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FLOOD RISK ASSESSMENT

15383 DUNFORD ROAD,

HADE EDGE

Produced in accordance with NPPF, this Site Specific Flood Risk Assessment will assess the vulnerability of the site to flooding from all sources and will consider the effect of the new development.

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Revision	Description	Issued by	Date	Checked
00	Preliminary Issue	CP	13.05.16	VB CEng MICE
01	For Planning	CP	17.05.16	VB CEng MICE
02	Layout Updated	VB	22.07.16	VB CEng MICE
03	Infiltration Data Added	VB	16.09.16	VB CEng MICE
04	Layout Updated	VB	03.05.17	VB CEng MICE
05	Minor Modifications to Client Comments	VB	09.05.17	VB CEng MICE

INTRODUCTION

1. Introduction

This Flood Risk Assessment (FRA) has been prepared by Dudleys Consulting Engineers on behalf of Jones Homes (the Client). Every effort has been made to ensure that the information contained herewith is accurate at the time of creation. Any advice, opinions, or recommendations provided should be read in the context of the report as a whole.

2. The Site

SITE LOCATION

The site lies within the village of Hade Edge, within the Metropolitan Borough of Kirklees, West Yorkshire. The majority of the site is surrounded by farmland, with Greave Road to the north, Dunford Road to the west and Snittle Road to the east. The site is located 12 miles from the M62 motorway and 10 miles from Huddersfield town centre. The site location is described below:

- Postcode HD9 2TG
- OS X (Eastings) 414751
- OS Y (Northings) 405282
- Nat Grid SE 14751 05282

The site location is illustrated in Figure 1 below.

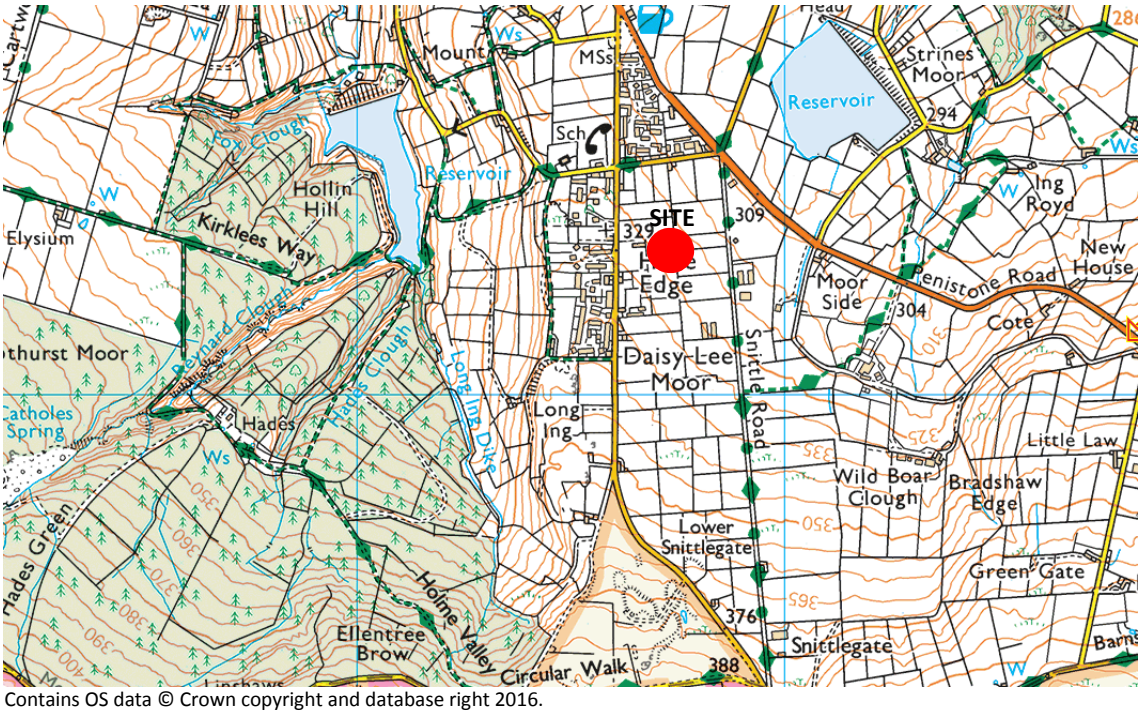

Figure 1: Site Location Plan

THE SITE

SITE DESCRIPTION

The scheme comprises a Greenfield site of circa 2.9 hectares to be developed with 59 traditional residential properties onto a new highway footprint with separate adoptable systems of foul and surface water drainage.

Existing levels fall steadily from southwest, at an elevation of approximately 330 m A.O.D., to northeast, at 320 m A.O.D, providing some 10 m of fall across the site.

A stretch of land to the east of the site, allocated as greenbelt, is provided for drainage and attenuation.

The site and its associated boundary are shown in Figure 2.

Figure 2: Aerial Photography

3. Sources of Flooding

The following data has been obtained from the Environment Agency (EA). The maps show the predicted likelihood of flooding for defined scenarios. There may be occasions when the observed pattern of flooding does not in reality match the predicted patterns shown. The EA flood data is continuously improved and updated quarterly. This FRA is based upon data obtained at the time of writing the report.

FLOOD MAP FOR PLANNING (RIVERS AND SEA)

Fluvial flooding occurs when high flows exceed the capacity of the river channel and spill out onto the floodplain, usually after a period of prolonged or heavy rainfall.

The Environment Agency Flood Map for Planning (Rivers and Sea) is shown in Figure 3.

The site is located within Flood Zone 1, which comprises land assessed as having a less than 1 in 1000 annual probability of flooding from rivers or sea. The flood zone is based upon the 'undefended' scenario. This is judged to be a precautionary scenario.

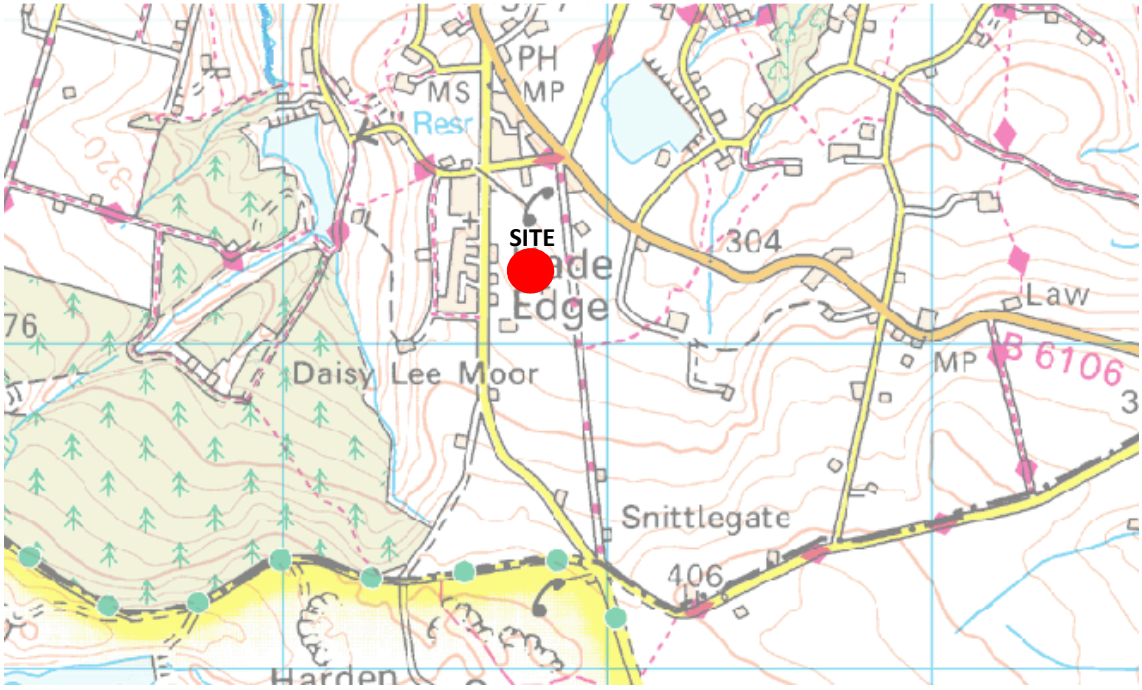

Figure 3: Environment Agency Flood Map for Planning (Rivers and Sea)

SOURCES OF FLOODING

Figure 4 shows the risk of flooding from rivers and sea based on the flood defences which currently exist.

Again, the developed area of the site is at 'very low' risk, indicating a less than 1 in 1000 annual probability of flooding.

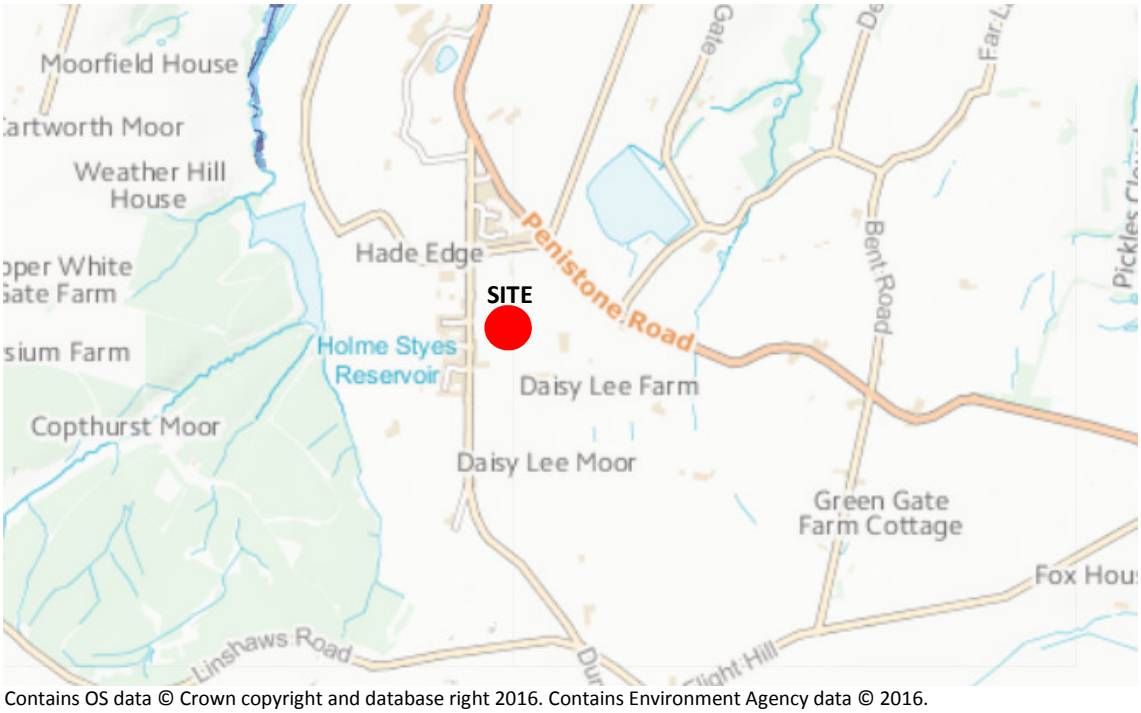

Figure 4: Environment Agency Risk of Flooding From Rivers and Sea Map

SOURCES OF FLOODING

FLOOD RISK VULNERABILITY

The Flood Risk Vulnerability Classification has been determined in accordance with Planning Practice Guidance, Flood Risk and Coastal Change. The Flood Risk Vulnerability Classification is 'More Vulnerable'. This classification includes *'Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels'*.

FLOOD ZONE COMPATIBILITY

The Flood Zone Compatibility has been reviewed in accordance with Planning Practice Guidance, Flood Risk and Coastal Change, paragraph 067.

Flood Zones	**Flood Risk Vulnerability Classification**				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	X	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	X	X	X	✓*

Key:

✓ Development is appropriate

X Development should not be permitted

Table 1: Flood risk vulnerability and Flood Zone 'Compatibility'

The site is located within Flood Zone 1. The vulnerability classification is 'more vulnerable'. The scheme proposals are therefore considered appropriate in accordance with Planning Practice Guidance.

SOURCES OF FLOODING

FLOODING FROM LAND (PLUVIAL FLOODING)

The EA Flood Map showing Risk of Flooding from Surface Water is shown in Figure 5. This type of flooding can be difficult to predict, much more so than river or sea flooding as it is hard to forecast exactly where or how much rain will fall in any storm.

The map indicates that the developed area of the site has a 'very low' chance of flooding with a less than 1 in 1000 annual probability of flooding.

The map is not definitive and is based on the best information available to the Environment Agency, such as ground levels and drainage.

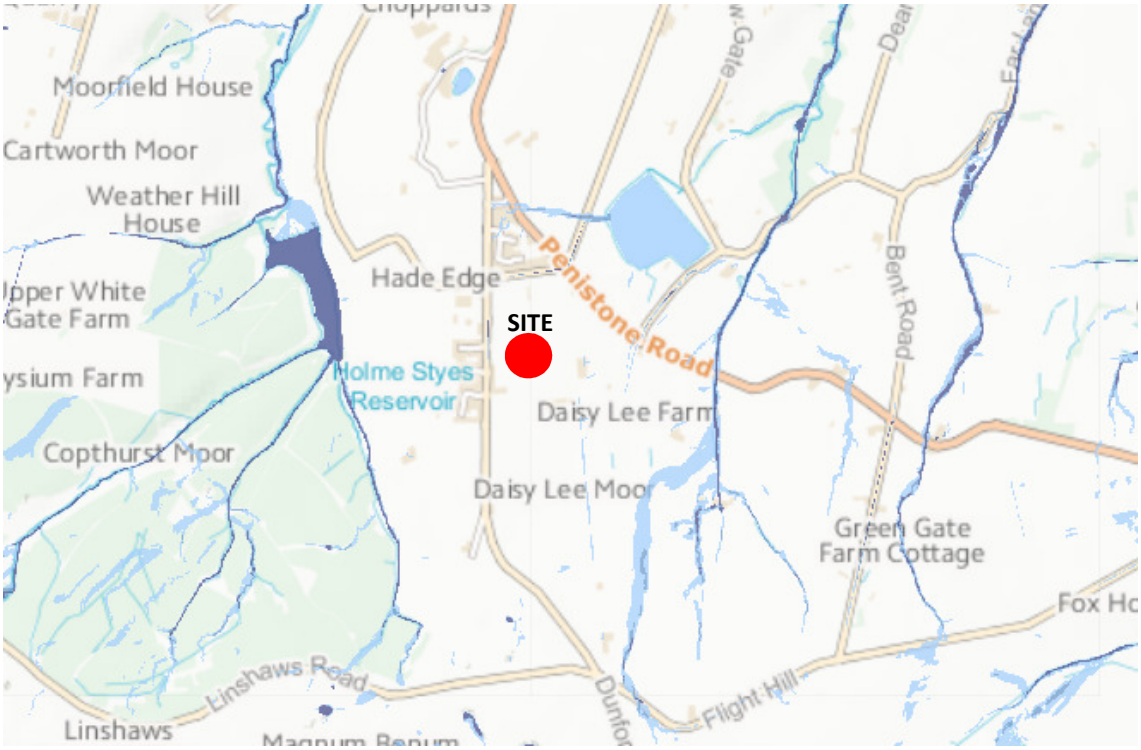

Figure 5: Risk of Flooding from Surface Water

The site will be positively drained by a dedicated surface water drainage network and will cater for storm events up to and including the 1 in 100 year Critical Duration Event, with an allowance for climate change and urban creep. This will mitigate the likelihood of pluvial flooding to and from the site.

SOURCES OF FLOODING

FLOODING FROM GROUNDWATER

Groundwater flooding occurs when water levels in the ground rise above surface levels, and is more likely to occur in low lying areas.

The nearest British Geological Survey (BGS) borehole logs are located approximately 500m north (SE10NW33) and 500m south of the site (SE10SW25). Neither borehole gives any indication of groundwater being an issue, however a Geotechnical Investigation will be carried out to confirm this.

FLOODING FROM SEWERS

Yorkshire Water asset plans indicate that there are no sewers crossing the site. The asset plans can be found in Appendix B.

FLOODING FROM RESERVOIRS

Reservoir flooding is extremely unlikely to happen. There has been no loss of life in the UK from reservoir flooding since 1925. All large reservoirs must be inspected and supervised by reservoir panel engineers. As the enforcement authority for the Reservoirs Act 1975 in England, the EA ensure that reservoirs are inspected regularly and essential safety work is carried out.

However, in the unlikely event that a reservoir dam failed, a large volume of water would escape at once and flooding could happen with little or no warning.

The EA flood map showing risk of flooding from reservoirs is shown in Figure 6.

Figure 6: Risk of Flooding from Reservoirs

The shading illustrates that in the unlikely event of a reservoir failure, the site would be unaffected.

4. Design Proposals

PROPOSED SCHEME

The Planning Application proposes a residential redevelopment including affordable housing provision, with a new vehicular access from Dunford Road. The proposed layout is contained within Appendix A.

PROPOSED DRAINAGE STRATEGY

It is the intention to develop the Greenfield site at Dunford Road, Hade Edge, with separate systems for surface and foul water drainage. Every effort will be taken during the design process to utilise SuDS.

In accordance with best practice, the following hierarchy of techniques has been considered in order of preference: Infiltration; Watercourse; Surface Water Sewer; Combined Sewer.

Infiltration

Intrusive investigations were carried out on 25th and 26th April 2016 and comprised trial pitting and window sampling. Soakaway tests were carried out in trial pits TP1, TP3 and TP6 in accordance with BRE Digest 365. The recorded Soil Infiltration Rates are detailed below.

TRIAL PIT	SOIL INFILTRATION RATE
TP1	1.39×10^{-4} (m/s)
TP3	1.41×10^{-5} (m/s)
TP6	1.93×10^{-5} (m/s)

Table 2: Soil Infiltration Rates

Table 3 illustrates that the infiltration rates achieved fall in the range for 'Good Infiltration Media' based on soil types published by CIRIA.

TABLE 25.1 Typical infiltration coefficients based on soil texture (after Bettess, 1996)

Soil type/texture	ISO 14688-1 description (after Blake, 2010)	Typical infiltration coefficients (m/s)
Good infiltration media		
• gravel	Sandy GRAVEL	$3 \times 10^{-4} - 3 \times 10^{-2}$
• sand	Slightly silty slightly clayey SAND	$1 \times 10^{-5} - 5 \times 10^{-5}$
• loamy sand	Silty slightly clayey SAND	$1 \times 10^{-4} - 3 \times 10^{-5}$
• sandy loam	Silty clayey SAND	$1 \times 10^{-7} - 1 \times 10^{-5}$
Poor infiltration media		
• loam	Very silty clayey SAND	$1 \times 10^{-7} - 5 \times 10^{-6}$
• silt loam	Very sandy clayey SILT	$1 \times 10^{-7} - 1 \times 10^{-5}$
• chalk (structureless)	N/A	$3 \times 10^{-8} - 3 \times 10^{-6}$
• sandy clay loam	Very clayey silty SAND	$3 \times 10^{-10} - 3 \times 10^{-7}$
Very poor infiltration media	–	
• silty clay loam	–	$1 \times 10^{-8} - 1 \times 10^{-6}$
• clay	Can be any texture of soil	$< 3 \times 10^{-8}$
• till	described above	$3 \times 10^{-9} - 3 \times 10^{-6}$

Table 3: Typical Infiltration Coefficients [Ref Table 25.1 CIRIA Suds Manual 2015]

Infiltration structures will be located a minimum of 5m from any existing or proposed buildings and will be designed to ensure that surface water flows are contained on site for the 1 in 100 year plus 40% climate change Critical Duration Event.

Foul Water

Foul water flows will be separated from surface water and will be collected by a dedicated foul water gravity system, designed in accordance with BS EN 752 2008. Foul water flows will be discharged to Yorkshire Water Combined sewer, subject to agreement from Yorkshire Water.

Climate Change

The drainage strategy will include an increase in the storm intensity of 40%, which is consistent with the effects of climate change for a development with a design life of 100 years.

5. Conclusions

This FRA has been prepared for the Planning Application at Dunford Road, Hade Edge. The Planning Application proposes a residential redevelopment, with new vehicular access served from Dunford Road.

The site is located within Flood Zone 1. The Flood Risk Vulnerability Classification for the proposed development is 'More Vulnerable'. The development is therefore considered appropriate according to the Planning Practice Guidance compatibility test.

Environment Agency data indicates a very low risk of flooding from rivers and sea.

Environment Agency data indicates a very low risk of flooding from surface water. Overland flood flow routes have been considered as part of the on-site civil engineering scheme design.

In accordance with best practice, the following hierarchy of techniques has been considered in order of preference: Infiltration; Watercourse; Surface Water Sewer; Combined Sewer.

Soakaway tests were carried out in April 2016. The infiltration rates achieved fall in the range for 'Good Infiltration Media' based on data published by CIRIA.

Infiltration structures will be located a minimum of 5m from any existing or proposed buildings and will be designed to ensure that surface water flows are contained on site for the 1 in 100 year plus 40% climate change Critical Duration Event.

Foul water flows will be collected by a separate dedicated gravity network and will discharge to existing Yorkshire Water Combined Sewer, subject to approval from Yorkshire Water.

APPENDICES

6. Appendices

Appendix A: Proposed Layout

Appendix B: Asset Records

APPENDICES

APPENDIX A: PROPOSED LAYOUT

Schedule of Accommodation

	Housetype	Type	No. of Units	Percentage
BU	Bungalow	Semi-detached	2	3.39
CR	Cranford	Terraced	10	16.95
BV	Beverley	Semi-detached	12	20.34
HO	Holcombe	Detached	6	10.17
BA	Banbury	Detached	9	15.25
NO	Northwood	Detached	8	13.56
ST	Stratton	Detached	5	8.47
LT	Latchford	Detached	7	11.86
	Totals		59	100.00

LEGEND:

- 1.8M (h) TIMBER FENCE
- PROPOSED TREES
- EXISTING TREES TO BE REMOVED/PRUNED
- EXISTING TREES
- AFFORDABLE UNITS

N S

Dunford Road, **HADE EDGE**

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

SKETCH
subject to structural review
subject to accurate measured survey

revision	date	content	initials
C	19.04.17	SITE LAYOUT AMENDED IN LINE WITH LATEST SKETCH SCHEME & CLIENT COMMENTS. SCHEDULE OF ACCOMMODATION AMENDED.	JB
B	29.11.16	SITE LAYOUT AMENDED IN LINE WITH LATEST SKETCH SCHEME. SCHEDULE OF ACCOMMODATION AMENDED.	JB
A	19.04.16	AFFORDABLE UNITS INDICATED. PROPOSED SHOP LOCATION ADDED. PLOTS RE-NUMBERED AND SCHEDULE OF ACCOMMODATION AMENDED.	JB

project: PROPOSED RESIDENTIAL, DUNFORD ROAD HADE EDGE

client: JONES HOMES

title: PROPOSED SITE LAYOUT

date: 29.03.16 | scale: 1:500@A1 | drawn: JB

drawing number: 2847-0-001 C | checked:

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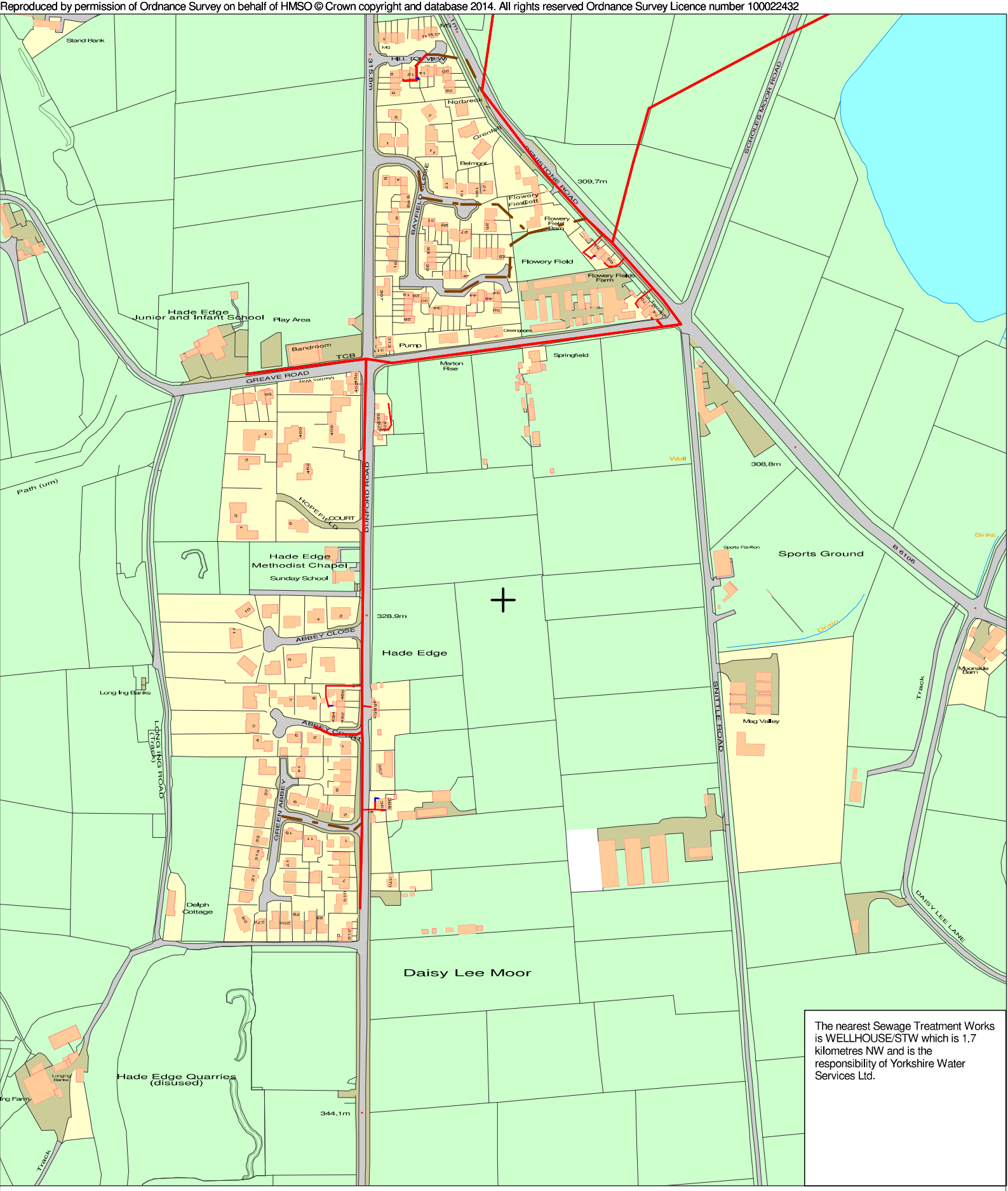
APPENDICES

APPENDIX B: ASSET RECORDS



The nearest Sewage Treatment Works is WELLHOUSE/STW which is 1.7 kilometres NW and is the responsibility of Yorkshire Water Services Ltd.

Public Waste Water Network 27/11/2015 13:41:48 OS Grid Coordinates: 414329 : 404898 Map Name : SE1404NW KAYA