User name	mike1	Catchment name		Date/time modelled	23-Aug-2017 15:00
Company name	mja	Catchment easting	376500	Version	1.4
Project name	clitheroe small	Catchment northing	441100		
		Catchment area	0.61		

Summary of model setup		Loss model parameters		Routing model parameters		Baseflow model parameters	
Design rainfall parameters		C_{max} (mm)	246	T_p (hr)	0.97	BL (hr)	21.9
Return period (yr)	30	C_{dur} (mm)	133	U_2	0.65	BR	0.69
Duration (hr)	2.1	α factor	0.91	U_k	0.2	BF_0 (m ³ /s)	0
Timestep (hr)	0.1						
Season	Winter						

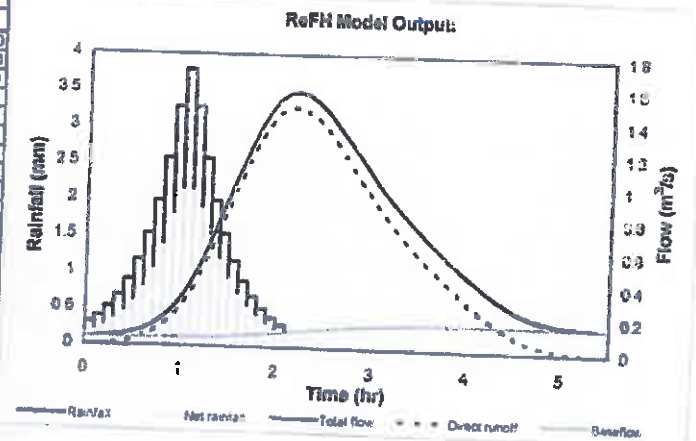
Summary of results

FEH DDF rainfall (mm)	41.6	Peak rainfall (mm)	3.3
Design rainfall (mm)	30.6	Peak flow (m ³ /s)	1.6

Results

Series	Design Rainfall	Net rainfall	Direct runoff	Baseflow	Total flow
Unit	mm	mm	m ³ /s	m ³ /s	m ³ /s
0.0	0.3	0.2	0.0	0.0	0.0
0.1	0.4	0.2	0.0	0.0	0.0
0.2	0.5	0.3	0.0	0.0	0.0
0.3	0.7	0.4	0.0	0.0	0.1
0.4	0.9	0.5	0.0	0.0	0.1
0.5	1.2	0.8	0.0	0.0	0.1
0.6	1.3	0.8	0.1	0.0	0.1
0.7	2.0	1.1	0.1	0.0	0.1
0.8	2.8	1.4	0.1	0.0	0.1
0.9	3.3	1.8	0.2	0.0	0.2
1.0	3.8	2.1	0.2	0.0	0.3
1.1	3.3	1.9	0.3	0.0	0.4
1.2	2.6	1.5	0.5	0.1	0.6
1.3	2.0	1.2	0.6	0.1	0.8
1.4	1.5	0.9	0.7	0.1	0.8
1.5	1.2	0.7	0.8	0.1	0.9
1.6	0.9	0.6	1.0	0.1	1.1
1.7	0.7	0.4	1.1	0.1	1.2
1.8	0.5	0.3	1.3	0.1	1.3
1.9	0.4	0.3	1.4	0.1	1.4
2.0	0.3	0.2	1.4	0.1	1.5
2.1	0.0	0.0	1.5	0.1	1.6
2.2	0.0	0.0	1.5	0.1	1.6
2.3	0.0	0.0	1.4	0.1	1.5
2.4	0.0	0.0	1.3	0.1	1.5
2.5	0.0	0.0	1.3	0.1	1.4
2.6	0.0	0.0	1.2	0.1	1.3
2.7	0.0	0.0	1.1	0.1	1.2
2.8	0.0	0.0	1.0	0.1	1.1
2.9	0.0	0.0	0.9	0.1	1.1
3.0	0.0	0.0	0.8	0.1	1.0
3.1	0.0	0.0	0.8	0.1	0.9
3.2	0.0	0.0	0.7	0.1	0.8
3.3	0.0	0.0	0.6	0.1	0.8
3.4	0.0	0.0	0.5	0.2	0.7
3.5	0.0	0.0	0.5	0.2	0.7
3.6	0.0	0.0	0.4	0.2	0.6
3.7	0.0	0.0	0.3	0.2	0.5
3.8	0.0	0.0	0.3	0.2	0.5
3.9	0.0	0.0	0.2	0.2	0.4
4.0	0.0	0.0	0.2	0.2	0.4
4.1	0.0	0.0	0.2	0.2	0.4
4.2	0.0	0.0	0.2	0.2	0.3
4.3	0.0	0.0	0.1	0.2	0.3
4.4	0.0	0.0	0.1	0.2	0.3
4.5	0.0	0.0	0.1	0.2	0.3
4.6	0.0	0.0	0.1	0.2	0.2
4.7	0.0	0.0	0.1	0.2	0.2
4.8	0.0	0.0	0.1	0.2	0.2
4.9	0.0	0.0	0.1	0.2	0.2
5.0	0.0	0.0	0.1	0.2	0.2
5.1	0.0	0.0	0.1	0.2	0.2
5.2	0.0	0.0	0.1	0.2	0.2
5.3	0.0	0.0	0.1	0.2	0.2
5.4	0.0	0.0	0.1	0.2	0.2
5.5	0.0	0.0	0.1	0.2	0.2
Total (mm)	30.6	17.2	3.6	20.9	

Graph



Model comments

Model run with ReFH v1.4 0005

Catchment

Catchment descriptors imported from file
 Catchment descriptor file = 'clitheroesmall.csv'
 Catchment descriptor file exported from CD ROM version 3
 Catchment descriptor file exported on 23-Aug-2017 14:03
 BFHOST value of 0.346 used
 PROPWET value of 0.6 used
 SAAR value of 1250 used
 QPLBAR value of 1.45 used
 DPSBAR value of 90.1 used
 URBEITY value of 0 used
 C value of -0.02551 used
 D1 value of 0.40206 used

Revitalised FSR/FEH rainfall runoff method

Specialist applications report

User name: mikel
Company name: mls
Project name: clitheroe small

Catchment name:
Catchment easting: 375500
Catchment northing: 441100
Catchment area: 0.61

Date/time modelled: 23-Aug-2017 15:08
Version: 1.4

Summary of model setup

Design rainfall parameters

Return period (yr): 100
Duration (hr): 2.1
Timestep (hr): 0.1
Season: Winter

Loss model parameters

C_{max} (mm): 246
 C_{int} (mm): 136
 α factor: 0.83

Routing model parameters

T_p (hr): 0.97
 U_p : 0.65
 U_k : 0.6

Baseflow model parameters

BL (hr): 21.6
BR: 0.99
 BF_0 (m³/s): 0

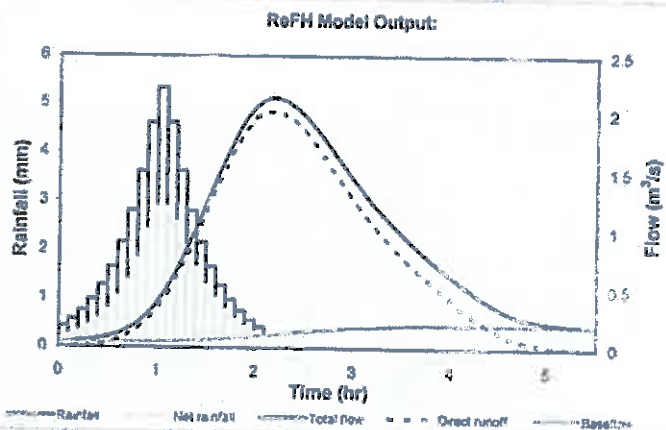
Summary of results

FEH DDF rainfall (mm): 58.5
Design rainfall (mm): 43.1
Peak rainfall (mm): 5.3
Peak flow (m³/s): 2.1

Results

Series	Design Rainfall	Net rainfall	Direct runoff	Baseflow	Total flow
Unk	mm	mm	m ³ /s	m ³ /s	m ³ /s
0.0	0.4	0.2	0.0	0.0	0.0
0.1	0.6	0.3	0.0	0.0	0.0
0.2	0.7	0.3	0.0	0.0	0.1
0.3	1.0	0.6	0.0	0.0	0.1
0.4	1.3	0.6	0.0	0.0	0.1
0.5	1.7	0.8	0.0	0.0	0.1
0.6	2.2	1.1	0.1	0.0	0.1
0.7	2.8	1.4	0.1	0.0	0.1
0.8	3.6	1.8	0.2	0.0	0.2
0.9	4.6	2.4	0.2	0.0	0.3
1.0	5.3	2.9	0.3	0.0	0.4
1.1	4.8	2.6	0.5	0.1	0.5
1.2	3.6	2.1	0.6	0.1	0.7
1.3	2.8	1.7	0.8	0.1	0.8
1.4	2.2	1.3	1.0	0.1	1.0
1.5	1.7	1.0	1.2	0.1	1.2
1.6	1.3	0.8	1.4	0.1	1.4
1.7	1.0	0.6	1.5	0.1	1.6
1.8	0.7	0.5	1.7	0.1	1.8
1.9	0.6	0.4	1.9	0.1	1.9
2.0	0.4	0.3	2.0	0.1	2.1
2.1	0.0	0.0	2.0	0.1	2.1
2.2	0.0	0.0	2.0	0.1	2.1
2.3	0.0	0.0	2.0	0.1	2.1
2.4	0.0	0.0	1.9	0.1	2.1
2.5	0.0	0.0	1.8	0.1	2.0
2.6	0.0	0.0	1.7	0.1	1.9
2.7	0.0	0.0	1.6	0.2	1.8
2.8	0.0	0.0	1.5	0.2	1.7
2.9	0.0	0.0	1.4	0.2	1.6
3.0	0.0	0.0	1.3	0.2	1.4
3.1	0.0	0.0	1.2	0.2	1.3
3.2	0.0	0.0	1.1	0.2	1.2
3.3	0.0	0.0	1.0	0.2	1.1
3.4	0.0	0.0	0.9	0.2	1.1
3.5	0.0	0.0	0.8	0.2	1.0
3.6	0.0	0.0	0.7	0.2	0.9
3.7	0.0	0.0	0.6	0.2	0.8
3.8	0.0	0.0	0.6	0.2	0.8
3.9	0.0	0.0	0.5	0.2	0.7
4.0	0.0	0.0	0.4	0.2	0.6
4.1	0.0	0.0	0.4	0.2	0.6
4.2	0.0	0.0	0.3	0.2	0.5
4.3	0.0	0.0	0.2	0.2	0.4
4.4	0.0	0.0	0.2	0.2	0.4
4.5	0.0	0.0	0.1	0.2	0.3
4.6	0.0	0.0	0.1	0.2	0.3
4.7	0.0	0.0	0.1	0.2	0.3
4.8	0.0	0.0	0.1	0.2	0.3
4.9	0.0	0.0	0.0	0.2	0.2
5.0	0.0	0.0	0.0	0.2	0.2
5.1	0.0	0.0	0.0	0.2	0.2
5.2	0.0	0.0	0.0	0.2	0.2
5.3	0.0	0.0	0.0	0.2	0.2
5.4	0.0	0.0	0.0	0.2	0.2
5.5	0.0	0.0	0.0	0.2	0.2
Total (mm)	43.1	23.6	23.6	4.6	28.0

Graph



Audit comments

Model run with ReFH 6L version 1.4 6005

Catchment

Catchment description imported from file
Catchment descriptor file = 'clithersmall.csv'
Catchment descriptor file exported from CD ROM version 2
Catchment descriptor file exported on 23-Aug-2017 14:03
BFHCS1 value of 0.348 used
PROPWET value of 0.6 used
SAAR value of 1250 used
DPLBAR value of 1.45 used
DPSBAR value of 90.1 used
URBEXT value of 0 used
C value of 0.02551 used
D1 value of 0.40205 used

VERSION	FEH CD-R Version	3 exported at	14:04:59 GMT	Wed	23-Aug-17
CATCHMENT	GB	374200	440650 SD 74200 40650		
AREA	6.38				
ALTBAR	211				
ASPBAR	283				
ASPVAR	0.69				
BFIHOST	0.349				
DPLBAR	3.21				
DPSBAR	111.6				
FARL	1				
LDP	6.58				
PROPWET	0.54				
RMED-1H	10.3				
RMED-1D	40.9				
RMED-2D	55.4				
SAAR	1274				
SAAR4170	1255				
SPRHOST	42.12				
URBCONC1990	-999999				
URBEXT1990	0.0025				
URBLOC1990	-999999				
URBCONC2000	0.265				
URBEXT2000	0.005				
URBLOC2000	0.301				
C	-0.0257				
D1	0.40195				
D2	0.37888				
D3	0.40006				
E	0.30184				
F	2.46818				
C(1 km)	-0.025				
D1(1 km)	0.398				
D2(1 km)	0.385				
D3(1 km)	0.43				
E(1 km)	0.299				
F(1 km)	2.444				

VERSION	FEH CD-R	Version	3 exported at	14:03:51 GMT	Wed	23-Aug-17
CATCHMENT	GB	375500	441100 SD 75500 41100			
AREA		0.61				
ALTBAR		178				
ASPBAR		287				
ASPVAR		0.91				
BFIHOST		0.346				
DPLBAR		1.45				
DPSBAR		90.1				
FARL		1				
LDP		3.2				
PROPWET		0.6				
RMED-1H		10.8				
RMED-1D		41.1				
RMED-2D		56.3				
SAAR		1250				
SAAR4170		1231				
SPRHOST		41.13				
URBCONC1990		-999999				
URBEXT1990		0				
URBLOC1990		-999999				
URBCONC2000		-999999				
URBEXT2000		0				
URBLOC2000		-999999				
C		-0.02551				
D1		0.40206				
D2		0.38513				
D3		0.40008				
E		0.30155				
F		2.47105				
C(1 km)		-0.025				
D1(1 km)		0.399				
D2(1 km)		0.389				
D3(1 km)		0.402				
E(1 km)		0.301				
F(1 km)		2.467				

VERSION	FEH CD-R Version	3 exported at	14:03:51 GMT	Wed	23-Aug-17
CATCHMENT	GB	375500	441100 SD 75500 41100		
AREA	0.61				
ALTBAR	178				
ASPBAR	287				
ASPVAR	0.91				
BFIHOST	0.346				
DPLBAR	1.45				
DPSBAR	90.1				
FARL	1				
LDP	3.2				
PROPWET	0.6				
RMED-1H	10.8				
RMED-1D	41.1				
RMED-2D	56.3				
SAAR	1250				
SAAR4170	1231				
SPRHOST	41.13				
URBCONC1990	-999999				
URBEXT1990	0				
URBLOC1990	-999999				
URBCONC2000	-999999				
URBEXT2000	0				
URBLOC2000	-999999				
C	-0.02551				
D1	0.40206				
D2	0.38513				
D3	0.40008				
E	0.30155				
F	2.47105				
C(1 km)	-0.025				
D1(1 km)	0.399				
D2(1 km)	0.389				
D3(1 km)	0.402				
E(1 km)	0.301				
F(1 km)	2.467				

VERSION FEH CD-R Version			3 exported at 14:05:56 GMT			Wed	23-Aug-17	B2030
Parameters			Clitheroe rain depths			met		
Calculator Design rainfall			Unadjusted					
Calculator For a point								
Calculator 1 km point GB			375000	441000	SD 75000	41000		
Duration=			6	1 (hours)				
Fixed dura no								
Return per			100	1 (years)				
Annual max yes								
c	d1	d2	d3	e	f			
-0.025	0.396	0.378	0.412	0.3	2.444			
A design rainfall of 75.6 mm was calculated.								
No warning(s) or note(s) were present for this calculation.								
The data in the following table have been computed using sliding durations.								
			10	20	50	100	200	500
Duration minutes	Duration hours	Duration days	year rainfa mm	year rainfa mm	year rainfa mm	year rainfa mm	year rainfa mm	year rainfall mm
15	0.25	0.010417	14.13	17.98	24.55	31.02	39.15	53.22
30	0.5	0.020833	17.88	22.47	30.2	37.69	46.99	62.88
45	0.75	0.03125	20.52	25.6	34.08	42.23	52.3	69.33
60	1	0.041667	22.63	28.08	37.14	45.78	56.42	74.3
75	1.25	0.052083	24.41	30.17	39.69	48.75	59.83	78.4
90	1.5	0.0625	25.97	31.99	41.91	51.31	62.78	81.91
105	1.75	0.072917	27.36	33.82	43.89	53.59	65.38	85.01
120	2	0.083333	28.63	35.1	45.67	55.64	67.73	87.79
135	2.25	0.09375	29.8	36.45	47.3	57.51	69.86	90.31
150	2.5	0.104167	30.89	37.71	48.82	59.24	71.83	92.63
165	2.75	0.114583	31.91	38.88	50.22	60.84	73.66	94.78
180	3	0.125	32.86	39.99	51.55	62.35	75.37	96.78
195	3.25	0.135417	33.77	41.03	52.79	63.77	76.97	98.67
210	3.5	0.145833	34.63	42.02	53.97	65.11	78.49	100.44
225	3.75	0.15625	35.45	42.96	55.1	66.38	79.93	102.12
240	4	0.166667	36.24	43.86	56.17	67.6	81.3	103.72
255	4.25	0.177083	36.99	44.73	57.19	68.76	82.61	105.25
270	4.5	0.1875	37.72	45.56	58.18	69.87	83.87	106.7
285	4.75	0.197917	38.42	46.36	59.12	70.94	85.07	108.1
300	5	0.208333	39.09	47.13	60.03	71.97	86.23	109.44
315	5.25	0.21875	39.74	47.87	60.92	72.97	87.34	110.74
330	5.5	0.229167	40.38	48.6	61.77	73.93	88.42	111.98
345	5.75	0.239583	40.99	49.3	62.59	74.86	89.46	113.19
360	6	0.25	41.59	49.98	63.39	75.76	90.47	114.35
375	6.25	0.260417	42.17	50.64	64.17	76.63	91.45	115.48
390	6.5	0.270833	42.74	51.28	64.92	77.48	92.4	116.58
405	6.75	0.28125	43.29	51.91	65.66	78.31	93.33	117.64
420	7	0.291667	43.83	52.52	66.38	79.11	94.23	118.67
435	7.25	0.302083	44.35	53.11	67.08	79.89	95.1	119.68
450	7.5	0.3125	44.86	53.7	67.76	80.66	95.96	120.66
465	7.75	0.322917	45.37	54.27	68.42	81.41	96.79	121.62
480	8	0.333333	45.86	54.82	69.08	82.13	97.6	122.55
495	8.25	0.34375	46.34	55.37	69.71	82.85	98.4	123.46
510	8.5	0.354167	46.81	55.9	70.34	83.55	99.17	124.35
525	8.75	0.364583	47.28	56.43	70.95	84.23	99.93	125.22
540	9	0.375	47.73	56.94	71.55	84.9	100.68	126.07
555	9.25	0.385417	48.18	57.44	72.13	85.55	101.41	126.91
570	9.5	0.395833	48.62	57.94	72.71	86.2	102.12	127.72
585	9.75	0.40625	49.05	58.43	73.28	86.83	102.83	128.53
600	10	0.416667	49.47	58.9	73.83	87.45	103.51	129.31
615	10.25	0.427083	49.89	59.37	74.38	88.06	104.19	130.08
630	10.5	0.4375	50.3	59.84	74.91	88.66	104.85	130.84
645	10.75	0.447917	50.7	60.29	75.44	89.24	105.51	131.58
660	11	0.458333	51.1	60.74	75.96	89.82	106.15	132.31
675	11.25	0.46875	51.49	61.18	76.47	90.39	106.78	133.03
690	11.5	0.479167	51.88	61.61	76.98	90.95	107.4	133.73
705	11.75	0.489583	52.26	62.04	77.47	91.5	108.01	134.43
720	12	0.5	52.63	62.46	77.96	92.06	108.61	135.11
735	12.25	0.510417	52.98	62.85	78.41	92.55	109.16	135.73
750	12.5	0.520833	53.33	63.24	78.86	93.04	109.71	136.35
765	12.75	0.53125	53.67	63.62	79.3	93.53	110.24	136.95
780	13	0.541667	54.01	64	79.73	94	110.77	137.54
795	13.25	0.552083	54.34	64.37	80.16	94.48	111.29	138.13
810	13.5	0.5625	54.67	64.74	80.58	94.94	111.8	138.7
825	13.75	0.572917	54.99	65.1	80.99	95.4	112.3	139.27
840	14	0.583333	55.31	65.46	81.41	95.85	112.8	139.83
855	14.25	0.59375	55.62	65.81	81.81	96.3	113.29	140.38
870	14.5	0.604167	55.94	66.16	82.21	96.74	113.78	140.93
885	14.75	0.614583	56.25	66.5	82.61	97.18	114.26	141.46

Surface water storage requirements for sites

www.uksubs.com | Storage estimation tool

Calculated by: michael lambert
Site name: peel park avenue
Site location: clitheroe

Site coordinates
Latitude: 53.86455° N
Longitude: 2.38468° W

This is an estimation of the storage volume requirements that are needed to meet normal best practice criteria in line with Environment Agency guidance 'Preliminary rainfall runoff management for developments' W5-074/A/TR1:1 rev. E (2012) and the SuDS Manual, C75 (Cina, 2015). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modeling software is used to calculate volume requirements and design details before finalising the drainage scheme.

Reference: 6080400
Date: 2017-08-24T10:02:11

Methodology		FEH Statistical	
Site characteristics			
Total site area (ha)		2.0	
Significant public open space (ha)		0.35	
Area positively drained (ha)		1.65	
Pervious area contribution (%)		30	
Impermeable area (ha)		0.63	
Percentage of drained area that is impermeable (%)		50	
Impervious area drained via infiltration (ha)		0	
Return period for infiltration system design (year)		10	
Impervious area drained to rainwater harvesting systems (ha)		0	
Return period for rainwater harvesting system design (year)		10	
Compliance factor for rainwater harvesting system design (%)		66	
Net site area for storage volume design (ha)		1.65	
Net impermeable area for storage volume design (ha)		0.93	
* Where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50 % of the 'area positively drained', the net site area and the estimates of Qbar and other flow rates will have been reduced accordingly.			
Design criteria			
Volume control approach		Use long term storage	
Climate change allowance factor	Default	Edited	
Urban creep allowance factor	1.3	1.3	
Interception rainfall depth (mm)	1.1	1.1	
Minimum flow rate (l/s)	5	5	
Qmed estimation method	Calculate from BFI and SAAR		
BFI & SPR estimation method	Specify BFI and SPR manually		
Qmed (l/s)	Default	Edited	
Qbar / Qmed Conversion Factor	22.15	--	
HOST class	1.075	1.075	
BFI / BFIHOST	---	N/A	
SPR / SPRHOST	0.346	0.346	
	0.41	0.41	
Hydrology			
SAAR (mm)	Default	Edited	
M5-60 Rainfall Depth (mm)	1203	1203	
'r' Ratio M5-60/M5-2 day	20	20	
Rainfall 100 yrs 6 hrs	0.3	0.3	
Rainfall 100 yrs 12 hrs	70		
FEH/FSR conversion factor	97.44		
Hydrological region	1.16	1.16	
Growth curve factor: 1 year	10		
Growth curve factor: 10 year	0.87	0.87	
Growth curve factor: 30 year	1.38	1.38	
Growth curve factor: 100 year	1.7	1.7	
	2.08	2.08	
Estimated storage volumes			
Interception storage (m³)	Default	Edited	
Attenuation storage (m³)	33	33	
Long term storage (m³)	--	422	
Treatment storage (m³)	0	0	
Total storage (excluding treatment) (m³)	100	100	
	--	456	
Site discharge rates			
Qbar total site area (l/s)	Default	Edited	
Qbar net site area (l/s)	--	28.86	
1 in 1 year (l/s)	--	23.81	
1 in 30 years (l/s)	--	20.7	
1 in 100 years (l/s)	--	40.5	
	--	49.5	



Flood map for planning

BETA This is a new service – your [feedback \(/feedback\)](#) will help us to improve it.

Flood probability

Your proposed development is in an area with a low probability of flooding

FLOOD ZONE 1

Land and property in flood zone 1 have a low probability of flooding

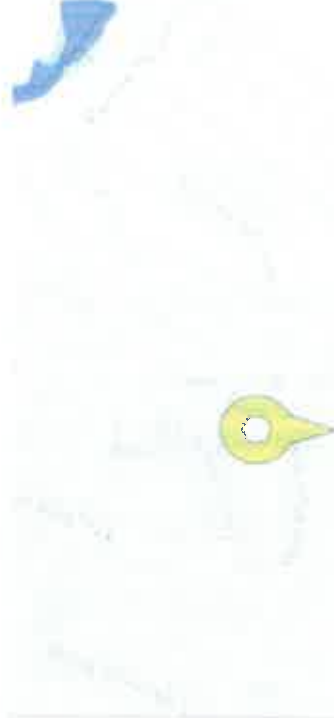
[More information about flood zones](#)

<http://planningguidance.communities.gov.uk/blog/guidance-risk-and-coastal-change/flood-zone-and-flood-risk-tables/table-1-flood-zones>

1

You don't need to do a [flood risk assessment](#)

<https://www.gov.uk/guidance/flood-risk->



Learn more about this area's flood risk

From the list on the left, select the information you're interested in. The map view will then update.

'Detailed view' shows more options.



Basic view

Detailed view

Flood risk from rivers or the sea

Extent of flooding

Depth and flow estimates at monitoring stations

Flood risk from surface water

Extent of flooding

High risk: depth

Location

Enter a place or postcode in England



Full screen ↵

Medium risk scenario

Flood depth
(millimetres)



Long term flood risk information

Learn more about this area's flood risk

From the list on the left, select the information you're interested in. The map view will then update.

'Detailed view' shows more options.



Basic view

Detailed view

Location



flow 1.1-30 yr

or the sea

Extent of flooding

Depth and flow estimates at monitoring stations

Flood risk from surface water

Extent of flooding

High risk: depth

Full screen

High risk scenario

Flood depth
(millimetres)

Learn more about this area's flood risk

From the list on the left, select the information you're interested in. The map view will then update.

'Detailed view' shows more options.

 Basic view

 Detailed view

Flood risk from rivers or the sea

Extent of flooding

Depth and flow estimates at monitoring stations

Flood risk from surface water

Extent of flooding

High risk: depth

Location

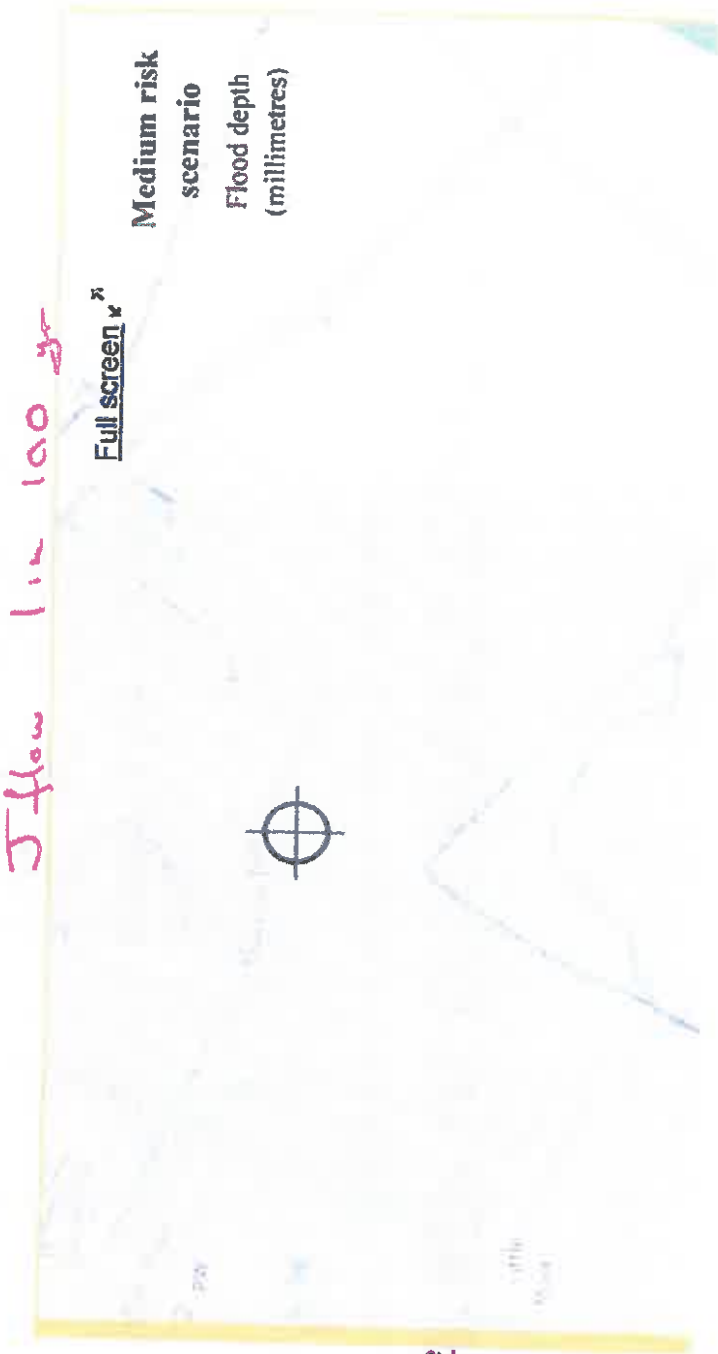
Enter a place or postcode in England

5400 1.2 100 y

Full screen

Medium risk scenario

Flood depth (millimetres)





Long term flood risk information

Learn more about this area's flood risk

From the list on the left, select the information you're interested in. The map view will then update.

'Detailed view' shows more options.

Basic view



Detailed view

Location

Enter a place or postcode in England



Flood risk from rivers or the sea

Extent of flooding

Depth and flow estimates at monitoring stations

Flood risk from surface water

Extent of flooding

High risk: depth





From the list on the left, select the information you're interested in. The map view will then update.

'Detailed view' shows more options.

The screenshot displays the Flood Risk Assessment tool interface. At the top left, there are two tabs: "Basic view" (selected) and "Detailed view". Below the tabs is a search bar labeled "Location" with the placeholder text "Enter a place or postcode in England" and a magnifying glass icon. To the right of the search bar is a red handwritten note: "flood risk from reservoirs".

The main area shows a map of a coastal region. A black crosshair symbol is centered on the map. Below the map, there is a yellow horizontal bar.

On the right side, there are four sections of information:

- Flood risk from rivers or the sea**
- Extent of flooding**
- Depth and flow estimates at monitoring stations**
- Flood risk from surface water**
- Extent of flooding**
- High risk: depth**

At the bottom right, there are three labels:

- Flood risk**
- Maximum extent of flooding**
- Location you selected**

A link labeled "Full screen" with an external link icon is located near the bottom center.



Lancashire and Blackpool Local Flood Risk Management Strategy

**October 2013
Draft for Consultation**



**Blackpool
Council**

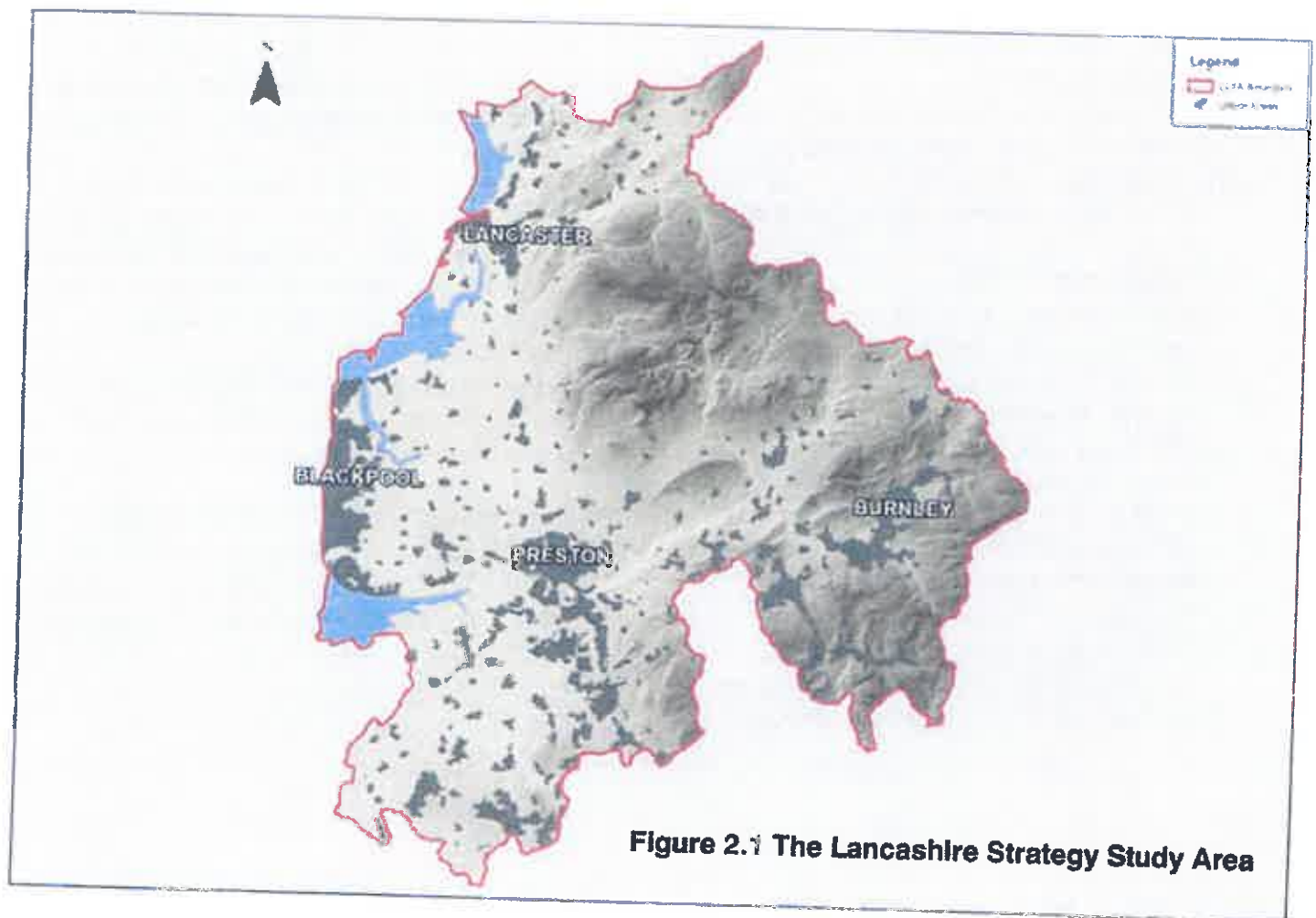
ALLISON • BETTER COMMUNITY FOR ALL

Lancashire
County
Council



3 Local Flood Risk within Lancashire

In this section of the strategy we describe the level of flood risk across Lancashire from local sources and how it varies across the area.



3.1 Introduction

Lancashire has experienced historical incidents of flooding in the past and has also suffered the consequences of flooding several times in recent years. Some recent notable events are

listed in Box 3.1. These events have resulted in flooding of homes, businesses, agricultural land as well as roads, railways and public services.

22nd & 23rd June 2012

- A band of heavy rainfall began in the south of the region and moved steadily north through the day.
- Rainfall totals of 100mm were recorded across much of Lancashire with a period of particularly intense rain across East Lancashire.
- River levels responded rapidly to the heavy rainfall, and record river levels were reached on the upper River Irwell in the Bacup and Rawtenstall areas.
- The most severe flooding occurred in Croston (72 properties), Whalley (18 properties), Leyland (15 properties) and various parts of Rossendale (127 properties).

24th September 2012

- Heavy persistent rain resulted in 80% of the average monthly rainfall falling on Monday 24th into Tuesday 25th September.
- The most severe property flooding occurred in West Lancashire (20 properties) largely caused by excess surface water, green field run off, and ordinary watercourse culvert surcharges, all resulting from exceptionally intense and localised rainfall.
- Property flooding also occurred in other locations, on a lesser scale, in parts of Wyre. 12 properties in Hambleton were flooded due to flow from the highway drainage and

sewer networks, and 7 properties in Preesall suffered flooding as a result of excess discharges to a culvert.

- Extensive field flooding was also reported in Fylde, Wyre and West Lancashire.

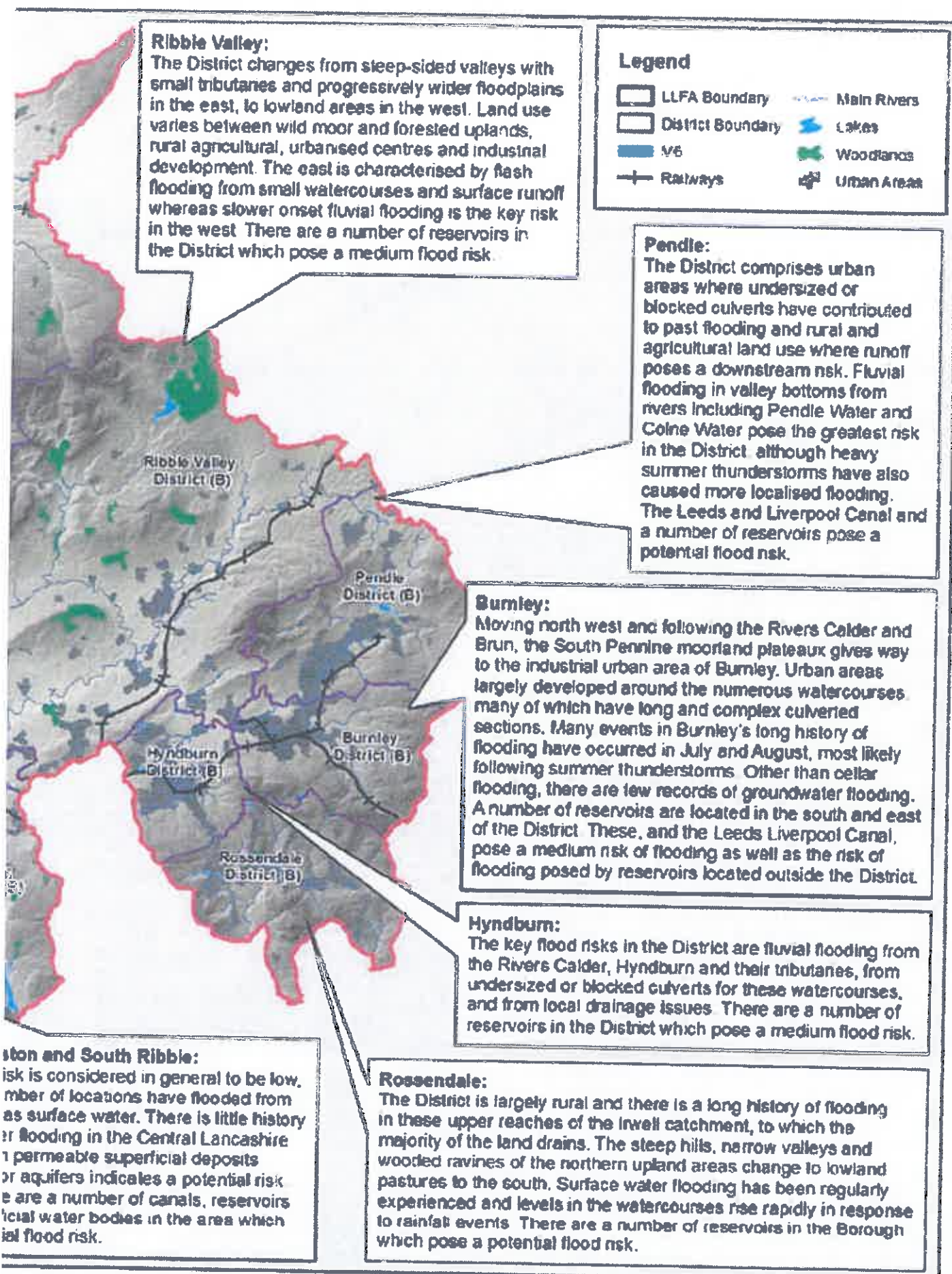
Other recent notable flooding incidents

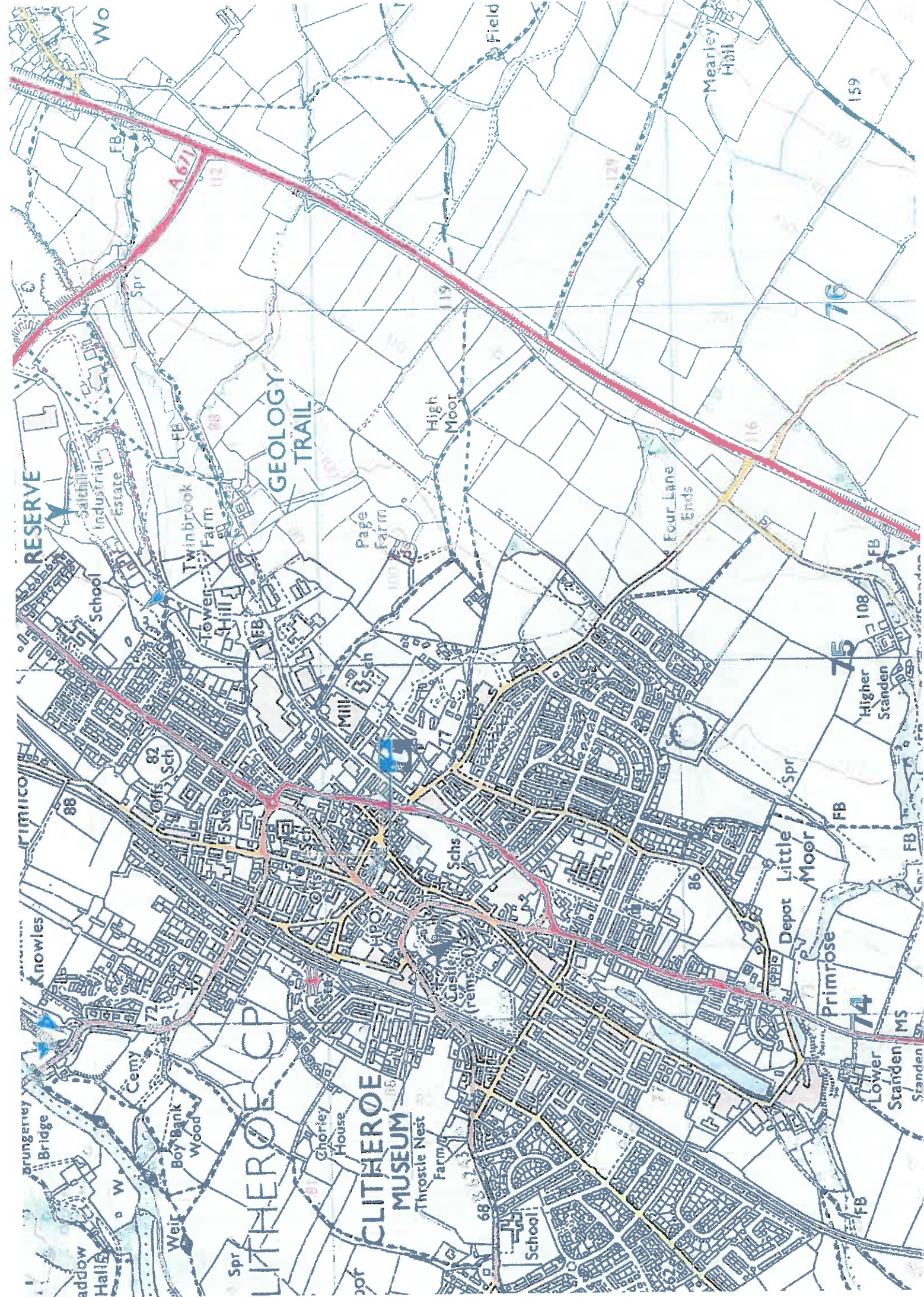
- Torrential rain in December 2012 caused flooding of roads and damage to highway infrastructure in East Lancashire.
- In September 2012, roads in Croston, Chorley and Morecombe were affected by flooding and a caravan park in Fleetwood evacuated.
- Flooding on the West Coast Main Line in September 2011, as well as on the M6 and other major roads, caused travel disruption.
- Heavy rain in August 2011 caused flooding of roads and properties in the village of Ribchester.
- Breaching of an Ordinary Watercourse caused flooding of agricultural land near Ormskirk in February 2011.

Prior to these, flooding has been recorded across the county, with clusters of notable incidents in Lancaster/Morecambe, Blackpool, Preston and Bacup/Rawtenstall in Rossendale.



Figure 3.2 Local Flood Risk across Lancashire





32 Peel Park Avenue, Cl
B87 1EU

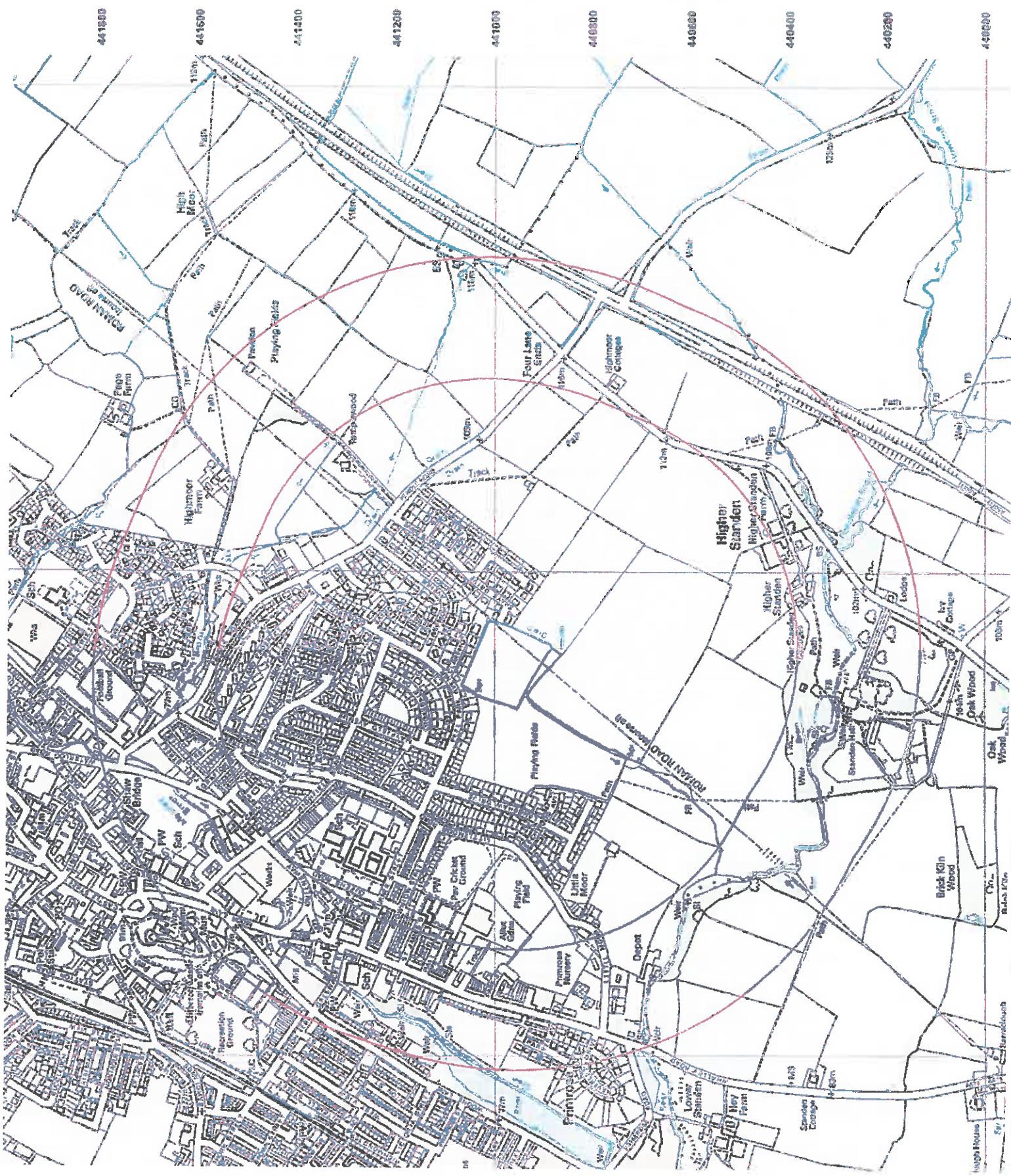
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Report Ref: CMAPS-CM-374810,440
Grid Ref:

Map Name: 1:10,000 Ra

Map date: 2002

Scale: 1:10,000

Printed at: 1:10,000





Site Details:

32 Peel Park Avenue, Clitheroe,
BB7 1EU

Client Ref: 30974
Report Ref: CMAPS-CM-639333-30974-120717HIS
Grid Ref: 374810, 440975

Map Name: County Series

Map date: 1932

Scale: 1:2,500

Printed at: 1:2,500



Surveyed 1832
Revised 1832
Edition N/A
Copyright N/A
Levelled N/A



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Groundsure Insights
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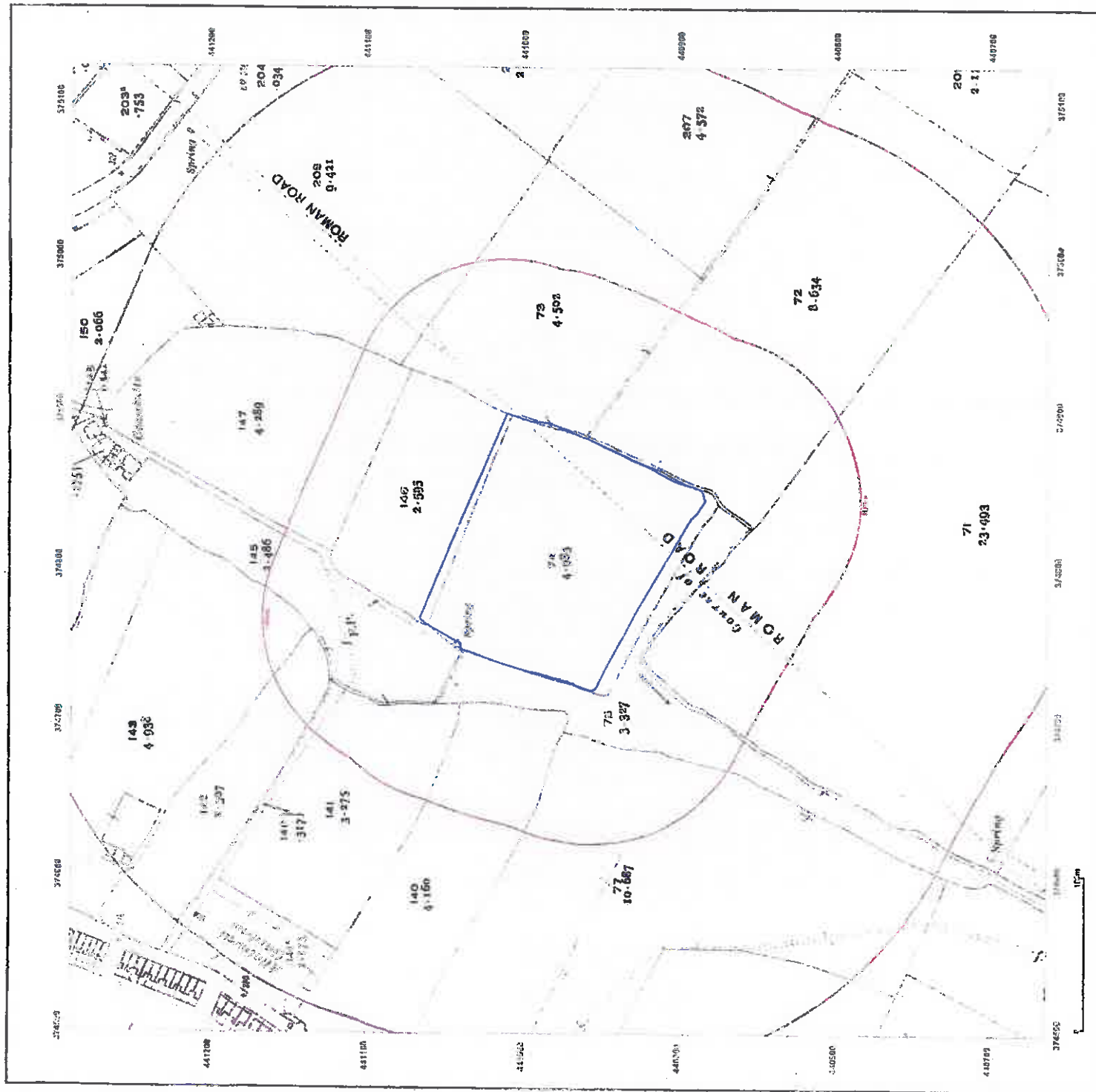


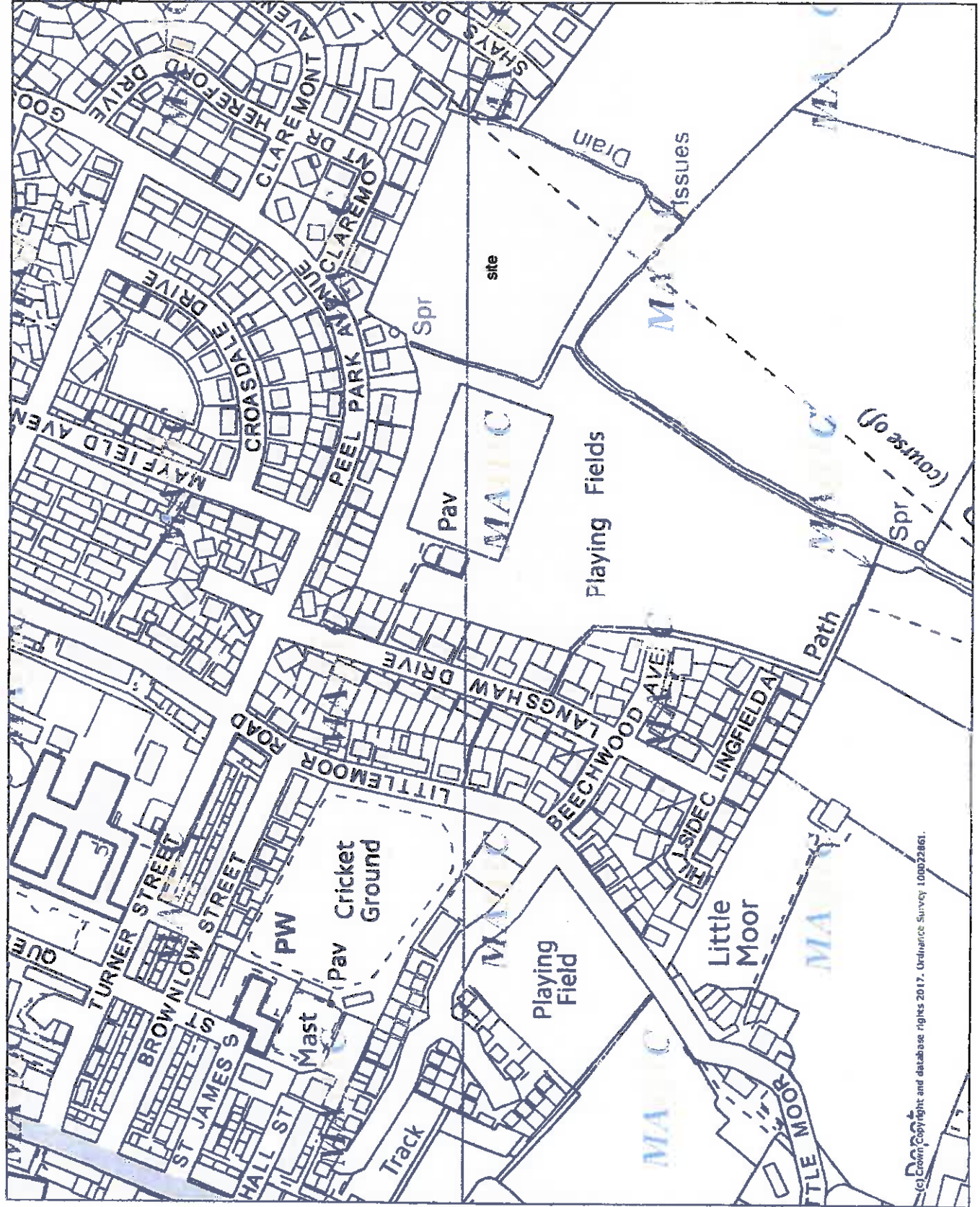
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Production date: 12 July 2017

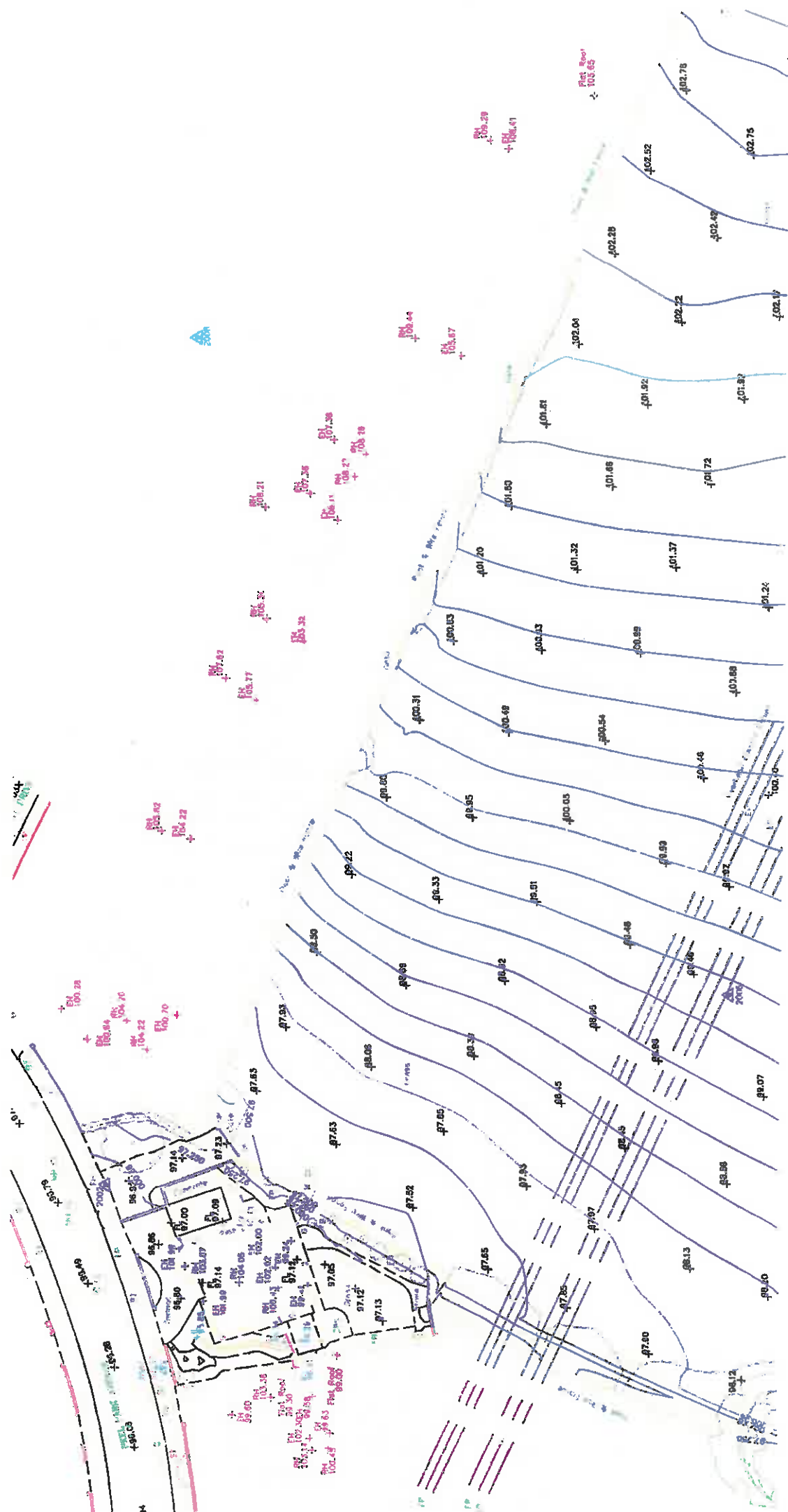
To view map legend click here [Legend](#)

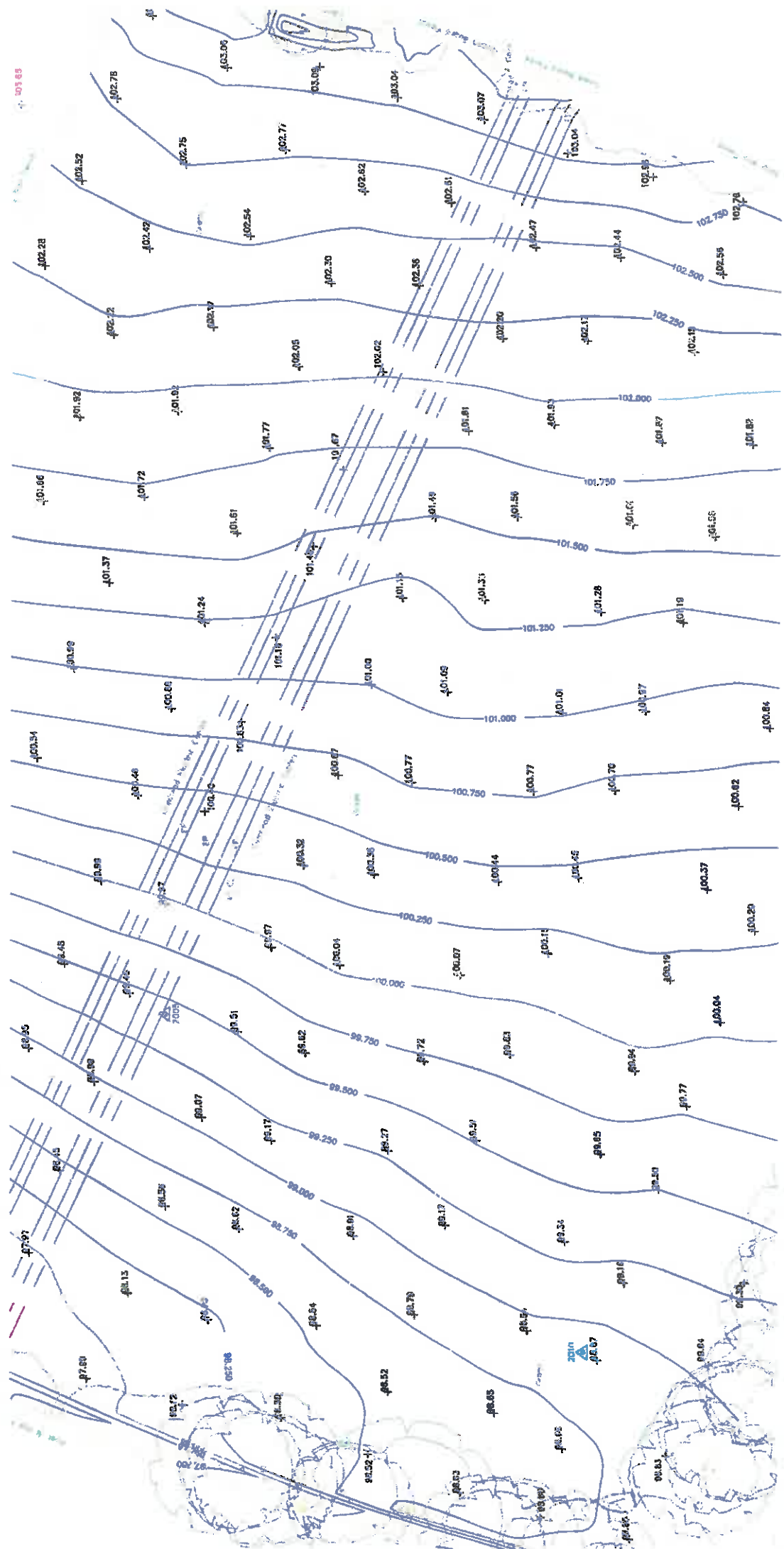


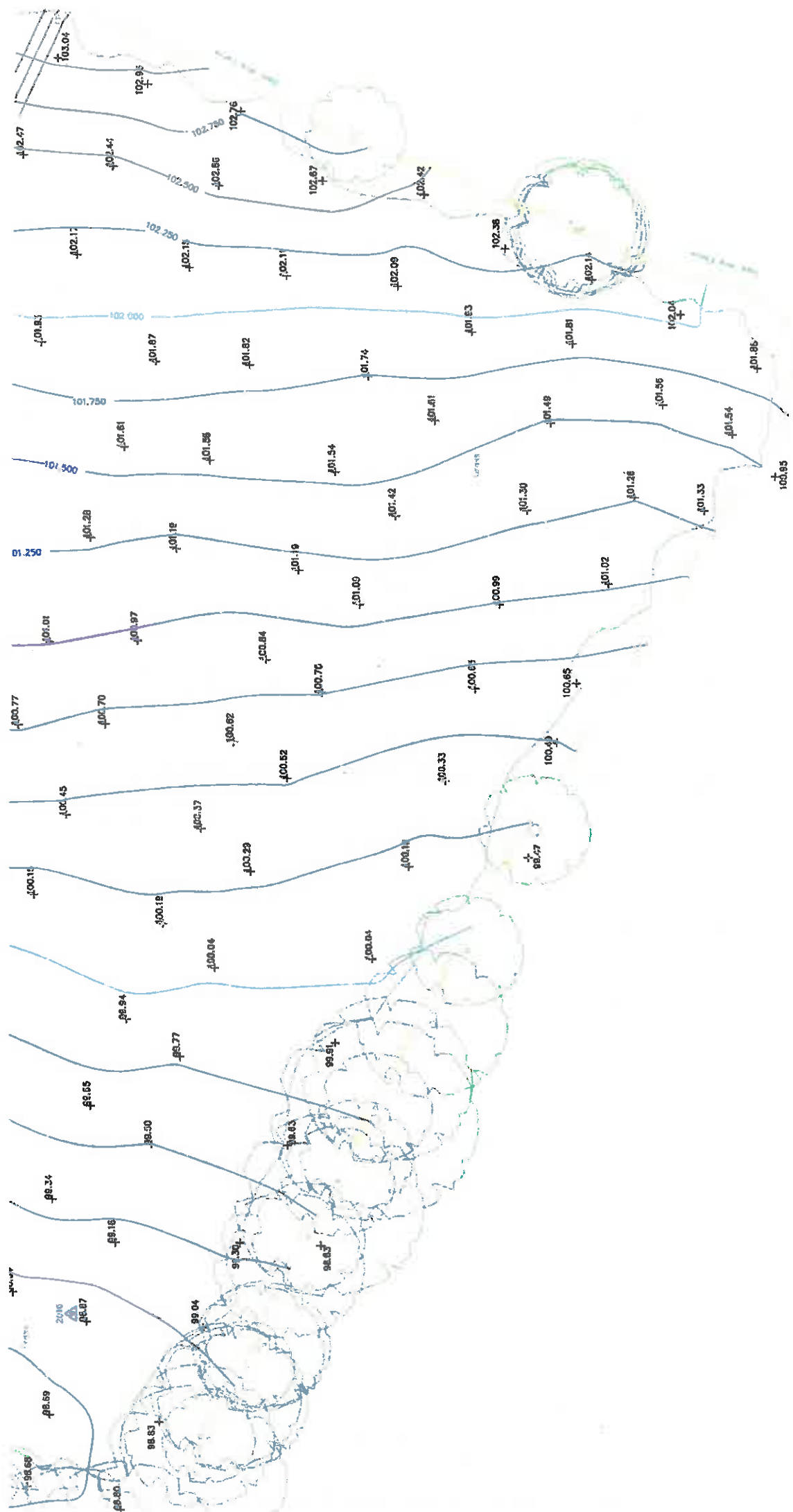


Projection = OSGB36
 ymin = 373906
 xmin = 440700
 ymax = 375200
 xmax = 441300

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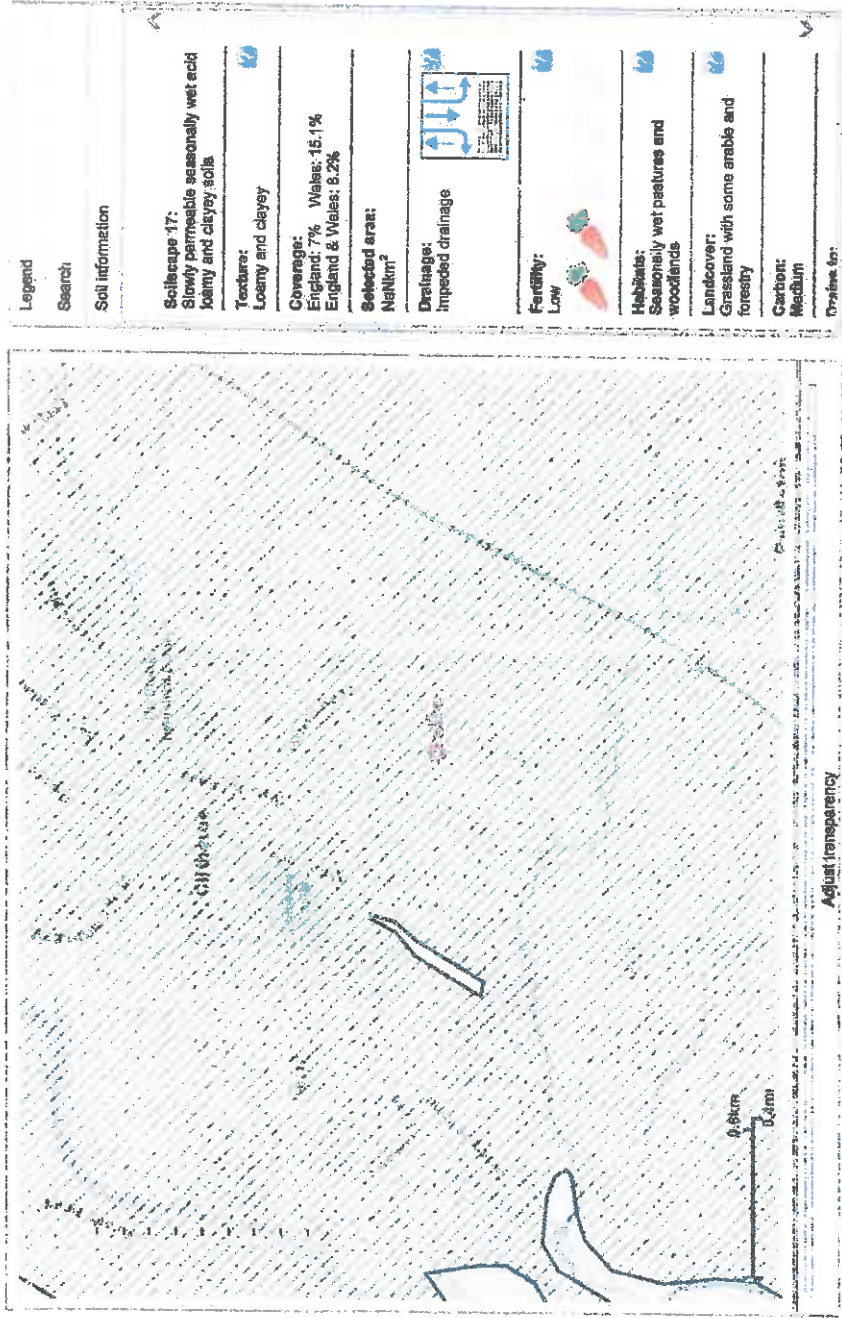


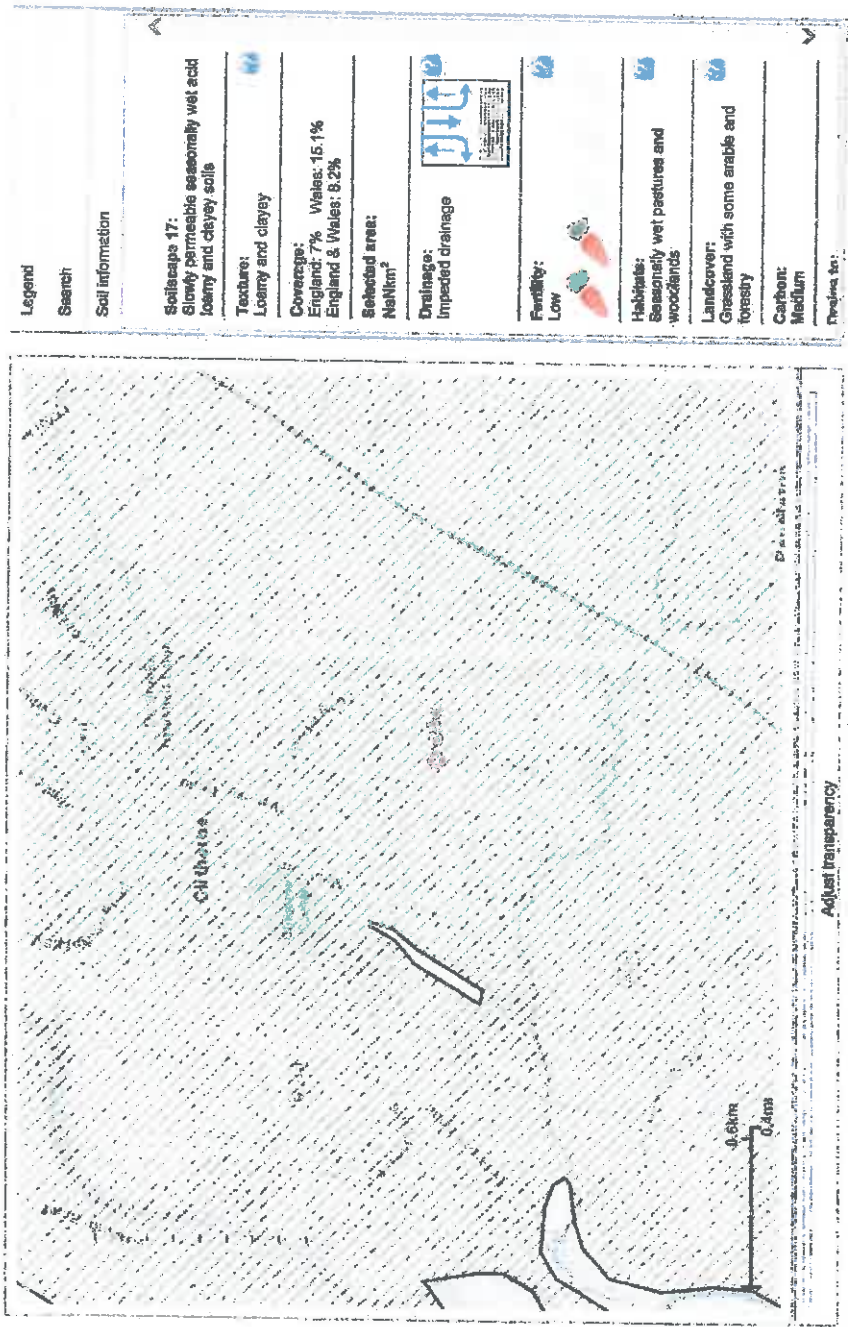












Proposed Site Layout 1:500

Key

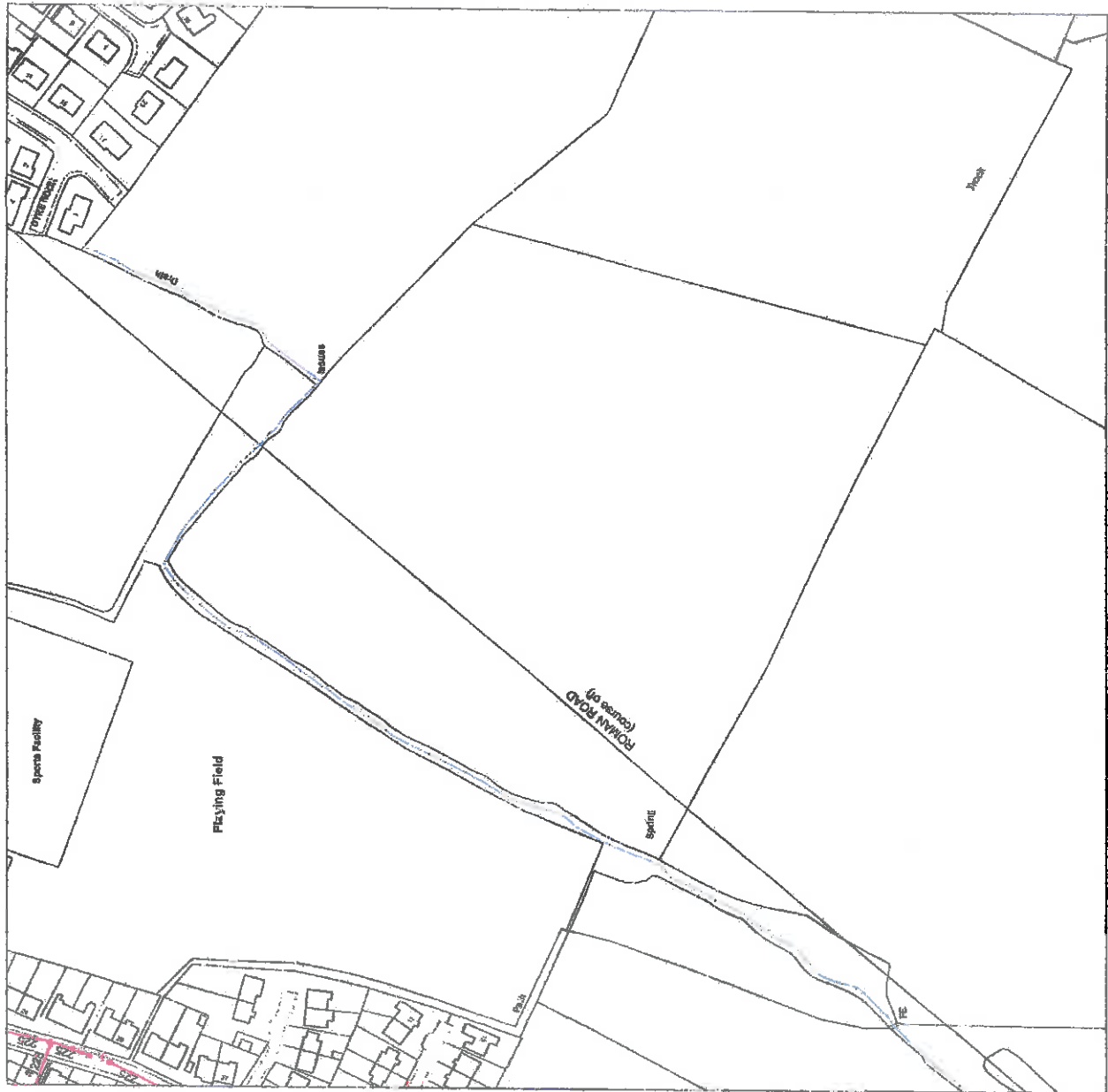
- 1.2m high boundary edge fence
- 1.2m high fence wall
- Boundary line to be retained
- Existing line to be removed



Applicability

Pool Park Avenue,
Clifton
Proposed Site Layout





1000
1200
1500
1800
2100
2400
2700
3000
3300
3600
3900
4200
4500
4800
5100
5400
5700
6000
6300
6600
6900
7200
7500
7800
8100
8400
8700
9000
9300
9600
9900
10200
10500
10800
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12000
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45900
46200
46500
46800
47100
47400
47700
48000
48300
48600
48900
49200
49500
49800
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