FORTEM

Civil Engineering Consultants Ltd

Proposed Residential Development Rowley Lane, Lepton

Flood Risk Assessment

April 2022

KCS Development Ltd

Report

This report consists of a Flood Risk Assessment and Drainage Strategy, produced to support the proposed residential development of the site located at Rowley Lane, Lepton. It has been produced by FORTEM Civil Engineering Consultants Ltd for KCS Development Ltd.

Revision History

Rev Ref	Date	Amendments	By	Chk'd
1	20.01.2021	First Issue	BS	ADC
2	06.02.2021	Updated with client comments	BS	ADC
3	03.04.2021	Updated in accordance with Kirklees Council consultation	BS	ADC
4	24.03.2022	Updated in accordance with revised layout	BS	ADC
5	29.04.2022	Updated in accordance with revised layout	BS	ADC

Contract

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Executive Summary

Site Description

The proposed development is located off Hermitage Park (Rowley Lane), Lepton. The site area is 5.39ha and the current use of the land is agricultural grassland.

There is a 100mm diameter combined water sewer crossing the site entrance and a 225mm diameter surface water and 300mm diameter combined water sewer located in Rowley Lane north-west of the site.

Two watercourses are located within the vicinity of the development. An unnamed watercourse on the north-eastern boundary and Beldon Brook approximately 300m south of the site boundary.

Proposed Development

It is proposed to construct 80 residential dwellings within the development boundary.

Flood Risk

Environment Agency Flood Mapping confirms the site is located in Flood Zone 1 with flood risk from all sources low.

In order to mitigate any potential overland flows from the east, a cut off swale is to be incorporated into the eastern boundary.

The following standard mitigation measures are recommended:

Finished floor levels for all new build properties are to be set minimum 150mm above external levels to mitigate any risk from blockage and exceedance events;

Drainage design blockage/exceedance events have been considered, ensuring the proposed development and surrounding areas are not put at risk from overland flows.

Drainage

Development surface water runoff is proposed to discharge to the open watercourse south of the development boundary (Beldon Brook).

The surface water discharge rate is to be limited to greenfield runoff (13.3l/s) and the surface water drainage designed such that there is no external flooding for the 1 in 30 year event and all flows retained on site for up to the 1 in 100 year + climate change event.

It is proposed to discharge the foul water flows from the development to the 300mm combined network in Rowley Lane. Due to the topography of the site a pumped discharge will be required for the southern part of the development.

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Appendix D	**Consultation**
	Kirklees Council LLFA Correspondence

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1. Introduction

1.1. Report Background

1.1.1. This report has been produced to support the planning application for the proposed residential development located off Hermitage Park (Rowley Lane), Lepton. It has been produced in accordance with the National Planning Policy Framework (NPPF) and guidance documents produced by Kirklees Council.

1.1.2. The study consists of data collection, consultation and review with regulatory bodies and third parties in relation to flood risk and drainage. FORTEM cannot guarantee the reliability of third party information and/or changes in consultee conclusions/responses.

1.2. Site Description

1.2.1. The site is located at Rowley Lane, Lepton, OS grid reference SE 19262 14731, see Appendix A for Development Location Plan. Details of the site are tabled below:

Site Area		6.13ha.
Topography		The site falls from north-east to south, with average gradients of 1 in 28, see appendix A for topographical survey.
Land Use		The proposed development site is currently agricultural grassland.
Boundaries	**North:**	Existing residential dwellings extending onto adoptable highway (Hermitage Park and Rowley Lane).
	South:	Dense woodlands (Lepton Great Wood).
	East:	Dense woodlands (Lepton Great Wood).
	West:	Existing residential dwellings and agricultural grassland.
Watercourses		Beldon Brook (ordinary watercourse) is located approximately 300m to the south of the proposed development. An unnamed open and culverted watercourse is located on the north-eastern boundary of the development. See Appendix A for drawing 1093-004C - Existing Drainage.
Public Sewers		Yorkshire Water record drawings confirm the existence of a 100mm diameter water sewer crossing the development site entrance and a 225mm diameter surface water and 300mm diameter combined water sewer in Rowley Lane, north-west of the site. See Appendix A for Yorkshire Water Records.
Other Drainage		Other than the watercourse covered above, there are no other known systems on or serving the site, however based upon the historic use of the site it is likely the fields are served by land drainage.
Ground		Geological and BGS records indicate that the strata of the area is CLAYS overlaying Mudstone. Anecdotal information indicates that rainfall infiltration into the ground is unlikely.

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1.3. Proposed Development

1.3.1. It is proposed to construct 80 No residential dwellings within the development, see Appendix B for the Niemen Architects Proposed Site Layout drawing 3284-0-002O.

1.3.2. The development land has been allocated for residential development through Kirklees Local Plan.

1.4. Consultation

1.4.1. Consultation with the relevant consultees has been undertaken, see summary below:

Consultee	Response Summary
Kirklees Council (KC)	KC Flood Risk Management team have been consulted as part of this report and have confirmed: • No records of flooding incidents on the site; • Their record drawings confirm an unnamed watercourse on the north-eastern boundary; • Due to ground conditions they accept infiltration drainage is not suitable for the development; • Development surface water discharge to Beldon Brook at a restricted rate of 13.3l/s is acceptable. See Appendix D for correspondence.
Yorkshire Water	Yorkshire Water Records have been received for the site and are included in Appendix A. Yorkshire Water were consulted as part of previous planning enquiries for the wider development regarding the proposed foul water discharge from the development. Yorkshire Water confirmed foul water should discharge to the 300mm combined sewer in Rowley Lane.

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2. Sources of Flood Risk

2.1. Summary

2.1.1. Below is a summary of the sources of flood risk and the potential risk associated to the proposed development:

Source	Risk Level	Notes
Fluvial/Tidal	Low	In accordance with the Environment Agency Flood Maps the site is located within Flood Zone 1.
Surface Water/Pluvial	Low	Environmental Agency maps confirm low risk of surface water flooding for the site. The open watercourse located on the north-eastern boundary is elevated to the proposed development, see Section 2.2 below.
Groundwater	Low	There are no known records of any historic groundwater flooding or risk.
Sewers	Low	Based upon searches undertaken, no historic incidents have been recorded within the vicinity of the proposed development.
Other Man-Made Sources	Low	The site is not in an area at risk from a major failure of a reservoir and there are no other known artificial sources of flood risk in the area.

Copies of the Environment Agency flood maps are included in Appendix C.

2.2. Surface Water/Pluvial

2.2.1. There is a part culverted/part open unnamed watercourse located outside of the proposed development on the north-eastern boundary, see drawing 1093-004C – Existing Drainage, Appendix A. Anecdotal information indicates this system only operates during sustained rainfall (no base flow) and existing topography confirms that in the event of a blockage and/or exceedance event, flows will follow existing topography, routing between Numbers 34b and 36a before discharging onto Rowley Lane.

2.2.2. The proposed development will not affect the existing watercourse and will not increase flood risk to the existing dwellings. As the watercourse is elevated to the site, it is recommended a cut off swale is incorporated on the eastern boundary of the site. This will mitigate any potential runoff from the wood or watercourse if the current arrangement were to be adjusted, with any runoff routed to Beldon Brook.

2.3. Development Mitigation

2.3.1. The following standard mitigation measures are recommended:

2.3.2. Finished floor levels for all new build properties are to be set minimum 150mm above external levels to mitigate any risk from blockage and exceedance events;

2.3.3. Blockage/exceedance events have been considered as part of the concept design confirming the proposed development and surrounding areas are not put at risk from overland flows, see Appendix B for drawing 1093-009 Exceedance Flow Routing;

2.3.4. The proposed development surface water drainage is to be designed such that there is no external flooding for the 1 in 30 year event and all flows retained on site for up to the 1 in 100 year plus climate change (30%) event.

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3. Development Drainage

3.1. Existing Site Drainage

3.1.1. As covered in section 1.2, Yorkshire Water record drawings confirm there is an existing 100mm diameter combined water sewer crossing the site entrance and a 225mm diameter surface water and 300mm diameter combined water sewer located in Rowley Lane, north-west of the site, see drawing 1093-004C – Existing Drainage, Appendix A.

3.1.2. There is an unnamed watercourse located outside of the proposed development site on the north-eastern boundary. The watercourse is elevated and does not receive any runoff from the site, see drawing 1093-004C – Existing Drainage, Appendix A.

3.1.3. Located approximately 300m to the south of the development is Beldon Brook. There is no evidence that the agricultural grassland has been served by a positive drainage system, however based upon the topography of the site the existing surface water runoff discharges south to Beldon Brook, see drawing 1093-004C – Existing Drainage, Appendix A.

3.1.4. The greenfield run-off for the site has been calculated using the IH124 method for 50Ha, with a resulting Q_{Bar} of 123.5l/s, which is equivalent to 2.47l/s/ha, see Appendix A for calculations. Therefore the existing greenfield runoff for the site is:

Development Area (Excluding BNG)	Greenfield Runoff Rate	Existing Greenfield Runoff
5.39ha	x 2.47l/s/ha	= **13.3l/s**

3.2. Development Surface Water Drainage

3.2.1. The potential surface water outfall/discharge options have been considered and summarised below:

Outfall/Discharge Option **(Ranked in order of Preference)**	✓/✗	**Notes**
1. Infiltration	✗	The existing strata consists of CLAYS overlaying Mudstone, which is unsuitable for the use of infiltration drainage.
2. Discharge to Watercourse	✓	Existing watercourse (Beldon Brook) located to the south of the proposed development. The discharge is in accordance with the existing runoff off from the farmland.
3. Discharge to Public Surface Water Sewer	✗/✓	Existing 225mm diameter surface water sewer located in Rowley Lane to the north-west of the proposed development. No historic discharge proven, no capacity in network and due to topography it is necessary to pump flows.
4. Discharge to Public Combined Sewer	✗	Existing 300mm diameter combined sewer located in Rowley Lane to the north-west of the proposed development. Discharge cannot be considered where watercourse and surface water sewer options are available.

3.2.2. Based upon the findings of the review above and in accordance with surface water drainage hierarchy, it is proposed to discharge the surface water from the proposed residential development to the existing open watercourse located south of the site (Beldon Brook), see drawing 1093-006C Proposed Drainage Strategy.

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3.2.3. Surface water discharge to Beldon Brook is to be restricted to the existing greenfield runoff of 13.3l/s.

3.2.4. The proposed development surface water drainage is to be designed such that there is no external flooding for the 1 in 30 year event and all flows retained on site for up to the 1 in 100 year + climate change event.

3.2.5. Based upon a discharge rate of 13.3l/s, the total attenuation required for the development is 1,192m^3 (1 in 100 + 30% c/c event), see Appendix B for attenuation calculations. The attenuation is to be split over two attenuation basins with two flow control devices, see Appendix B for drawing 1093-006C Proposed Drainage Strategy.

3.2.6. The development surface water discharge to Beldon Brook at a restricted flow rate of 13.3l/s has been agreed with Kirklees Council LLFA, see Appendix D for correspondence.

3.2.7. Blockage/exceedance events have been assessed for the proposed drainage design, see Appendix B for drawing 1093-009 Exceedance Flow Routing. The assessment confirms the proposed development and surrounding areas are not put at risk from overland flows.

3.3. Surface Water Treatment

3.3.1. Surface Water treatment is to be incorporated into the surface water detailed design and installation. The treatment of the surface water run-off to Beldon Brook has been considered in accordance with CIRIA SuDs Manual 2015 (Chapter 4 and 26) and the assessment is tabled below:

Pollution Hazard / Mitigation Indices for discharge to Beldon Brook			
Land Use/Treatment	**Total Suspended Solids (TSS)**	**Metals**	**Hydrocarbons**
Residential development general access road (minimum requirement)	0.5	0.4	0.4
Detention Basin	0.5	0.5	0.6
Total Mitigation	**0.5 ✓**	**0.5 ✓**	**0.6 ✓**

The above review confirms the proposed drainage for the development meets the necessary water quality requirements.

3.3.2. In accordance with the above assessment, runoff from the proposed development discharging to Beldon Brook is to be treated by the proposed detention basins, see drawing 1093-006C – Proposed Drainage Strategy, Appendix B. This is to be supplemented by the use of trapped gullies throughout the development.

3.4. Development Foul Water Drainage

3.4.1. It is proposed to discharge the foul water flows from the development to the existing 300mm combined sewer in Rowley Lane.

3.4.2. The northern part of the site will discharge via gravity, whilst due to the site topography the southern part requires a pumping station, see drawing 1093-006C Proposed Drainage Strategy, Appendix B.

3.5. Maintenance

3.5.1. It is proposed for both the foul and surface water drainage networks to be adopted by Yorkshire Water under a Section 104 agreement. Therefore the long term maintenance of the adoptable drainage system will be the responsibility of Yorkshire Water.

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4. Conclusion

4.1. Flood Risk

4.1.1. Environment Agency Flood Mapping confirms the site is located in Flood Zone 1, with all other forms of flood risk low.

4.1.2. In order to mitigate any potential overland flows from the steeply sloping land to the east and the unnamed watercourse to the north-east of the development, it is recommended for a cut off swale to be incorporated on the eastern boundary of the proposed development.

4.1.3. The following standard mitigation measures are recommended:

- Finished floor levels of all new build properties to be set 150mm above the surrounding ground levels;
- Blockage/exceedance events have been considered confirming the proposed development and surrounding areas are not put at risk from overland flows.

4.2. Drainage

4.2.1. Development surface water runoff is proposed to discharge to the open watercourse south of development boundary (Beldon Brook).

4.2.2. The surface water discharge rate is to be limited to greenfield runoff (13.3l/s) and the surface water drainage designed such that there is no external flooding for the 1 in 30 year event and all flows retained on site for up to the 1 in 100 year + climate change event.

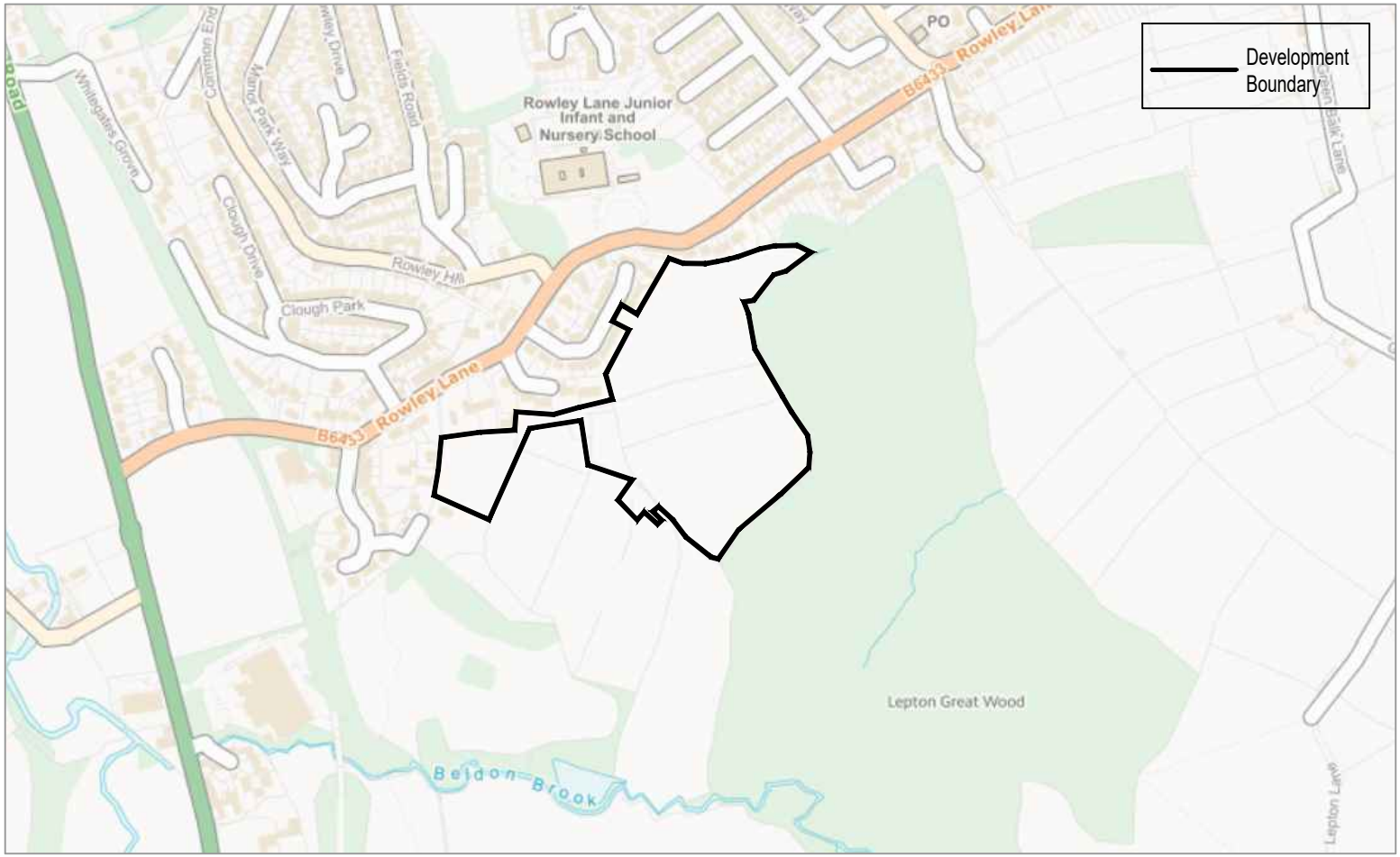
4.2.3. It is proposed to discharge the foul water flows from the development to the 300mm combined network in Rowley Lane. Due to topography a pumping station will be required for the southern part of the site.

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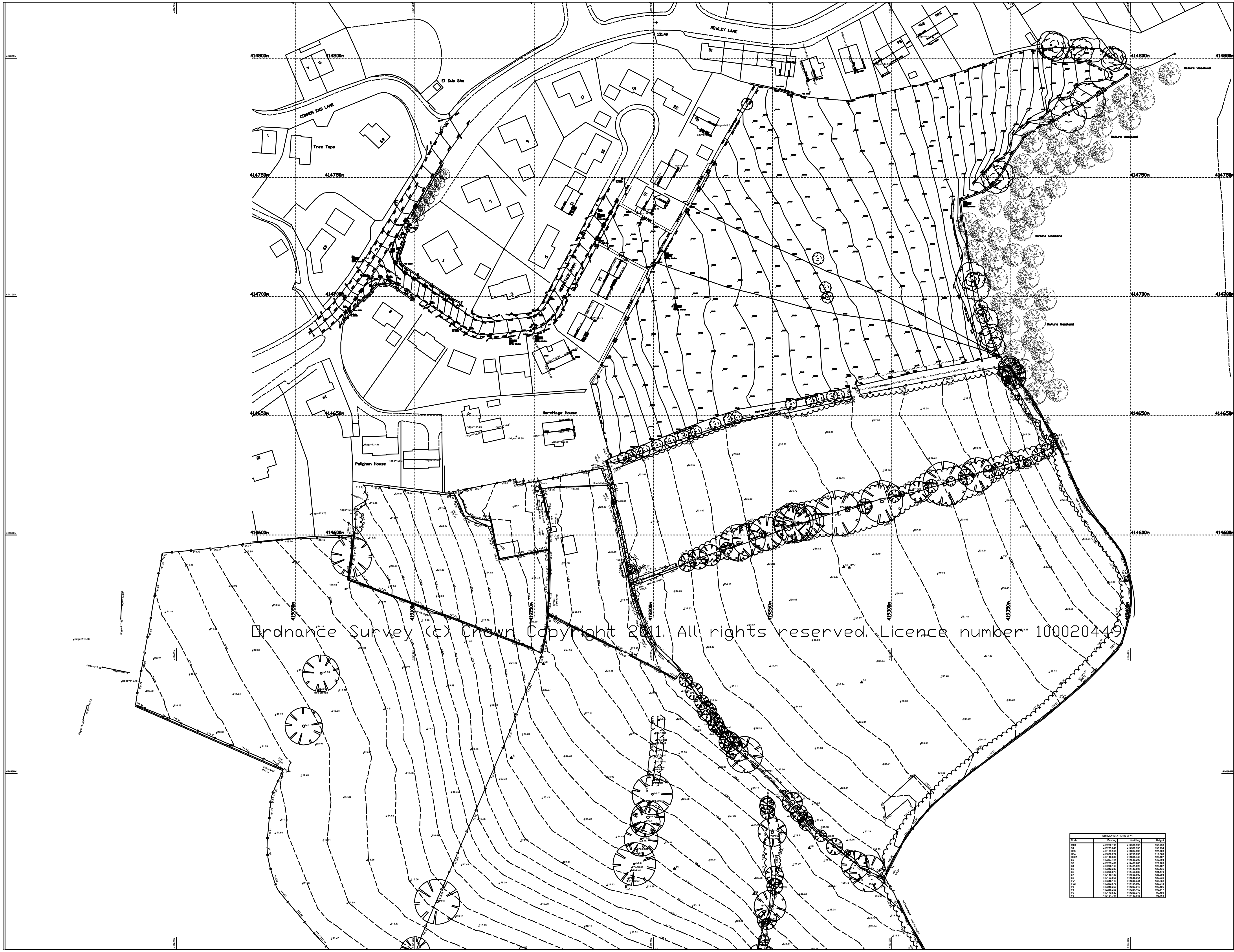
Appendix A **Existing Site**

Development Location Plan
Drawings sss-4806 Lepton Rev A – Topographical Survey
Yorkshire Water Sewer Records
Drawing 1093 – 004C – Existing Drainage
IH124 Calculation

FORTEM



ROWLEY LANE, LEPTON
DEVELOPMENT LOCATION PLAN
EXTRACT TAKEN 09.11.2020 : NTS



SURVEY STATIONS SF=1			
Code	Easting	Northing	Height
RTK	419282.190	414586.396	136.233
S1	419279.846	414586.593	136.134
H03	419139.956	414684.593	127.703
H04	419078.227	414715.235	119.560
H02A	419148.586	414685.743	128.407
S2	419287.411	414538.208	135.704
S3	419265.431	414468.685	129.709
S4	419296.169	414421.820	128.407
S5	419242.249	414449.507	126.135
S6	419208.878	414460.086	124.470
S7	419140.438	414506.602	123.394
S8	419153.865	414545.964	126.632
FV1	419346.119	414590.341	138.852
FV2	419282.675	414401.099	125.043
V3	419248.250	414297.913	106.196
V4	419216.258	414231.162	100.117
V5	419179.642	414206.275	96.491
V6	419161.701	414183.856	96.768

deciduous tree
defined by one point at centre & one point on spread
d=.5
trunk radius as drawn
(girth size and position +/- 50mm)
station
trial pit
conifer tree (defined as above)
gate
bush
borehole
window sample

- note heights / points / lines all same colour
- e.g. for channel, all crosses / lines / heights are magenta

56.24
spot level

bottom of batter / wood / ridge / timber face / gutter
top of batter
break line / discontinuity
wall (see text nearby for height / width / type)
retaining wall (see text nearby for height / width / type)
channel (all levels at channel unless noted)
kerb levels (shown parallel to channel -)
railway
drain / river / canal
overhead lines / buildings (not surveyed unless specified)
concrete / ramp
building / stone
face of cladding / flower bed
canopy
verge
fence (see text nearby for height / width / type) (panel / security / etc.)
columns / gridlines / conveyors / column face
brick
cycle lane / bus lane / white line (see text)
tanks / decking
hedge scaled to width
line may be as above, if just one edge
i.e. for level specific surveys both sides
measured not to show level change
(see text for type / height / width / etc)
path / window / door
track
contours 143 142.5
pipe line
bt cable
electric cable
gas
tarmac
footpath

can't lift - can't lift
cl=65.23
il=59.78

- only manholes found on site during survey marked
- other manholes may be present but covered
- all invert levels taken where possible at main channel
- all surveys to our specification based on RICS (see website)
- some surveying done with GPS - please contact us regarding accuracy

?	unknown cover
ac box	air conditioning box
av	air valve
bb	belisha beacon
bin	bin
bt	bt line
bt	bt manhole
bt	bt post
bt box	bt box
bm	OSBM
block	blocked manhole
bus shelter	bus shelter
cable	cable
can't lift	can't lift
ctv box	cable tv box
ctv	cable tv manhole
data mh	data manhole
dk	drop kerb
ds&g	down spout (with gulley)
dsr	recessed downspout
ds	building step back not surveyed
el. post	electric post
el.	electric
el. mh	electric manhole
el box	electric box
earth	earth strap/spike
f.hydr	fire hydrant
gas	gas
gas mh	gas man hole
gas box	gas box
gu=5.68	gulley top
guy	guy rope/stay
.5 dia	pipe diameter
light	light
lp	lamp post
lt	left turn arrow
peg	peg
phone box	phone box
post box	post box
pipe	pipe
planter	planter
post	post
rod. eye	rodding eye
rsj	steel rsj
rt	right turn
salt	salt box
security cam	security camera
seat	seat
si	sign - with indicative text
slab=3.19	slab (generally conc.)
st.tap	stop tap
str.	straight on
sv.	sluice valve
tactile paving	tactile paving
ts.	traffic signal
ts. mh	traffic signal manhole
ts.box	traffic signal box
trap	trap
utility	utility (unknown)
utility mh	utility manhole (unknown)
utility box	utility box (unknown)
water	water
water mh	water manhole
water box	water box
wo	wash out valve
tap	tap
parking meter	parking meter
cycle rack	cycle rack
cycle shelter	cycle shelter

STANDARD FENCE ABBREVIATIONS
b/w - barbed wire
c/l - chain link
cl/b - close boarded
c/i - corrugated iron
con/pan - concrete panel
cr/ba - crash barrier
h/r - hand rail
i/r - iron rail
pal - palisade
panel - panel
p/b - public barrier
pick - picket
p/r - post & rail
p/w - post & wire
sec. - security fence
wood - wooden fence

STANDARD ABBREVIATIONS
conc. - concrete
conc. boll. - concrete bollard
conc. wall - concrete wall
edg.cut grass - edge cut grass
el.sub st. - elec. substation
face conc. - face of concrete
face clad. - face of cladding
face tim. - face of timber
trel - trellis
hi pr. gas - high pressure gas
no ri. turn - no right turn
rough ground - rough ground
ret. wall - retaining wall
sur. drain - surface drain
ped. studs - pedestrian studs

cl=5.32 (manhole cover level)
dpc=56.45 (dpc level)
eav=34.29 (eaves level)
ffl=5.34 (finished floor level)
gu=34.29 (gulley level)
gutter=34.29 (gutter level)
hip=34.29 (hip level)
il=5.34 (invert level)
oh=5.34 (overhead level)
ramp=5.34 (ramp level)
rid=34.29 (ridge level)
silt l=5.34 (silt level)
sill=5.34 (sill level)
silt l=5.34 (silt level)
slab=5.34 (slab level)
top conc=5.34 (top of concrete)
tpi=60.67dia.15 (top of pipe)
t.st.=10.36 (top of step)
twl=56.72 (top of wall)
wal=56.19 (water level)
cfl=5.67 (cellar floor level)
.05level step (level step)

Location Plan
Sheet 2 of 2

Site Surveying Services - A.M.I.C.E.S.
70a Downham Road
Chatburn
Lancashire
BB7 4AU
Tel: 01200 438320
Fax: 07092376338
www.sitesurvey.co.uk
Land / Engineering Surveyors

Setting Out & Control Surveys
Topographic/Volumetric Surveys
GPS Specialists using also
GPS Post Process to tie any site
to OS without trig point or BM
Construction Line Registered
TSA member

construction line

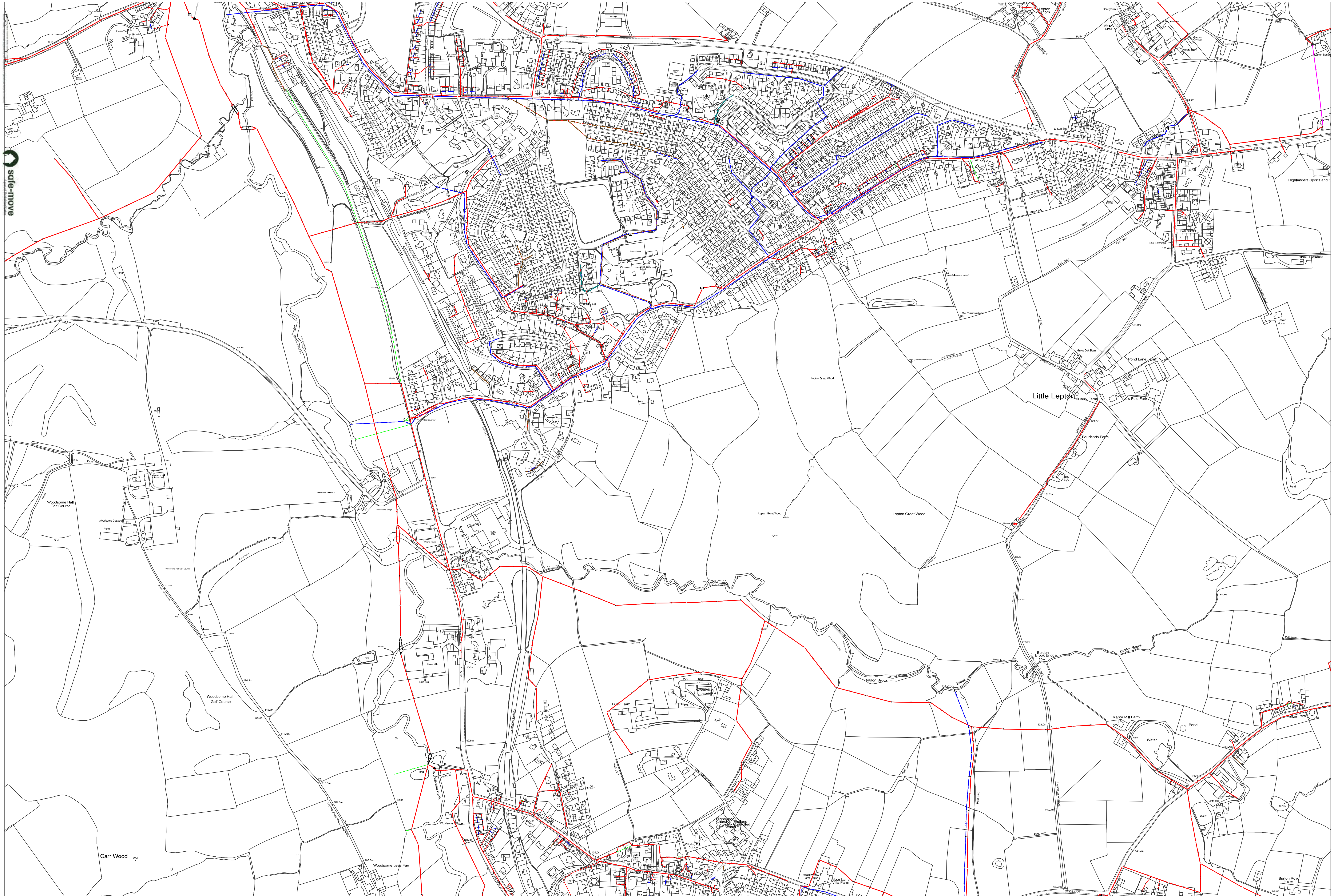
Client / Location: Redrow
Rowley Lane, Lepton (Kirklees)

All work to our standard terms & conditions (see website)

THE SURVEY ASSOCIATION

Additional Comments:
To local grid based on ostn02/osgm02 all work to sss specification, some by gps, contact us regarding details

Drawing Number:	sss-4806 Lepton	Revision:	A
Drawn By:	IV	Checked By:	HW
Date:	23/04/2013	Scale:	1:500 @ A0



418763 : 414197	Map Name : SE1713SE	Title	Partial Key
	Yorkshire Water, PO Box 500, Halifax Road, Bradford BD6 2LZ	Notes	Foul Sewer = F Combined Sewer = C Surface Water Sewer = SW Trade Sewer = TD Partially Separate = PS
	Contact Name : Ms H Webster		
	Contact Tel :		

This plan is furnished as a general guide only and no warranty as to its correctness is given or implied. This plan must not be relied upon in the event of excavations or other works made in the vicinity of public sewers. No house or property connections are shown.

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Date Req : 01/03/2016, 12:18:27
Date Gen : 01/03/2016, 12:18:31
Source : Sewer Network Enquiry

UPN: Undefined Originator: H Webster, Safe Move,

N

NOTES:

1. THIS DRAWING IS BASED UPON NIEMEN ARCHITECTS PROPOSED SITE LAYOUT DRAWING 3284-0-002 O, YORKSHIRE WATER RECORD DRAWINGS, SITE WALKOVER DATED 09.03.21. KIRKLEES COUNCIL DRAINAGE RECORDS AND ORDNANCE SURVEY MAPS.

KEY:

- DEVELOPMENT BOUNDARY
- EXISTING PUBLIC COMBINED SEWER
- EXISTING PUBLIC FOUL SEWER
- EXISTING PUBLIC SURFACE WATER SEWER
- EXISTING OPEN WATERCOURSE - BELDON BROOK (ORDINARY WATERCOURSE)
- EXISTING CULVERTED WATERCOURSE
- EXISTING OPEN WATERCOURSE (ORDINARY WATERCOURSE)

INLET MANHOLE TO CULVERTED SECTION

UNNAMED WATERCOURSE

ROWLEY LANE

HERMITAGE PARK

BELDON BROOK

EXISTING 225Ø
EXISTING 300Ø
EXISTING 150Ø
EXISTING 100Ø
EXISTING 375Ø

Rev	Date	Amendments	By
C	29.04.22	Updated to suit revised layout	BS
B	24.03.22	Updated to suit revised layout	BS
A	23.03.21	Updated to suit Kirklees CC comments received 15.02.21 and site walkover 09.03.21	BS

Drawing Status.
INFORMATION

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Client
KCS DEVELOPMENT LIMITED

Project
ROWLEY LANE, LEPTON

Drawing Title.
EXISTING DRAINAGE

Drawn: BS
Checked: ADC
Scale: 1:1000 @ A1
Date: JAN 2021

Drawing No. 1093 - 004
Rev. C

C:\Users\peter\FORTEM Civil Engineering Consultants Ltd\Andrew Calvert - FORTEM Projects\1093 - Rowley Lane, Lepton KCS\2. Drawings\1. FORTEM\2. Drawings\1. Current\1093 - 004 Existing Drainage Network.dwg 29 Apr, 2022 - 3:34pm

IH 124 Mean Annual Flood

Input

Return Period (years)	1	Soil	0.300
Area (ha)	50.000	Urban	0.000
SAAR (mm)	908	Region Number	Region 3

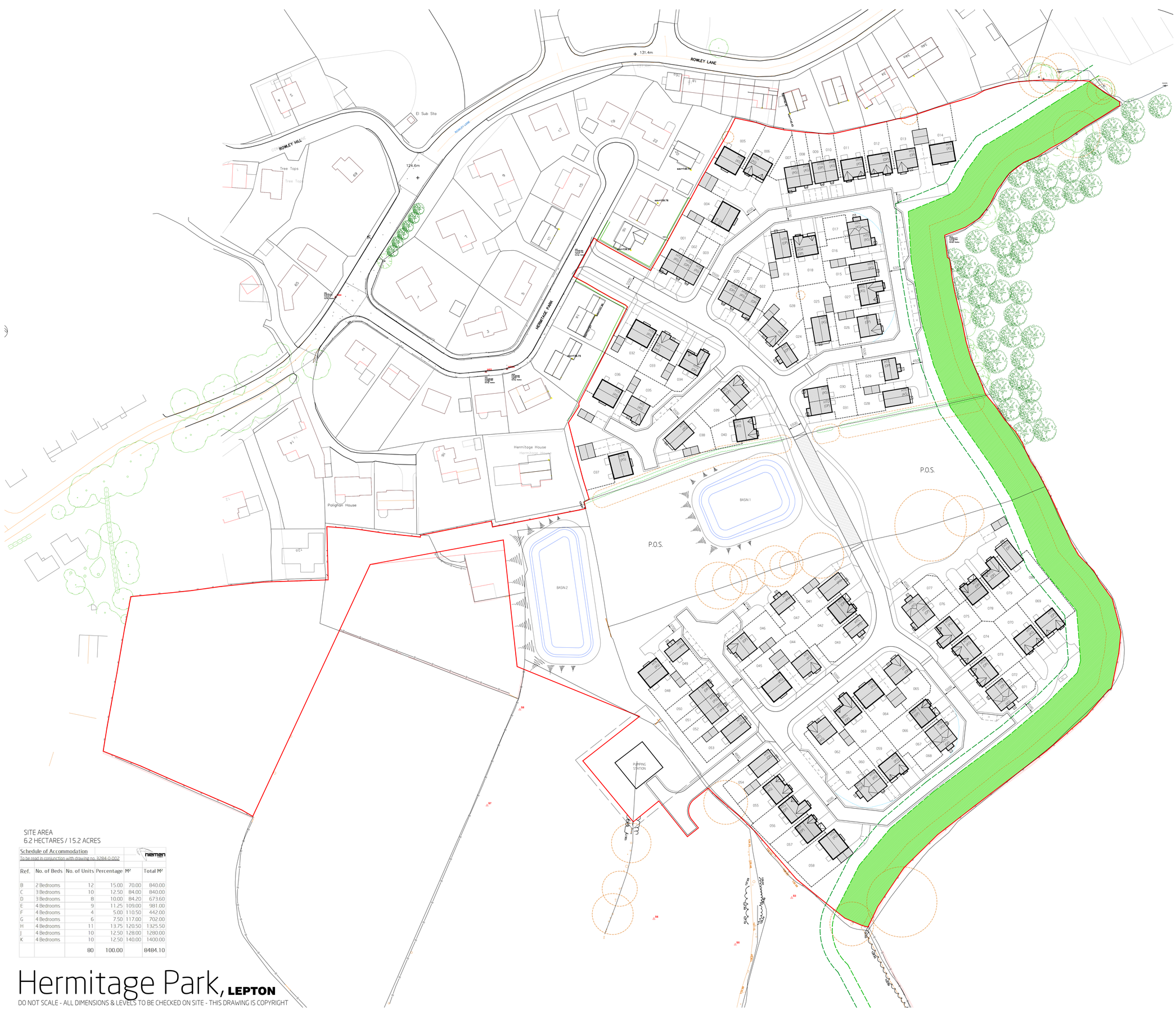
Results l/s

QBAR Rural	123.5
QBAR Urban	123.5
Q1 year	106.2
Q1 year	106.2
Q2 years	116.6
Q5 years	154.4
Q10 years	179.1
Q20 years	202.9
Q25 years	210.8
Q30 years	217.2
Q50 years	234.0
Q100 years	257.0
Q200 years	291.6
Q250 years	302.7
Q1000 years	375.6

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Appendix B **Proposed Development**

Drawing 3284-0-002 Rev O – Proposed Site Layout
Drawing 1093 – 006C - Proposed Drainage Strategy
Drawing 1093 – 009 – Exceedance Flow Routing
Attenuation Calculations



N

S

KEY:

- ANCIENT WOODLAND 15m OFFSET TO ROADS / PATHS
- ANCIENT WOODLAND 20m OFFSET TO BUILDINGS
- ANCIENT WOODLAND SEMI NATURAL BUFFER
- ROOT PROTECTION ZONE
- FORWARD VISIBILITY SPLAYS

SITE AREA
6.2 HECTARES / 15.2 ACRES

Schedule of Accommodation

To be read in conjunction with drawing no. 3284-0-002

Ref.	No. of Beds	No. of Units	Percentage	M²	Total M²
B	2 Bedrooms	12	15.00	70.00	840.00
C	3 Bedrooms	10	12.50	84.00	840.00
D	3 Bedrooms	8	10.00	84.20	673.60
E	4 Bedrooms	9	11.25	109.00	981.00
F	4 Bedrooms	4	5.00	110.50	442.00
G	4 Bedrooms	6	7.50	117.00	702.00
H	4 Bedrooms	11	13.75	120.50	1325.50
J	4 Bedrooms	10	12.50	128.00	1280.00
K	4 Bedrooms	10	12.50	140.00	1400.00
		80	100.00		8484.10

Hermitage Park, LEPTON

DO NOT SCALE - ALL DIMENSIONS & LEVELS TO BE CHECKED ON SITE - THIS DRAWING IS COPYRIGHT

revision	date	content	initials
O	06.04.22	RED LINE BOUNDARY REVISED AS PART OF BNG QUALIFICATION	ED
N	24.03.22	LAYOUT ADJUSTED IN LINE WITH ENGINEERS ADJUSTMENTS AND ARCHITECTS ADJUSTMENTS.	JB
M	22.02.22	HT DRAWINGS REVISED TO SHOW PATIOS TO REAR DOORS	ED
L	22.09.21	GARAGES TO PLOTS 41&54 REMOVED FROM RPA	ED
K	13.09.21	KERB RADII TO HERMITAGE RD REVISED TO TIE INTO EXISTING KERBLINE	ED
J	08.09.21	VIS SPLAY TO PLOTS 26 & 17 REVISED.	ED
I	06.09.21	CENTRELINE RADIUS ADJ PLOT 43. VISIBILITY SPLAYS INCORPORATED WITHIN PROPOSED ADOPTED HIGHWAY LIMIT	ED
H	31.08.21	LAYOUT REVISED IN LINE WITH HIGHWAYS ENGINEERS COMMENTS	ED
G	10.08.21	REVISED SITE LAYOUT	SM
F	02.11.20	ROOT PROTECTION ZONES ADDED AND SITE LAYOUT UPDATED TO SUIT	SN
E	23.10.20	TURNING HEADS IN FRONT OF PLOTS 58-61 & 70-72 UPDATED	SN
D	20.10.20	ANCIENT WOODLAND BUFFER, SUDS BASINS & PUMPING STATION ADDED, SITE LAYOUT AMENDED TO SUIT	SN
C	15.07.20	HIGHWAY UPDATES	SN
B	10.07.20	APARTMENTS ADDED & SITE UPDATED TO SUIT	SN
A	19.06.20	SHARED SURFACES UPDATED	SN

SKETCH
subject to structural review
subject to accurate measured survey

project: PROPOSED RESIDENTIAL HERMITAGE PARK LEPTON, HUDDERSFIELD

client: KCS DEVELOPMENTS

title: PROPOSED SITE LAYOUT

date: 17.06.20 | scale: 1:500 @ A0 | drawn: SN

drawing number: 3284-0-002 O | checked:

niemen architects
Niemen Architects
Deck 2 The Waterscape
42 Leeds & Bradford Road
Kirkstall Leeds LS5 3EG
Tel: 0113 239 5400
Fax: 0113 239 5401
office@niemen.co.uk
www.niemen.co.uk

N

NOTES:

1. THIS DRAWING IS BASED ON UPON:
   - NIEMEN ARCHITECTS PROPOSED SITE LAYOUT DRAWING 3284-0-002-O;
   - HOLDEN SURVEYS LTD SITE PLAN PPL_09_LEPTON;
   - SITE SURVEYING SERVICES TOPOGRAPHICAL SURVEY SSS-4806 LEPTON-A;
   - LAND REGISTRY TITLE PLAN WYK84238;
   - LAND REGISTRY TITLE PLAN WYK76804;
   - KIRKLEES COUNCIL DRAINAGE RECORDS; AND,
   - ORDNANCE SURVEY MAPS.
2. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE FORTEM FLOOD RISK ASSESSMENT R002-V5.

KEY:

- DEVELOPMENT BOUNDARY
- EXISTING PUBLIC COMBINED SEWER
- EXISTING PUBLIC FOUL SEWER
- EXISTING PUBLIC SURFACE WATER SEWER
- EXISTING OPEN WATERCOURSE - BELDON BROOK (ORDINARY WATERCOURSE)
- EXISTING CULVERTED WATERCOURSE
- EXISTING OPEN WATERCOURSE (ORDINARY WATERCOURSE)
- PROPOSED SURFACE WATER SEWER / MANHOLE
- PROPOSED FOUL WATER SEWER / MANHOLE
- PROPOSED FOUL WATER RISING MAIN
- PROPOSED COMBINED WATER MANHOLE
- PROPOSED EASEMENT (SEWER NETWORK LOCATED OUTSIDE ADOPTABLE HIGHWAY)
- BOUNDARY CUT-OFF SWALE

EXISTING 225Ø
EXISTING 300Ø
EXISTING 1500
EXISTING 375Ø
EXISTING 450Ø
EXISTING 1000
EXISTING 150Ø
EXISTING 225Ø
ROWLEY LANE
HERMITAGE PARK
UNNAMED WATERCOURSE
PROPOSED FOUL WATER DISCHARGE TO EXISTING 300Ø COMBINED WATER SEWER IN ROWLEY LANE
PUMPED FOUL WATER FLOWS DISCHARGE TO ADOPTABLE GRAVITY SYSTEM
FLOW CONTROL 1 MANHOLE
SURFACE WATER ATTENUATION POND 1
SURFACE WATER ATTENUATION POND 2
P.O.S.
PROPOSED FOUL WATER PUMPING STATION
FLOW CONTROL 2 MANHOLE RESTRICTED IN ACCORDANCE WITH FORTEM FRA
BELDON BROOK
SURFACE WATER TO DISCHARGE TO BELDON BROOK

Rev	Date	Amendments	By
C	29.04.22	Updated to suit revised layout	BS
B	24.03.22	Updated to suit revised layout	BS
A	30.03.21	Eastern boundary bund added and minor updates	BS

Drawing Status.
PLANNING

FORTEM

FORTEM Civil Engineering Consultants Ltd
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Client
KCS DEVELOPMENT LTD

Project
ROWLEY LANE, LEPTON

Drawing Title.
PROPOSED DRAINAGE STRATEGY

Drawn: BS
Checked: ADC
Scale: 1:1000 @ A1
Date: JAN 2021

Drawing No. 1093 - 006
Rev. C

C:\Users\peter\FORTEM Civil Engineering Consultants Ltd\Andrew Calvert - FORTEM Projects\1093 - Rowley Lane, Lepton KCS\2. Drawings\1. FORTEM\2. Drawings\1. Current\1093 - 006 Proposed Drainage Strategy.dwg 29 Apr, 2022 - 3:38pm

N

NOTES:

1. THIS DRAWING IS BASED ON UPON NEIMEN ARCHITECTS PROPOSED SITE LAYOUT DRAWING 3284-0-002-O, TURNBULL SURVEYING TOPOGRAPHICAL SURVEY S1158, YORKSHIRE WATER SEWER RECORDS AND ORDINANCE SURVEY MAPS.
2. THIS DRAWING PROVIDES AN OVERVIEW OF THE DEVELOPMENT DRAINAGE NETWORK AND PROPOSED TOPOGRAPHY IN RELATION TO EXCEEDANCE EVENTS ARISING FROM EXTREME RAINFALL.

KEY:

- PROPOSED SURFACE WATER SEWER / MANHOLE
- PROPOSED FOUL WATER SEWER / MANHOLE
- PROPOSED FOUL WATER RISING MAIN
- BOUNDARY CUT-OFF SWALE
- FLOW ROUTE MAPPING
- FLOW ROUTE MAPPING INTO PRIVATE DRAINAGE SYSTEM
- PROPOSED SW PLOT DRAINAGE

BLOCKAGE FLOW ROUTE NOTE
IN THE EVENT OF A BLOCKAGE DOWNSTREAM OF THE MANHOLE ADJACENT TO PLOT 033, WATER WILL OVERTOP THE GULLY AT THE SITE ENTRANCE, WATER WILL ENTER THE EXISTING DRAINAGE NETWORK IN HERMITAGE PARK ROAD.

BLOCKAGE FLOW ROUTE NOTE
IN THE EVENT OF A BLOCKAGE WITHIN THE HIGHWAY LOOP, SURFACE WATER FLOWS WILL BE CONTAINED WITHIN THE HIGHWAY UNTIL REJOINING THE ADOPTABLE NETWORK.

BLOCKAGE FLOW ROUTE NOTE
IN THE EVENT OF A BLOCKAGE DOWNSTREAM OF THE MANHOLE ADJACENT TO PLOT 024, WATER WILL OVERTOP THE GULLY IN THE ROAD, WATER WILL ENTER THE ADOPTABLE DRAINAGE NETWORK OF MANHOLE ADJACENT TO PLOT 028.

BLOCKAGE FLOW ROUTE NOTE
IN THE EVENT OF A BLOCKAGE UPSTREAM OF MANHOLE IN P.O.S., WATER WILL OVERTOP THE GULLY AT THE LOW POINT AT THE END OF THE ROAD, WATER WILL ENTER THE PRIVATE DRAINAGE NETWORK FOR PLOT 037. AND WILL RE-ENTER THE ADOPTABLE NETWORK DOWNSTREAM OF THE BLOCKAGE (AS INDICATED).

BLOCKAGE FLOW ROUTE NOTE
IN THE EVENT OF A BLOCKAGE UPSTREAM OF THE FLOW CONTROL MANHOLE, WATER WILL OVERTOP THE MANHOLE AND WILL ENTER BASIN 2 VIA OVERLAND FLOW.

BLOCKAGE FLOW ROUTE NOTE
IN THE EVENT OF A BLOCKAGE IN THE SURFACE WATER SYSTEM, WATER WILL OVERTOP THE GULLY AT THE END OF ROAD, AND WATER WILL REJOIN THE NETWORK AT BASIN 2 VIA OVERLAND FLOW.

BLOCKAGE FLOW ROUTE NOTE
IN THE EVENT OF A BLOCKAGE WITHIN THE HIGHWAY LOOP, SURFACE WATER FLOWS WILL BE CONTAINED WITHIN THE HIGHWAY UNTIL REJOINING THE ADOPTABLE NETWORK.

BLOCKAGE FLOW ROUTE NOTE
IN THE EVENT OF A BLOCKAGE DOWNSTREAM OF THE SURFACE WATER SEWER ADJACENT TO PLOT 054, WATER WILL OVERTOP THE GULLY AT THE END OF THE TURNING HEAD AND WILL ENTER THE WATERCOURSE VIA OVERLAND FLOWS.

EXCEEDANCE FLOW ROUTING NOTES:

THE PROPOSED SURFACE WATER DRAINAGE SYSTEM HAS BEEN DESIGNED TO ENSURE NO FLOODING UP TO AND INCLUDING 1 IN 100 YEAR + 30% CLIMATE CHANGE, WITH 10% ALLOWANCE FOR URBAN CREEP.

BEYOND THIS EXTREME EVENT, ANY EXCESS WATER WILL OVERTOP BASIN 2 WITH OVERLAND FLOWS ONTO THE ADJACENT FIELD, MIMICKING EXISTING FLOWS.

THIS WOULD POSE NO INCREASED RISK TO THE EXISTING OR PROPOSED DWELLINGS.

Rev	Date	Amendments	By

Drawing Status.
PLANNING

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Client
KCS DEVELOPMENT LTD

Project
ROWLEY LANE, LEPTON

Drawing Title.
EXCEEDANCE FLOW ROUTING

Drawn: JOH
Checked: AC
Scale: 1:1000 @ A1
Date: APR 2022

Drawing No.
1093 - 009

Rev.
-

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Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	102.351	0.351	13.3	418.2	O K
30 min Summer	102.469	0.469	13.3	559.0	O K
60 min Summer	102.594	0.594	13.3	708.1	O K
120 min Summer	102.718	0.718	13.3	856.2	O K
180 min Summer	102.782	0.782	13.3	932.0	O K
240 min Summer	102.818	0.818	13.3	974.8	O K
360 min Summer	102.856	0.856	13.3	1019.8	O K
480 min Summer	102.871	0.871	13.3	1037.8	O K
600 min Summer	102.872	0.872	13.3	1039.6	O K
720 min Summer	102.868	0.868	13.3	1034.6	O K
960 min Summer	102.856	0.856	13.3	1020.6	O K
1440 min Summer	102.822	0.822	13.3	979.9	O K
2160 min Summer	102.760	0.760	13.3	906.1	O K
2880 min Summer	102.691	0.691	13.3	823.3	O K
4320 min Summer	102.550	0.550	13.3	655.4	O K
5760 min Summer	102.435	0.435	13.3	519.0	O K
7200 min Summer	102.345	0.345	13.3	410.7	O K
8640 min Summer	102.278	0.278	13.3	331.0	O K
10080 min Summer	102.230	0.230	13.1	274.3	O K
15 min Winter	102.394	0.394	13.3	469.6	O K
30 min Winter	102.527	0.527	13.3	628.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	115.731	0.0	403.8	26
30 min Summer	77.804	0.0	547.1	41
60 min Summer	49.937	0.0	728.9	70
120 min Summer	30.956	0.0	905.2	128
180 min Summer	23.058	0.0	1011.8	188
240 min Summer	18.577	0.0	1086.9	246
360 min Summer	13.656	0.0	1198.1	364
480 min Summer	10.974	0.0	1282.9	482
600 min Summer	9.254	0.0	1351.2	598
720 min Summer	8.046	0.0	1408.5	648
960 min Summer	6.447	0.0	1500.9	768
1440 min Summer	4.709	0.0	1629.3	1030
2160 min Summer	3.432	0.0	1828.9	1452
2880 min Summer	2.739	0.0	1945.0	1856
4320 min Summer	1.989	0.0	2113.6	2604
5760 min Summer	1.583	0.0	2257.0	3344
7200 min Summer	1.325	0.0	2360.5	4040
8640 min Summer	1.147	0.0	2449.2	4680
10080 min Summer	1.015	0.0	2523.3	5352
15 min Winter	115.731	0.0	454.0	26
30 min Winter	77.804	0.0	613.6	40

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Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	102.669	0.669	13.3	797.0	O K
120 min Winter	102.810	0.810	13.3	965.0	O K
180 min Winter	102.882	0.882	13.3	1051.7	O K
240 min Winter	102.925	0.925	13.3	1102.0	O K
360 min Winter	102.971	0.971	13.3	1157.8	O K
480 min Winter	102.993	0.993	13.3	1183.7	O K
600 min Winter	103.000	1.000	13.3	1191.8	O K
720 min Winter	102.997	0.997	13.3	1189.0	O K
960 min Winter	102.977	0.977	13.3	1165.0	O K
1440 min Winter	102.933	0.933	13.3	1111.9	O K
2160 min Winter	102.845	0.845	13.3	1007.1	O K
2880 min Winter	102.747	0.747	13.3	890.3	O K
4320 min Winter	102.526	0.526	13.3	627.3	O K
5760 min Winter	102.359	0.359	13.3	428.1	O K
7200 min Winter	102.247	0.247	13.2	294.8	O K
8640 min Winter	102.185	0.185	12.7	220.6	O K
10080 min Winter	102.163	0.163	11.6	194.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	49.937	0.0	817.3	70
120 min Winter	30.956	0.0	1014.4	126
180 min Winter	23.058	0.0	1133.5	184
240 min Winter	18.577	0.0	1217.5	242
360 min Winter	13.656	0.0	1341.6	356
480 min Winter	10.974	0.0	1436.0	470
600 min Winter	9.254	0.0	1511.9	580
720 min Winter	8.046	0.0	1575.2	688
960 min Winter	6.447	0.0	1676.2	872
1440 min Winter	4.709	0.0	1808.3	1100
2160 min Winter	3.432	0.0	2048.9	1564
2880 min Winter	2.739	0.0	2178.8	2024
4320 min Winter	1.989	0.0	2369.4	2776
5760 min Winter	1.583	0.0	2528.5	3464
7200 min Winter	1.325	0.0	2644.6	4104
8640 min Winter	1.147	0.0	2744.5	4600
10080 min Winter	1.015	0.0	2829.0	5248

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 1.985

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.662	4	8	0.662	8	12	0.662

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Model Details

Storage is Online Cover Level (m) 104.000

Tank or Pond Structure

Invert Level (m) 102.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1192.0	1.000	1192.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0166-1330-1000-1330
Design Head (m)	1.000
Design Flow (l/s)	13.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	166
Invert Level (m)	102.000
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	13.3
Flush-Flo™	0.315	13.3
Kick-Flo®	0.694	11.2
Mean Flow over Head Range	-	11.3

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	5.9	1.200	14.5	3.000	22.4	7.000	33.7
0.200	12.8	1.400	15.6	3.500	24.2	7.500	34.9
0.300	13.3	1.600	16.6	4.000	25.8	8.000	36.0
0.400	13.2	1.800	17.6	4.500	27.3	8.500	37.0
0.500	12.9	2.000	18.5	5.000	28.7	9.000	38.1
0.600	12.4	2.200	19.3	5.500	30.0	9.500	39.1
0.800	12.0	2.400	20.2	6.000	31.3		
1.000	13.3	2.600	20.9	6.500	32.5		

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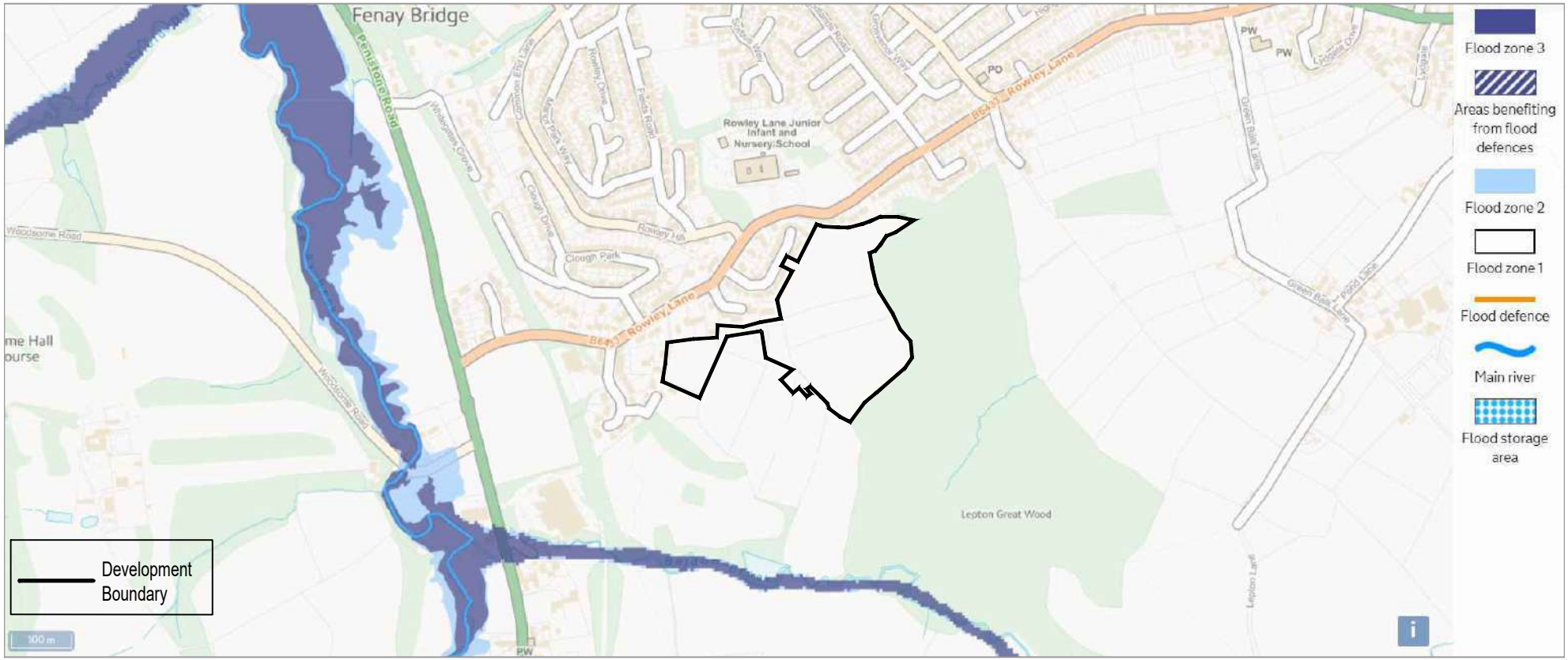
Appendix C **Flood Risk Mapping**

EA Flood Risk from Rivers and Sea

EA Map Risk of Flooding from Surface Water

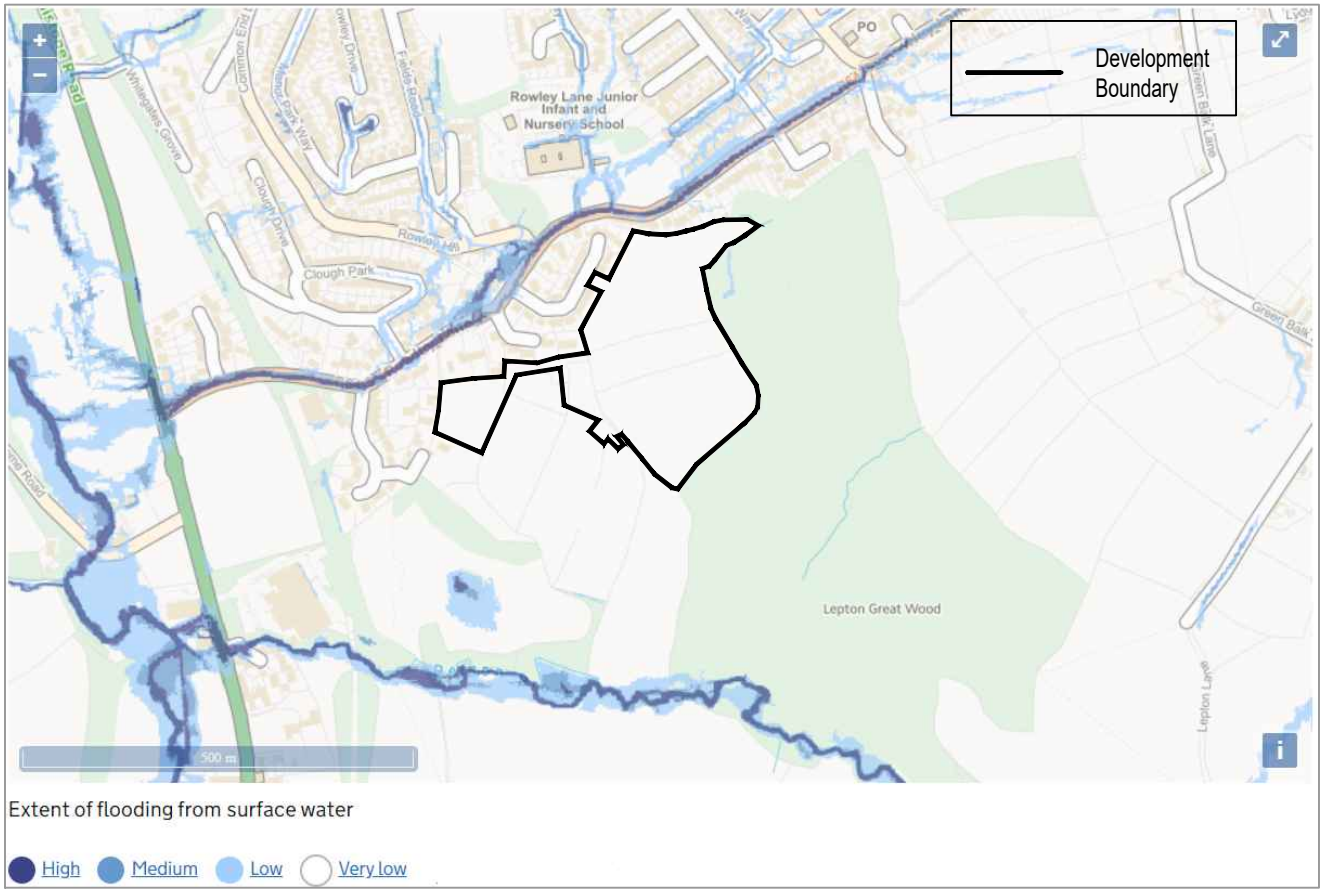
EA Map Risk of Flooding from Reservoir

FORTEM



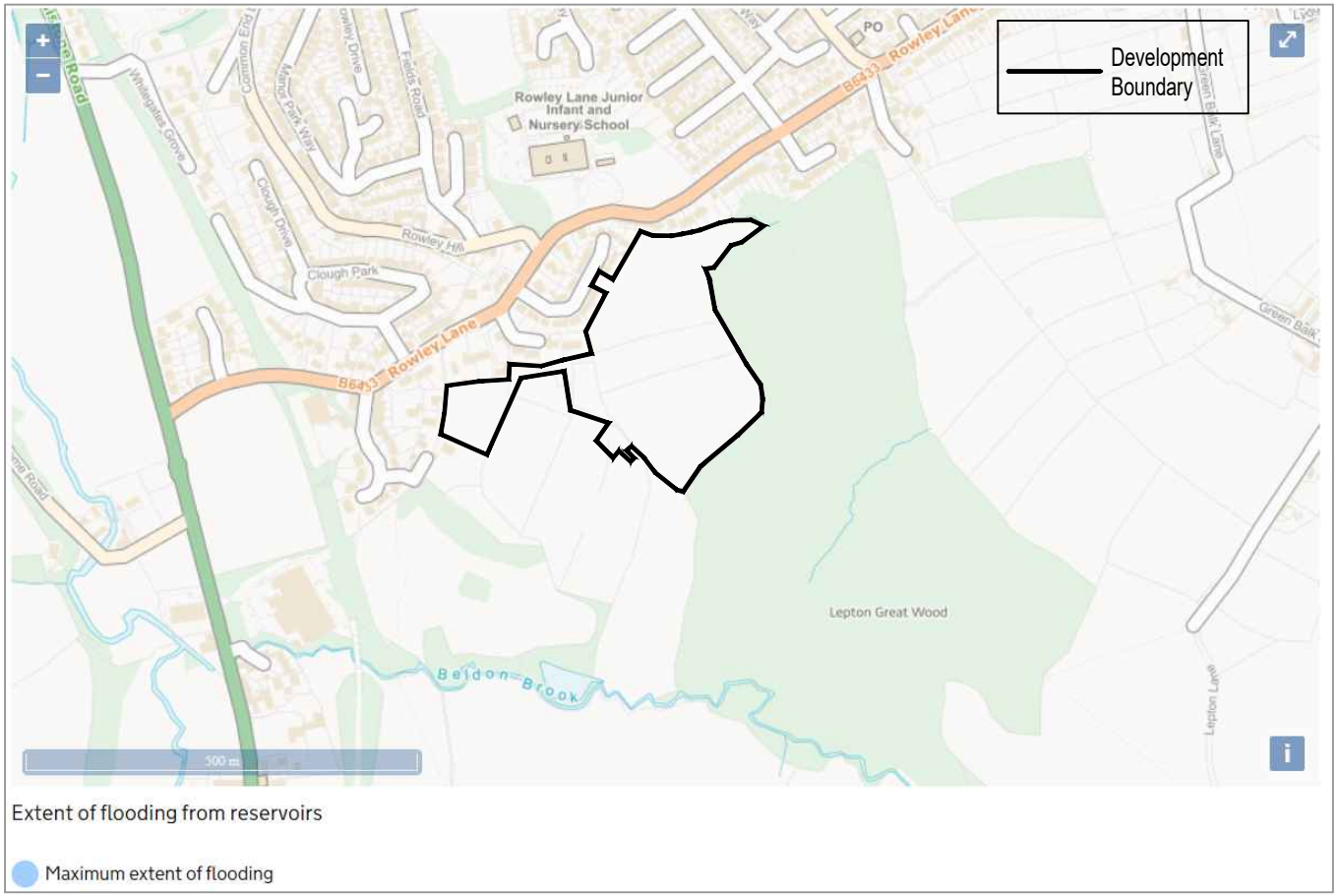
ROWLEY LANE, LEPTON
EXTRACT FROM ENVIRONMENT AGENCY MAPPING (GOV.UK)
FLOOD RISK FROM RIVERS AND SEA
EXTRACT TAKEN 09.11.2020 : NTS

FORTEM



ROWLEY LANE, LEPTON
EXTRACT FROM ENVIRONMENT AGENCY MAPPING (GOV.UK)
RISK FROM FLOODING FROM SURFACE WATER
EXTRACT TAKEN 09.11.2020 : NTS

FORTEM



ROWLEY LANE, LEPTON
EXTRACT FROM ENVIRONMENT AGENCY MAPPING (GOV.UK)
RISK FROM FLOODING FROM RESERVOIR
EXTRACT TAKEN 09.11.2020 : NTS

Appendix D **Consultation**

Kirklees Council LLFA Correspondence

Beth Scully

From: Paul Farndale <Paul.Farndale@kirklees.gov.uk>
Sent: 15 February 2021 09:51
To: Andrew Calvert <andrew.calvert@fortemconsultants.co.uk>
Cc: Customer Enquiries <Customer.Enquiries@kirklees.gov.uk>
Subject: RE: 210206KCC_Rowley Lane, Lepton

Hello Andy,

No flooding incidents recorded but this is unlikely to be reported for undeveloped land. No surface water flood risk shown on relevant mapping.

Please note the minor watercourse in the north east corner that has a trash screen on it prior to being culverted. Please run a total blockage scenario in a flood risk assessment to show where water would go and see what is affected on site.

We show the culvert then going north but old plans suggest the northern boundary for the site might be the original line. You will need to verify this.

Lastly plans right up to 1970 show a wall at the southern border. Please check.

Happy with 13.3l/s to Beldon Brook. Using a 5l/s/ha for a site that measures around 5.3ha @ 50% hardstanding is pretty much the same figure. BGS shows severe constraints for infiltration.

As with any application you need to examine possibilities for water treatment associated with SUDS conduits that can be adopted.

You will need to look at any other allocations around with a view to having a drainage strategy that incorporates master planning. Please talk to the LPA on this matter.

Any queries please give me a call.

Kind regards,

Paul Farndale
Kirklees LLFA