

Proposed Residential Development Rowley Lane, Lepton

Flood Risk Assessment

February 2023

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
6	07.09.2022	Updated in accordance with revised layout, site visit and consultation with Kirklees Council	ML	ADC
7	07.10.2022	Updated in accordance with Kirklees Council consultation	ML	ADC
8	22.02.2023	Updated in accordance with revised layout	ML	RD

Contract

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Executive Summary

Site Description

The proposed development is located off Hermitage Park (Rowley Lane), Lepton. The site area is 6.13ha 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 parcel. This forms Phase 2 of the wider HS2/HS3 allocation, in accordance with the full allocation masterplan.

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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	Drawing 1093 – 010- - North-Eastern Boundary Watercourse
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	Drawing 338-P-007 Rev D - Phasing Plan (HS2/HS3 Masterplan)
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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 drawings 1093-004D - Existing Drainage and 1093-010- North-Eastern Boundary Watercourse.
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		Based upon the intrusive site investigation works, a small section of land drainage is evident on site. This system has historically been investigated by Kirklees Council due to localised flooding of the field. Dartmouth Estates undertook a repair to the land drain which rectified the problem. The historic use of the site it is likely the fields are served by an extensive land drainage system.
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.

1.3. Proposed Development

- 1.3.1. It is proposed to construct 80 No residential dwellings within the development boundary, see Appendix B for the Niemen Architects Proposed Site Layout drawing 3284-0-002 Rev DD.
- 1.3.2. This outline application is part of the wider HS2/HS3 allocation and is Phase 2 in accordance with the allocation masterplan, see Appendix B for the Urban Wilderness Phasing Plan 338-P-007 Rev D.

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. • Flood Risk and drainage for the HS2/HS3 full allocation will be addressed for each phase in accordance with the masterplan. 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.

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 drawings 1093-004D - Existing Drainage and 1093-010- - North-Eastern Boundary Watercourse, Appendix A. Anecdotal information indicates this system only operates during sustained rainfall (no base flow). The existing topography and site visit (31.08.2022) has confirmed that in the event of a blockage and/or exceedance event, overland flows will follow existing topography, routing between Numbers 34b and 36a before discharging onto Rowley Lane.
- 2.2.2. Based upon site visits in 2020 and 2021, there has been evidence that the watercourse has been blocked by works to divert flows onto and over the proposed development site. our site visit on 31.08.2022 confirmed that these changes to the watercourse have been removed, with the normal operation and failure arrangement returned in accordance with 2.2.1. Based upon the potential for future works to be undertaken to the watercourse which could increase flood risk, it is necessary to consider additional mitigation to ensure there is no potential for increased flood risk to the development or existing drainage systems.
- 2.2.3. The information gathered from site and surveys confirms that flows associated within the watercourse will not affect the proposed development (flows maintained off site) and the development will not increase off site flood risk (no discharge to watercourse from development). As the wood on the eastern boundary is elevated to the site, and to provide mitigation in the event the watercourse is modified increasing flood risk to the development, it is proposed that a cut off swale is incorporated on the eastern boundary of the site. This will mitigate any runoff from the wood, with flows routed to Beldon Brook see Appendix B for drawing 1093-006F - Proposed Drainage Strategy.

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 1093-009D - 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.

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 1093-004D - 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 1093-004D - 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 1093-004D - Existing Drainage, Appendix A.
- 3.1.4. As part of the intrusive site investigation, a short length of land drainage has been identified in the northeast corner of the site (approx. 0.4m below ground level). Based upon the historic use of the site, it is anticipated that land drainage will be present. All existing land drainage will be removed as part of the site preparation works with positive drainage to serve the development.
- 3.1.5. 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	= <u>13.3l/s</u>

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 1093-006F - Proposed Drainage Strategy.
- 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 1,192m³ (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 1093-006F - Proposed Drainage Strategy.
- 3.2.6. The Microdrainage calculations are preliminary only to ensure sufficient space is provided within the site for the 2no. basins. A level check has been undertaken to verify the design with more detail to be provided at Reserved Matters submission.
- 3.2.7. 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.
- 3.2.8. Blockage/exceedance events have been assessed for the proposed drainage design, see Appendix B for drawing 1093-009D - 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
Online 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 1093-006F – 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 1093-006F - 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.

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 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.

Appendix A Existing Site

Development Location Plan

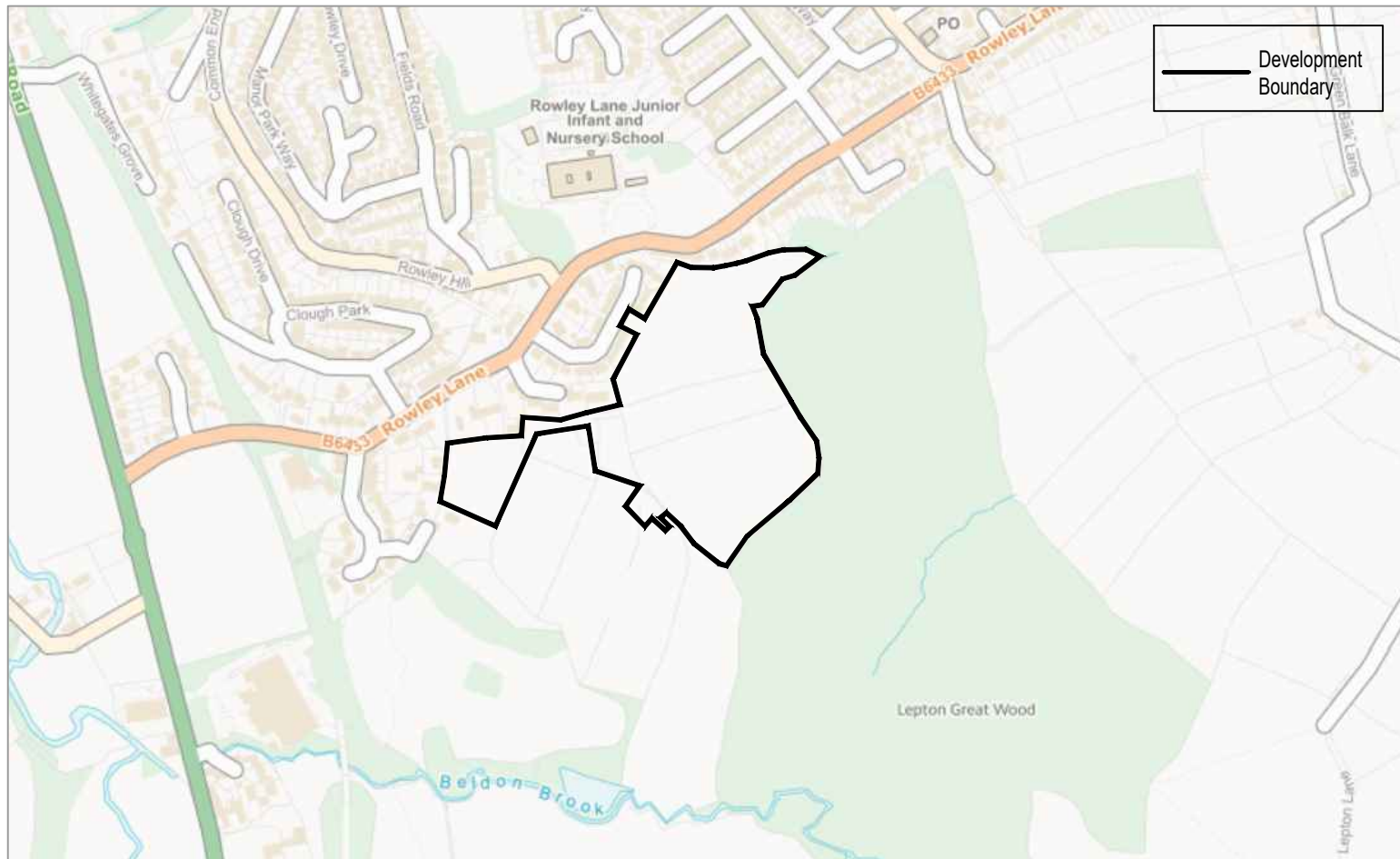
Drawings SSS-4806 Lepton Rev A - Topographical Survey

Yorkshire Water Sewer Records

Drawing 1093-004D - Existing Drainage

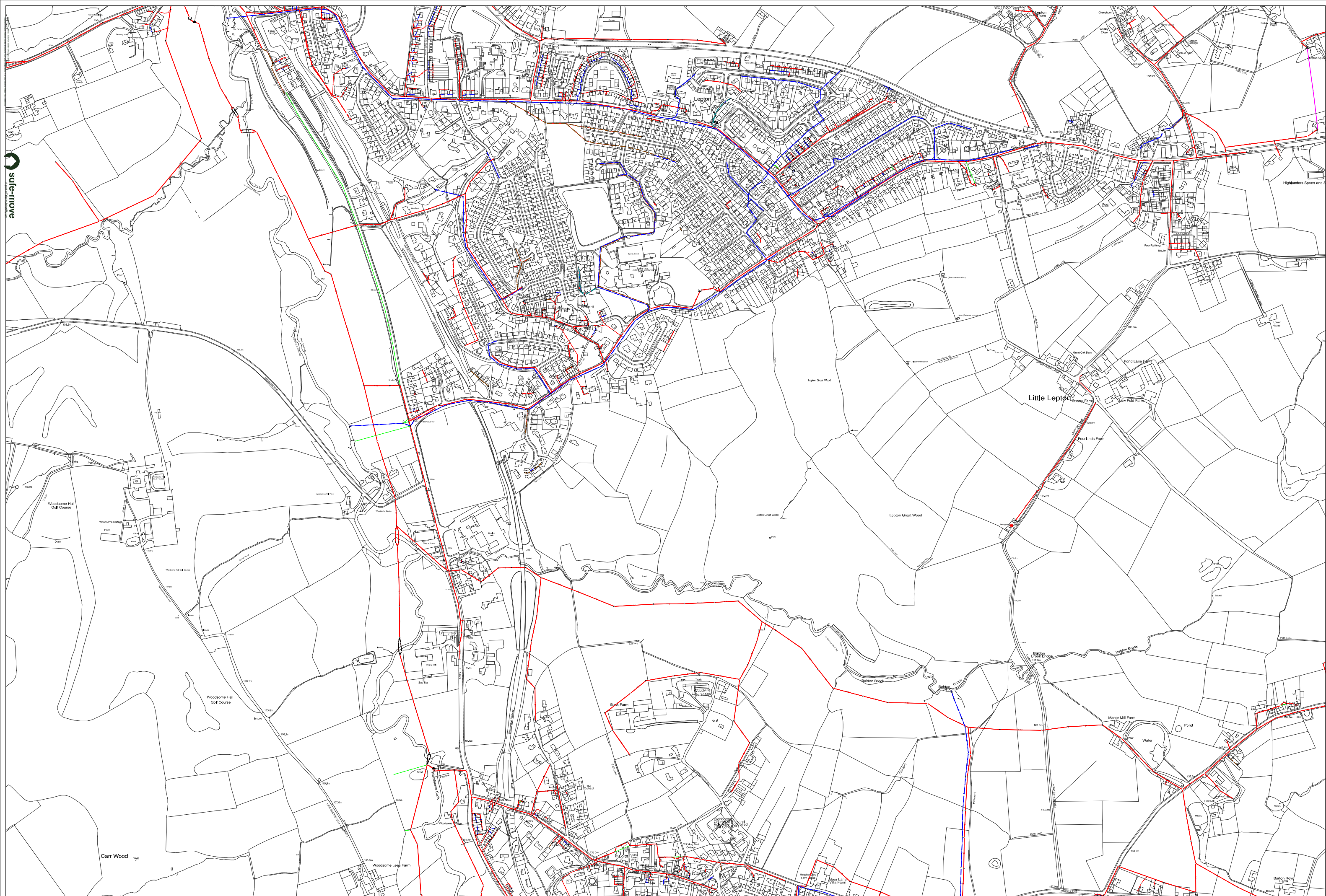
Drawing 1093-010- - North-Eastern Boundary Watercourse

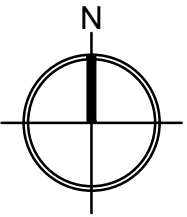
IH124 Calculation



ROWLEY LANE, LEPTON DEVELOPMENT LOCATION PLAN

EXTRACT TAKEN 09.11.2020 : NTS



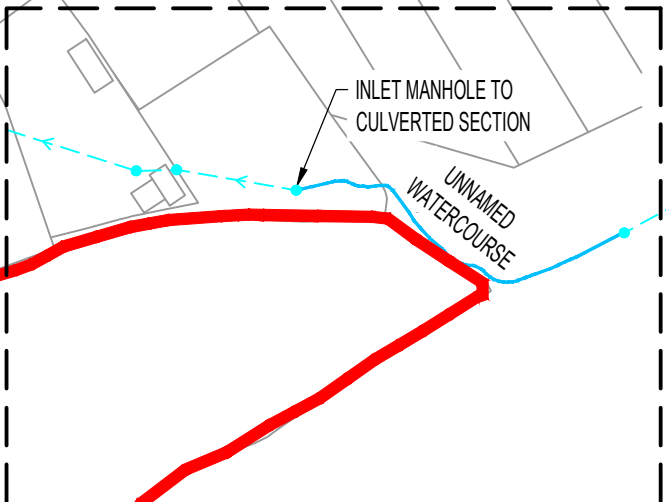


NOTES:

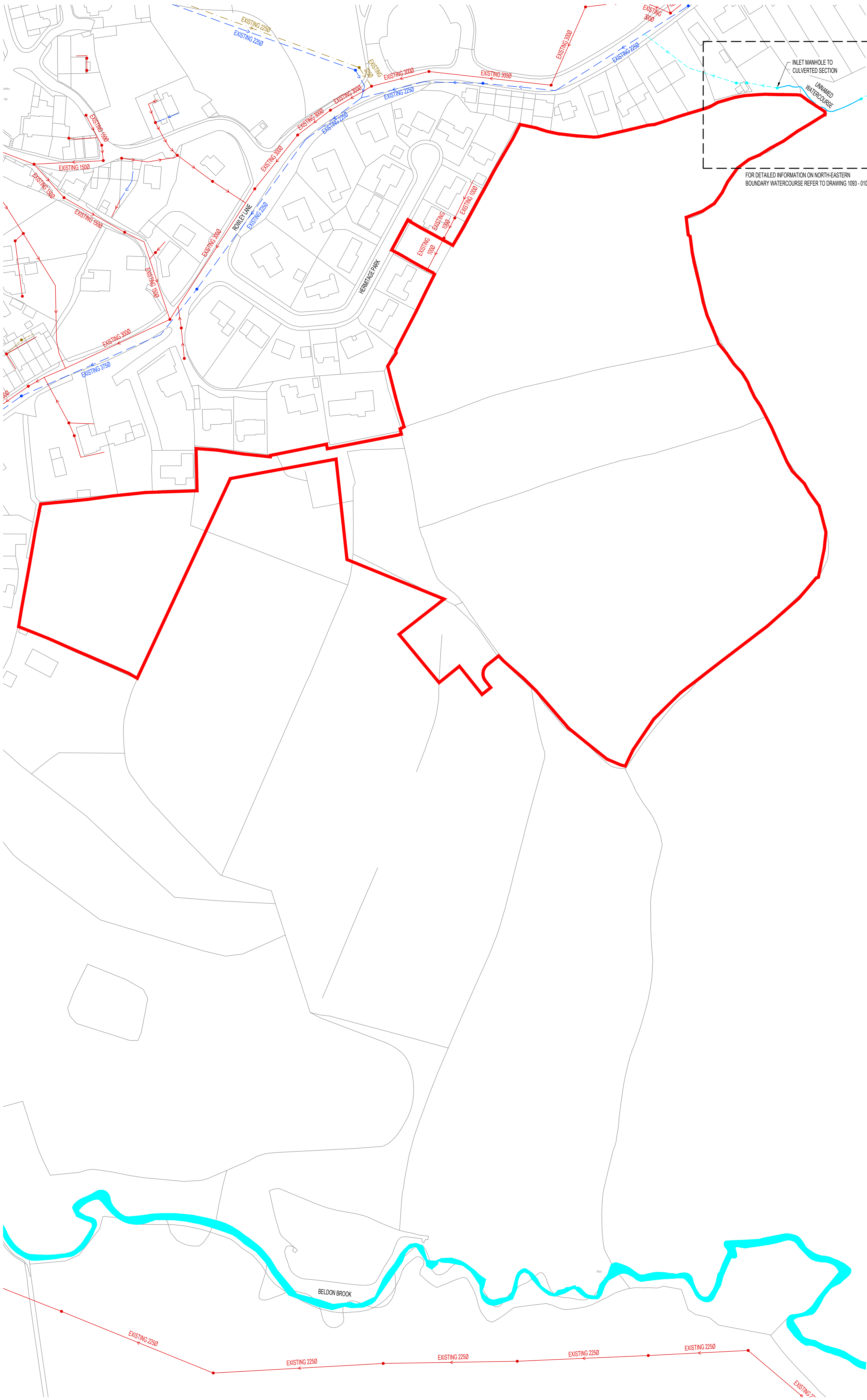
1. THIS DRAWING IS BASED UPON NIEMEN ARCHITECTS PROPOSED SITE LAYOUT DRAWING 3284-0-002 REV S, YORKSHIRE WATER RECORD DRAWINGS, SITE WALKOVER DATED 09.03.21, KIRKLEES COUNCIL DRAINAGE RECORDS AND ORDNANCE SURVEY MAPS.

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)



FOR DETAILED INFORMATION ON NORTH-EASTERN BOUNDARY WATERCOURSE REFER TO DRAWING 1093 - 010



D	07.09.22	Existing drainage updated in accordance with site visit.	JOH
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

Rev	Date	Amendments	By
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Drawing Status.

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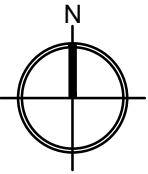
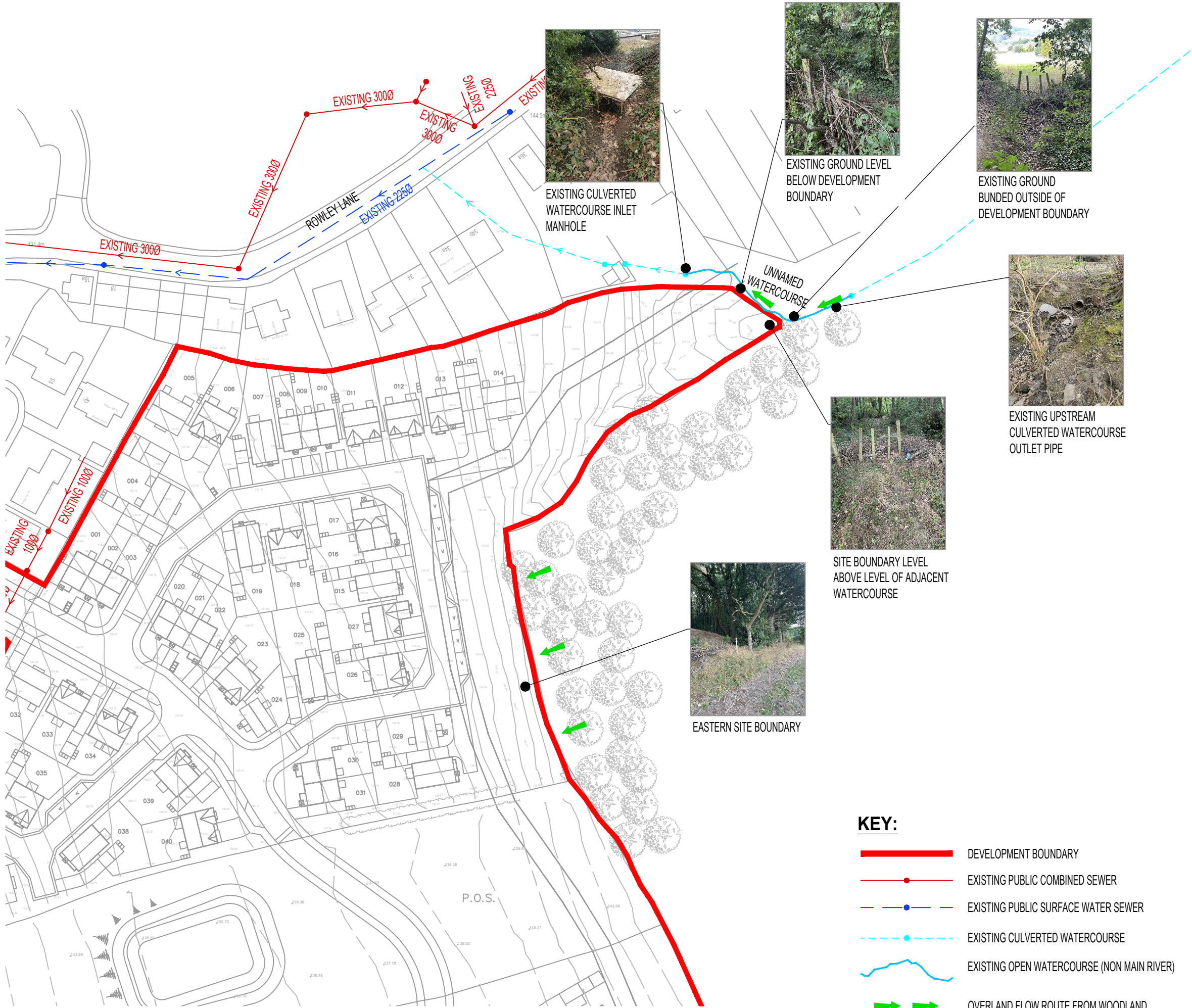
Project
ROWLEY LANE, LEPTON

Drawing Title.
EXISTING DRAINAGE

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

Drawing No.
1093 - 004
Rev.
D

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NOTES:

1. THIS DRAWING IS BASED ON UPON:
- NIEMEN ARCHITECTS PROPOSED SITE LAYOUT DRAWING 3284-0-002 REV S;
 - 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;
 - YORKSHIRE WATER SEWER RECORDS;
 - SITE WALKOVER DATED 31.08.22;
 - KIRKLEES COUNCIL DRAINAGE RECORDS; AND,
 - ORDNANCE SURVEY MAPS.

Rev	Date	Amendments	By
Drawing Status.			
INFORMATION			
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Client			
KCS DEVELOPMENT LIMITED			
Project			
ROWLEY LANE, LEPTON			
Drawing Title.			
EXISTING NORTH-EASTERN BOUNDARY WATERCOURSE			
Drawn:	ML	Scale:	1:1000 @ A3
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1093 - 010			-

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XP Solutions		Source Control 2017.1.2
<u>IH 124 Mean Annual Flood</u> 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

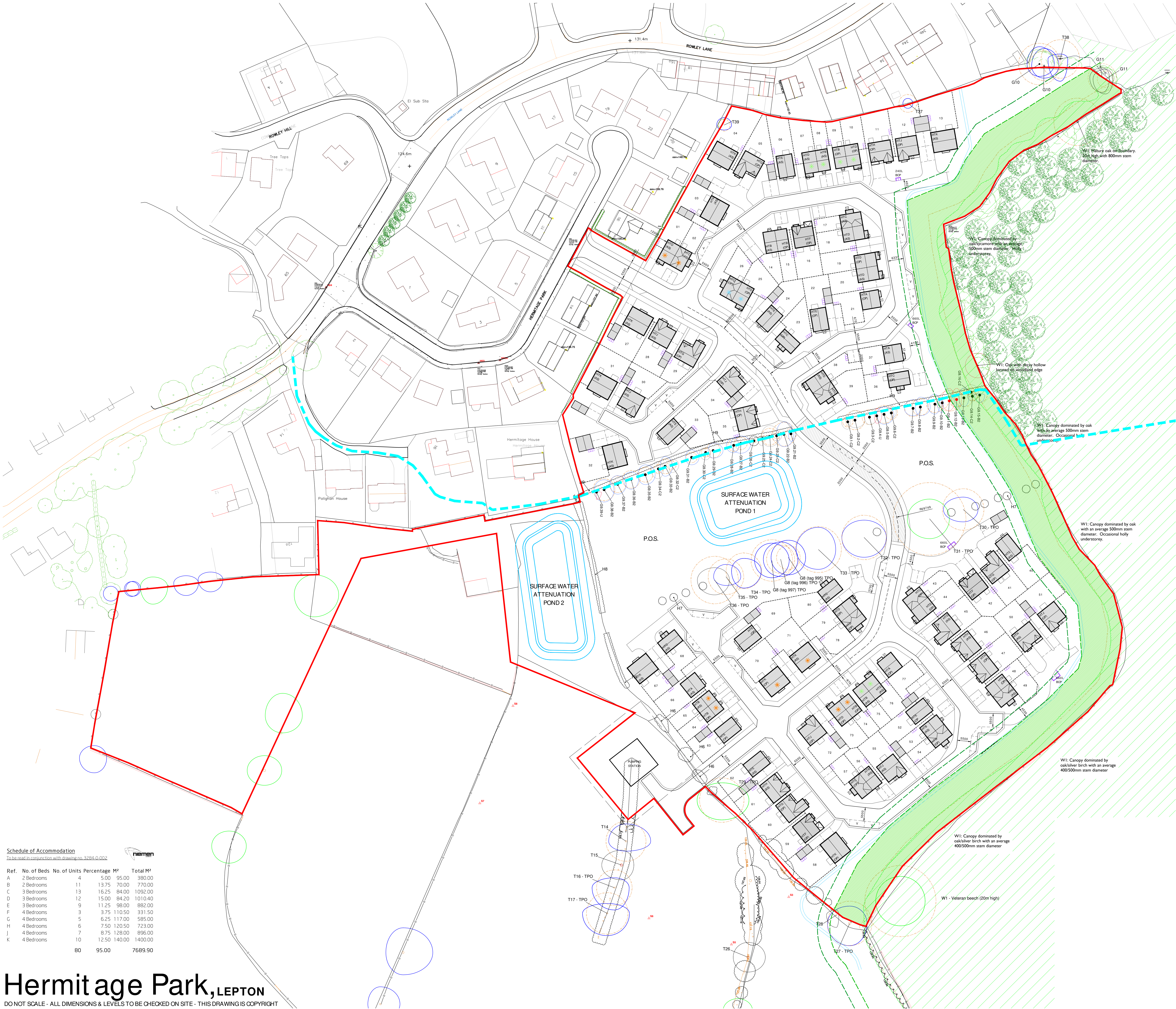
Drawing 3284-0-002 Rev DD - Proposed Site Layout

Drawing 338-P-007 Rev D - Phasing Plan

Drawing 1093-006F - Proposed Drainage Strategy

Drawing 1093-009D - Exceedance Flow Routing

Attenuation Calculations



- LEGEND
- ANCIENT WOODLAND 15m OFFSET TO ROADS/ PATHS
 - ANCIENT WOODLAND 50m OFFSET TO BUILDINGS
 - ANCIENT WOODLAND SEM NATURAL BUFFER
 - CLAIMED PUBLIC RIGHT OF WAY
 - EXISTING PUBLIC RIGHT OF WAY
 - 240V+ WHEELBIN STORAGE
 - 240V+ WHEELBIN SCREENED COLLECTION POINT
 - 600V+ WHEELBIN SCREENED COLLECTION POINT
 - AFFORDABLE RENTED
 - INTERMEDIATE HOUSING
 - FIRST HOMES
 - TREE RETENTION CATEGORY A
HIGH QUALITY WITH AN ESTIMATED LIFE EXPECTANCY OF AT LEAST 40 YEARS
 - TREE RETENTION CATEGORY B
MODERATE QUALITY WITH AN ESTIMATED LIFE EXPECTANCY OF AT LEAST 20 YEARS
 - TREE RETENTION CATEGORY C
LOW QUALITY WITH AN ESTIMATED LIFE EXPECTANCY OF AT LEAST 10 YEARS
 - TREE REMOVAL CATEGORY U
POOR CONDITION WITH AN ESTIMATED LIFE EXPECTANCY OF LESS THAN 10 YEARS
 - RPA
MINIMUM ROOT PROTECTION AREA
 - TREE TO BE REMOVED
 - EXISTING HEDGE
 - SWALE
 - 118m+ VISITOR PARKING SPACES

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

Ref.	No. of Beds	No. of Units	Percentage	M ²	Total M ²
A	2 Bedrooms	4	5.00	95.00	380.00
B	2 Bedrooms	11	13.75	70.00	770.00
C	3 Bedrooms	13	16.25	84.00	1092.00
D	3 Bedrooms	12	15.00	84.20	1010.40
E	3 Bedrooms	9	11.25	98.00	882.00
F	4 Bedrooms	3	3.75	110.50	331.50
G	4 Bedrooms	5	6.25	117.00	585.00
H	4 Bedrooms	6	7.50	120.50	723.00
J	4 Bedrooms	7	8.75	128.00	895.00
K	4 Bedrooms	10	12.50	140.00	1400.00
		80	95.00		7689.90

Hermitage Park, LEPTON

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

DD	20.02.23	SEPARATION DISTANCE BETWEEN PLOTS 08/09, 65/66 & 74/75 INCREASED. PLOT 01/02 MOVED TO CREATE 12M DISTANCE TO NEIGHBOURING PROPERTY. AFFORDABLE UNITS REVISED AND TENURES CLARIFIED.	ED
CC	30.01.23	PATH TO SIDE OF PLOT 70 EXTENDED. HARD MARGIN WIDENED TO SIDE OF PLOT 72 AS PER VISUALS.	ED
BB	24.01.23	LAYOUT AMENDED IN LINE WITH HIGHWAY CONSULTANTS COMMENTS. HIGHWAY ACCESS ONTO HERMITAGE PARK AMENDED IN LINE WITH HIGHWAY CONSULTANTS DRAWINGS.	ED
AA	20.01.23	PROPOSED ACCESS ONTO HERMITAGE PARK AMENDED IN LINE WITH HIGHWAY CONSULTANTS DRAWINGS.	ED
Z	18.01.23	LAYOUT AMENDED IN LINE WITH HIGHWAY CONSULTANTS COMMENTS. SOA REVISED. PLOTS 03/19/20 SUBSTITUTED. VISITOR PARKING AMENDED. PLOT 69 MAINTAINED.	ED
Y	03.01.23	LAYOUT AMENDED TO NORTHERN & SOUTHERN PORTIONS IN LINE WITH ARCHITECTS SKETCH DATED 03.01.23. PROM TRACKS ADDED. HIGHWAY LEADING TO PUMP STATION WIDENED.	.B
X	20.12.22	LAYOUT AMENDED TO NORTHERN & SOUTHERN PORTIONS IN LINE WITH ARCHITECTS SKETCH DATED 12.12.22. SCHEDULE OF ACCOMMODATION UPDATED. TYPE E AMENDED TO 3 BED TYPE.	.B
W	10.11.22	PLOT 37 GARAGE MOVED FORWARD BY 1.5M	ED
V	17.10.22	TREES REMOVED IN LINE WITH LANDSCAPE ARCHITECTS DRAWING. SWALE ADDED.	ED
U	12.09.22	TREE SURVEY INFORMATION REVISED SHOWING REMOVED TREES ALONG ACCESS ROAD. ATTENUATION BASIN UPDATED IN LINE WITH DRAINAGE ENGINEERS DRAWING.	SM
revision	date	content	initials

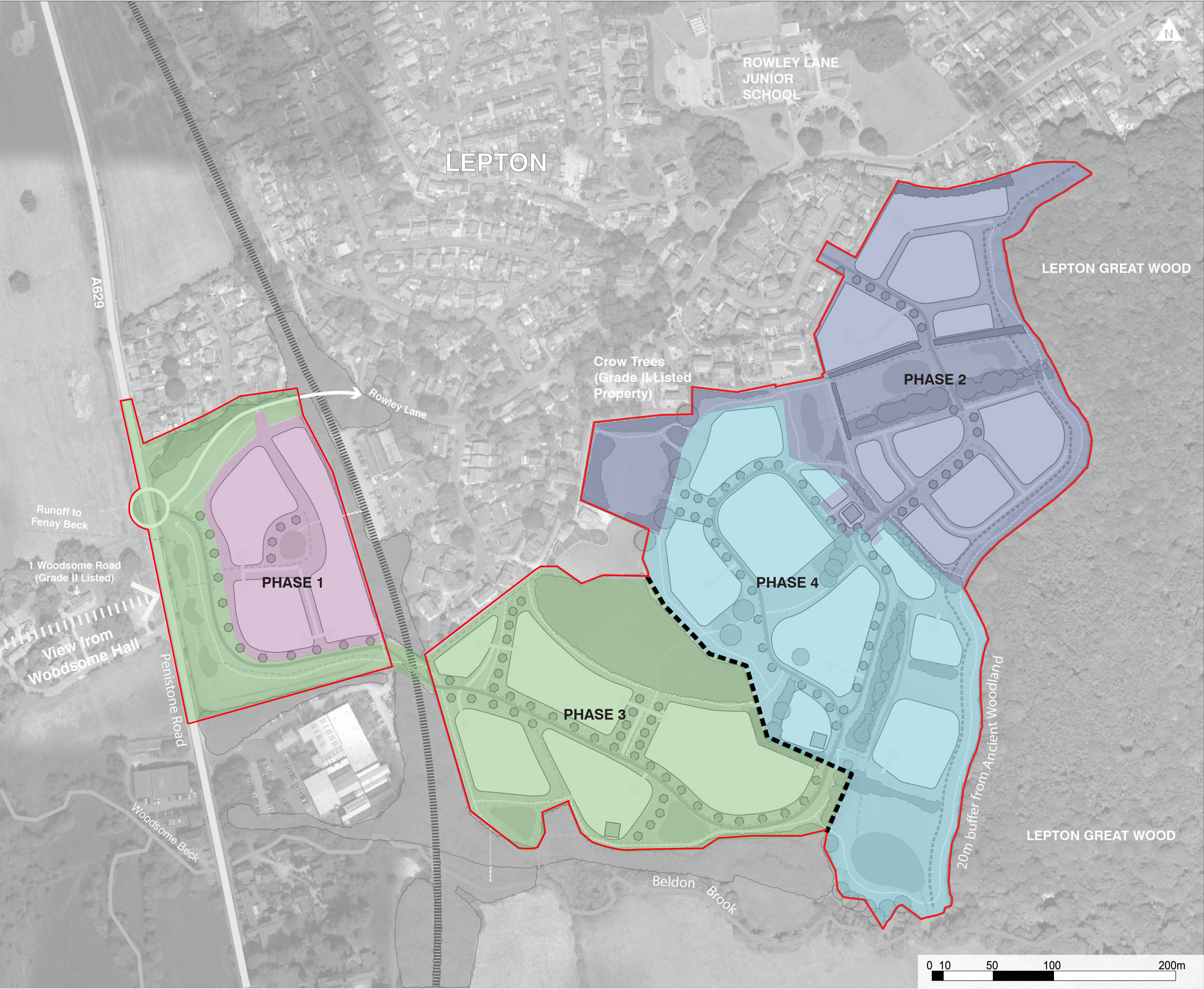
project	PROPOSED RESIDENTIAL HERMITAGE PARK LEPTON, HUDDERSFIELD				
client	KCS DEVELOPMENTS				
title	PROPOSED SITE LAYOUT				
date	17.06.20	scale	1:500 @ A0	drawn	SN
drawing number	3284-0-002	DD	checked		

Niemen Architects

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Tel: 0113 239 5400
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SKETCH
subject to structural review
subject to accurate measured survey



NOTES

All dimensions to be verified on site. Do not scale this drawing. All discrepancies to be clarified with project Landscape Architect.

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Drawing for planning purpose only.

KEY

Combined Allocation Boundaries
Combined Net Area: 21.5ha

- Phase 1
- Phase 2
- Phase 3
- Phase 4

Area Measurements

HS2

- Phase 1 (1.7ha)**
- Developable Area 1.61Ha
 - Plus infrastructure
- Phase 3 (7.5ha)**
(excluding the roundabout works)
- Developable Area 3.8Ha
 - POS 2.7Ha
 - Plus infrastructure

HS3

- Phase 2 (6.1ha)**
- Developable Area: 3.12Ha
 - POS Area: 2.7Ha
 - Plus infrastructure
- Phase 4 (6.2ha)**
- Developable Area: 3.2Ha
 - POS Area: 2.6Ha
 - Plus infrastructure

D	Amendments made to notes, minor roads and area measurements	31 Aug 22
	Play area added to Phase 1	
rev	details	date



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client
KCS Developments
project
Land off Hermitage Park, Lepton

drawing title
Phasing Plan

drawing status
Planning

drawn by	checked by	date
BVL/CH	TBR	01 Mar 21

scale	paper size
1:2000	A2

job/dwg no.	rev.
338-UW-P-007	D



1. THIS DRAWING IS BASED ON UPON:
 - NIEMEN ARCHITECTS PROPOSED SITE LAYOUT DRAWING 3284-002 REV 00;
 - 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 FORTM FLOOD RISK ASSESSMENT R002-V8.

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 HIGHWAY DRAIN |
| | 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 ADAPTABLE HIGHWAY) |
| | BOUNDARY CUT-OFF SWALE |

F	22.02.23	Updated to suit revised site layout.	RD
E	07.10.22	Updated in accordance with Kirklees Council consultation.	ML
D	06.09.22	Updated to suit revised layout. road contours added.	ML
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
Rev	Date	Amendments	By

Drawing Status.

PLANNING

FORTEM

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Client	
KCS DEVELOPMENT LTD	

Project

ROWLEY LANE, LEPTON

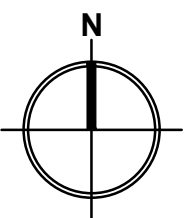
Drawing Title.

PROPOSED DRAINAGE STRATEGY

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

Drawing No.	1093 - 006	Rev.	F
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C:\Users\mth\Documents\FORTEM Projects\1093 - Rowley Lane, Lepton\KCS12 Drawings\1. Current\1093 - 1093 Exceedance Flow Routing.dwg, 22 Feb, 2023, 12:02pm



NOTES:

- THIS DRAWING IS BASED ON UPON NEIMEN ARCHITECTS PROPOSED SITE LAYOUT DRAWING 3284-0-002 REV.DD (WITH FORTEM AMENDMENTS), TURNBULL SURVEYING TOPOGRAPHICAL SURVEY S1158, YORKSHIRE WATER SEWER RECORDS AND ORDINANCE SURVEY MAPS.
- 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 HIGHWAY DRAIN
- - - - - PROPOSED SURFACE WATER SEWER / MANHOLE
- - - - - PROPOSED FOUL WATER SEWER / MANHOLE
- PROPOSED FOUL WATER RISING MAIN
- PROPOSED COMBINED WATER MANHOLE
- BOUNDARY CUT-OFF SWALE
- ← ← ← FLOW ROUTE MAPPING
- BOUNDARY RETAINING WALL

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
AND BE ROUTED DOWN HERMITAGE PARK ROAD.

BLOCKAGE FLOW ROUTE NOTE
IN THE EVENT OF A BLOCKAGE WITHIN THE
HIGHWAY LOOP, SURFACE WATER FLOWS
WILL OVERFLOW ONTO THE HIGHWAY.

BLOCKAGE FLOW ROUTE NOTE
IN THE EVENT OF A BLOCKAGE DOWNSTREAM
OF THE MANHOLE ADJACENT TO PLOT 024,
WATER WILL OVERFLOW ONTO THE HIGHWAY.

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

BLOCKAGE FLOW ROUTE NOTE
IN THE EVENT OF A BLOCKAGE UPSTREAM
OF THE MANHOLE IN THE P.O.S., FLOWS WILL
BE ROUTED BETWEEN PLOTS 36 & 37 TO THE
P.O.S. AND OVERLAND FLOW TO BASIN 2

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, TO THE P.O.S. AND OVERLAND FLOW TO BASIN 2

BLOCKAGE FLOW ROUTE NOTE
IN THE EVENT OF A BLOCKAGE WITHIN THE
HIGHWAY LOOP, SURFACE WATER FLOWS
WILL OVERFLOW ONTO THE HIGHWAY

BLOCKAGE FLOW ROUTE NOTE
IN THE EVENT OF A BLOCKAGE UPSTREAM OF THE
FLOW CONTROL CHAMBER, WATER WILL OVERTOP
THE DOUBLE GULLY AT THE LOW POINT IN ROAD 7
WITH FLOWS ROUTED ALONG THE PRIVATE ROAD
TO THE WATERCOURSE VIA OVERLAND FLOWS.

BLOCKAGE FLOW ROUTE NOTE
IN THE EVENT OF A BLOCKAGE DOWNSTREAM OF THE
FLOW CONTROL CHAMBER, 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.

D	22.02.23	Updated to suit revised layout	ML
C	24.11.22	Updated to suit Kirklees Council requirements.	ML
B	07.10.22	Updated in accordance with Kirklees Council consultation.	ML
A	06.09.22	Updated to suit revised layout, road contours added.	JOH
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.
D

FORTEM Civil Engineering Consultants Ltd					Page 1
11 The Covert York YO24 1JN		Rowley Lane Lepton			
Date 20/01/2021 File 210120 QSE 13.3LS.SRCX		Designed by Beth Scully Checked by Andrew Calvert			
XP Solutions		Source Control 2017.1.2			
<u>Summary of Results for 100 year Return Period (+30%)</u>					
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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11 The Covert York YO24 1JN		Rowley Lane Lepton			
Date 20/01/2021 File 210120 QSE 13.3LS.SRCX		Designed by Beth Scully Checked by Andrew Calvert			
XP Solutions		Source Control 2017.1.2			
<u>Summary of Results for 100 year Return Period (+30%)</u>					
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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FORTEM Civil Engineering Consultants Ltd		Page 3
11 The Covert York YO24 1JN	Rowley Lane Lepton	
Date 20/01/2021 File 210120 QSE 13.3LS.SRCX	Designed by Beth Scully Checked by Andrew Calvert	
XP Solutions	Source Control 2017.1.2	

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

FORTEM Civil Engineering Consultants Ltd		Page 4
11 The Covert York YO24 1JN	Rowley Lane Lepton	
Date 20/01/2021 File 210120 QSE 13.3LS.SRCX	Designed by Beth Scully Checked by Andrew Calvert	
XP Solutions Source Control 2017.1.2		

Model Details

Storage is Online Cover Level (m) 104.000

Tank or Pond Structure

Invert Level (m) 102.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
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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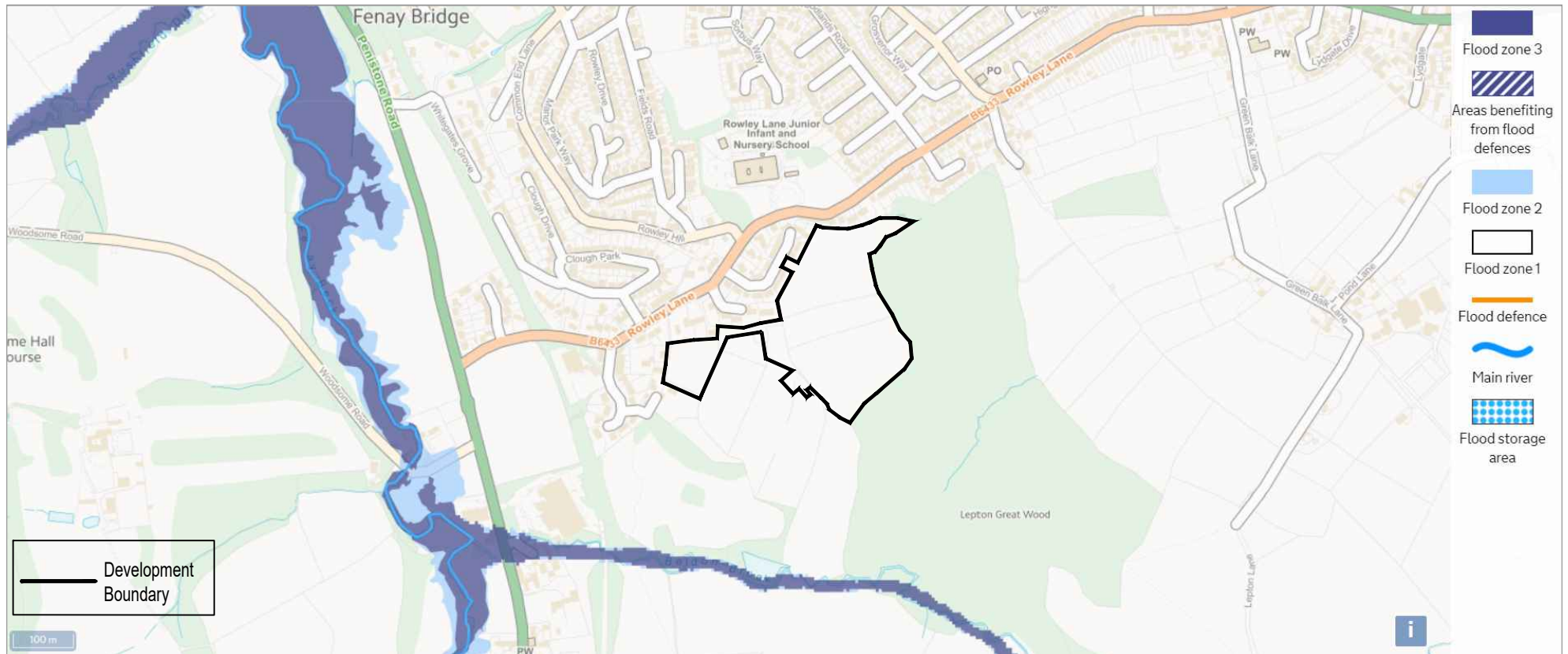
Appendix C Flood Risk Mapping

EA Flood Risk from Rivers and Sea

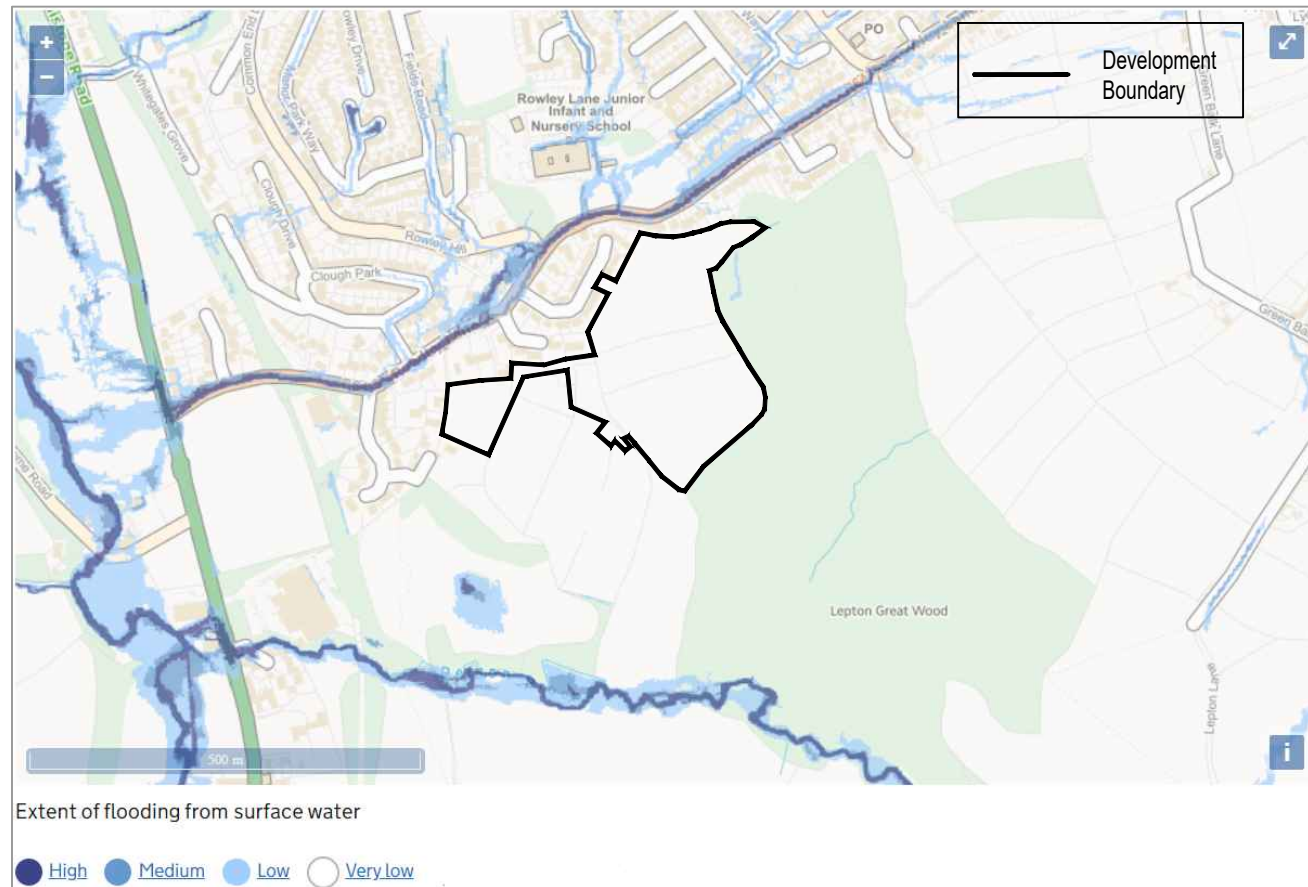
EA Map Risk of Flooding from Surface Water

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



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



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

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
