
Development of land east of Lockwood Road Goldthorpe

Flood Risk Assessment

Client:

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REVISION HISTORY

Revision	Date	Details
00	30 th March 2021	First issue

APENDICES

- A: Figure 1: Location Plan
- B: Topographical survey plan
- C: Infiltration tests report and calculations
- D: Yorkshire Water pre-development advice
- E: Schematic site layout plan
- F: Fluvial flood map
- G: Surface water flood map
- H: Reservoirs flood map
- I: ReFH2 estimates of runoff rates and volumes

ABBREVIATIONS

AEP:	Annual exceedance probability
AOD:	Above Ordnance Datum
BGS:	British Geological Survey
CCA:	Climate change allowance
CDA:	Critical drainage area
d/s:	Downstream
FDL:	Flood defence level
FEH:	Flood Estimation Handbook
FRA:	Flood risk assessment
IL:	Invert level
NE:	North-east
NGR:	National Grid Reference
OS:	Ordnance Survey
OWC:	Ordinary watercourse
PPG:	Planning Practice Guidance
ReFH2:	Revitalised flood hydrology model, version 2
SFRA:	Strategic Flood Risk Assessment
SW:	South-west
u/s:	Upstream

1.0 SITE	Land east of Lockwood Road, Goldthorpe.
2.0 PURPOSE OF THIS REPORT	This site-specific flood risk assessment is required in connection with a planning application to Barnsley Council for a residential development on the site. References in this report to “the site” are references to the site which is the subject of the planning application.
3.0 PLANNING APPLICATION NUMBER	Not yet issued
4.0 SITE LOCATION AND DESCRIPTION	See Figure 1: Location Plan in Appendix A.
4.1 National Grid Reference	446520E, 404685N
4.2 Gross Site Area	Approximately 4.68ha
4.3 Ground surface	100% pervious surface with grass or vegetation covering.
4.4 Topography	Ground levels generally fall towards the north-east but there is a secondary gradient falling towards the west towards a shallow valley parallel with the northern boundary. Ground levels are within the range 49.61m to 55.90m AOD. See topographical survey plan in Appendix B.
4.5 Geology	<u>Superficial</u>: None recorded. <u>Bedrock</u>: Ackworth Rock - Sandstone. Data source: BGS Geology of Great Britain database.
4.6 Ground investigation	Infiltration tests were carried out during the ground investigation by Eastwood and Partners. It was concluded from the test results that the soils are not suitable for infiltration drainage. The infiltrations tests report and the calculated infiltration rates are provided in Appendix C.

4.6 Watercourses

The site is not within 20 of a Main River.

There is an open drain at the NW corner of the site between the site boundary and the A635 highway. The LLFA has advised that this is a part of the highway drainage system for the A635.

4.7 Reservoirs

None in the immediate vicinity of the site.

4.8 Existing site drainage

Natural land drainage following the topography.

4.9 Existing sewers

The Yorkshire Water sewer map shows:

- a 225mm diameter surface water sewer which enters the site at the SE corner from Hamilton Road and progresses NE to MH 4701 where it connects to;
- a 525mm diameter surface water sewer which progresses to the NW corner where it leaves the site;

See Appendix D.

5.0 THE DEVELOPMENT

A development of 137 houses is proposed as shown on the planning layout drawing in Appendix E.

Access to the site will be from East Street.

5.1 Vulnerability classification

The development is classified as **'More Vulnerable'**, in accordance with Table 2 of the Planning Practice Guidance for Flood Risk and Coastal Change, paragraph 066.

5.2 Flood zone

The Flood Map For Planning shows the site to be in Flood Zone 1.

See Appendix F.

5.3 Requirement to consult the Environment Agency

Not required for more vulnerable development that is in Flood Zone 1 and more than 20m from a Main River.¹

5.4 Requirement for the sequential test

Not required when the development is in flood zone 1 and is not within 20m of a Main River or in a Critical Drainage Area.²

5.5 Requirement for the exception test

Not required for More Vulnerable developments in Flood Zone 1.³

¹ Environment Agency Standing Advice to local planning authorities. Updated 28th February 2017.

² Environment Agency Standing Advice to local planning authorities. Updated 28th February 2017.

³ Planning Practice Guidance for Flood Risk and Coastal Change, paragraph 067 Table 3.

6.0 CONSULTATIONS

6.1 Environment Agency

In view of the low risk of fluvial flooding, the Environment Agency was not consulted.

6.2 Barnsley LLFA

Barnsley LLFA was consulted in the preparation of this FRA and we are grateful for its helpful advice.

6.3 Yorkshire Water

Pre development advice was requested from Yorkshire Water and its response is provided in Appendix D.

Yorkshire Water has advised that surface water from the development may, if alternative methods of disposal are not feasible, be discharged to the 525mm diameter surface water sewer at a rate not exceeding 3.5 l/s.

7.0 FLUVIAL FLOODING

7.1 Functional floodplain

The site is not in the functional floodplain.

7.2 History of flooding

There is no available evidence of historic or potential flooding of the site.

7.3 Annual probability of fluvial flooding

0.1% or less.

7.4 Flood defences

None

7.5 Fluvial flood hazard

None

7.6 Loss of floodplain storage

None

7.7 Flood warning area

The site is not in an Environment Agency flood warning area.

8.0 SURFACE WATER FLOODING

8.1 Risk of surface water flooding

The Updated Surface Water Flood Map shows the site generally to be at a very low risk of surface water flooding. Some flooding is indicated however in the NW field and in the former allotment gardens area. The risk in these areas ranges from Low to High. Flood depths are indicated to be mainly less than 300mm but exceed 300mm in the NW field.

The area of flooding is consistent with the shallow valley area towards the north of the site. This will act as a natural basin for surface water runoff.

See Appendix G.

A comparison of the medium risk surface water flood depth map, which indicates an annual probability in the range 1% to 3.3%, with the topographical survey suggests that the limit of the flooded area occurs approximately at around 50.30m AOD. At the lowest point of the site, against the northern boundary, the ground level is 49.61m AOD, so depths ranging from 0.00m to approximately 700mm could be expected.

The surface water flow path from the site continues across the northern boundary and then flows west, adjacent to the A635 highway, culminating in a flooded area just to the east of the B6098/A635 roundabout.

It is therefore important that the layout of the development makes provision for this flow path and does not obstruct it.

8.2 Critical Drainage Areas

The site is not in a critical drainage area.

9.0 GROUNDWATER FLOODING

Groundwater flooding is associated with highly permeable rock such as chalk. This type of geology is not present at the site. It is possible however, at times of high soil saturation, that there could be some emergence of groundwater at the lowest part of the site and this should be considered in the design of any attenuation storage basin that may be located in this area.

10.0 SEWER FLOODING

Sewer flooding can occur when the capacity of the sewerage system is exceeded by exceptional rainfall. Although there are 225mm and a 525mm diameter surface water sewers crossing the site, there is no evidence that the site has been affected by this type of flooding.

The risk of sewer flooding to the development is assessed to be low.

11.0 FLOODING FROM RESERVOIRS AND CANALS

The site is not in an area at risk of flooding resulting from an uncontrolled release of water from reservoirs. (See Appendix H).

The site is not at risk of flooding from canals.

12.0 EFFECT OF THE DEVELOPMENT ON FLOOD RISK

12.1 Fluvial and tidal flood risk

No effect

12.2 Surface water flood risk

It is assumed for the purposes of this FRA that the development will create impervious area on approximately 50% of the gross site area. This is a conservative estimate as the impervious area in Gleeson developments is typically less than this.

Runoff rates and volumes in the existing and post-development conditions have been estimated using FEH point data for the site and the ReFH2 model. The results are shown in Appendix I.

The 2 year rural peak flow rate (Q MED) is 16.65 l/s for the site. As the site is in Hydrological Area 3, the growth curve factor used to convert Q bar to Q(T) is 0.94.

Q bar is therefore $Q \text{ MED}/0.94$

$= 16.65/0.94 = 17.72 \text{ l/s}$.

The ReFH2 model shows that the development will increase the peak runoff rate of a 1% AEP rainfall event by a factor of approximately 2.2.

Runoff volumes in the same event are estimated to increase by a factor of approximately 2.0.

12.3 Groundwater flood risk

The risk of groundwater emergence at the lowest part of the site may be reduced by the drainage system for the development.

12.4 Sewer flooding risk

No effect

13.0 EFFECT OF CLIMATE CHANGE

13.1 Lifetime of the development

Climate change must be considered over the expected lifetime of the development which, for residential development is defined to be 100 years in paragraph 026 of the Planning Practice Guidance. Climate change must therefore be considered up to 2119.

13.2 Current guidance

Current guidance on the application of climate change allowances was issued in February 2016 and updated on 22nd July 2020. The guidance provides the anticipated changes to peak river flow and rainfall intensity for different scenarios of carbon dioxide emissions over future epochs up to 2115.

13.3 Effect on fluvial flood risk

The effects of climate change on peak river flow are not relevant to this FRA as the site is not at risk from fluvial flooding.

13.4 Effect on surface water flood risk

The current guidance requires the Central and Upper End allowances to be used when assessing the effects of increases to peak rainfall intensities. The allowances apply across the whole of England and in the period 2070 to 2115 are:

- Central allowance: 20%
- Upper end allowance: 40%

The detailed drainage design must therefore take into account the range of climate change effects on rainfall intensity.

The ReFH2 estimates of post-development runoff rates and volumes are provided in Appendix I and a summary is provided below:

13.5 Post development runoff rates

- 3.3% AEP: 103.64 l/s
- 1% AEP: 142.16 l/s
- 1% AEP with 20% CCA: 171.86 l/s
- 1% AEP with 40% CCA: 202.02 l/s

13.6 Post development runoff volumes

- 3.3% AEP: 1,291.25 m³
- 1% AEP: 1,783.86 m³
- 1% AEP with 20% CCA: 2,167.54 m³
- 1% AEP with 40% CCA: 2,560.20 m³

14.0 FLOOD RISK MANAGEMENT

14.1 Fluvial flood risk

As the development is in Flood Zone 1, no flood risk management measures are required in respect of fluvial flooding.

Flood warnings

Not required.

Evacuation

Not required.

14.2 Surface water flood risk

As noted in section 8.1 above, it is important that provision is made for the overland surface water flow path in the layout of the development.

The design of the drainage system should ensure that surface water runoff is managed in the lowest part of the site in order to avoid a flooding risk to the proposed dwellings. The public open space shown on the site layout plan should be re-located to the central valley area close to the northern boundary where it can function as a flood storage area when necessary.

The effect of the development on surface water flood risk can be mitigated by the application of sustainable drainage principles in the detailed drainage design.

The ground investigation report concludes that infiltration will not be feasible owing to poor infiltration rates, but suggests that some limited infiltration from pervious paving could be considered. This method of disposal would however not be sufficient for the design rainfall event and a positive drainage outlet either to a watercourse or sewer would be required.

Barnsley LLFA has advised that the Barnsley Highway Authority has a policy of resisting the connection of flows from development sites to highway drains. Yorkshire Water on the other hand has stated that it will not accept surface water into its surface water sewer if the option of disposal to a watercourse is available.

The Land Drainage Act 1991 defines the term “watercourse” to include: *all rivers and streams and all ditches, drains, cuts, culverts, dikes, sluices, sewers (other than public sewers within the meaning of the Water Industry Act 1991) and passages through which water flows.* The Act makes no exclusion for highway drains, so the Highway Authority may have difficulty in upholding its policy in this instance, especially as it is clear from the topography that greenfield surface water runoff from the site must already enter the watercourse at the NW corner of the site.

Further discussions with the LLFA, the Highway Authority and Yorkshire Water will therefore be necessary in order to reach agreement on the method of disposal for surface water from the development. The restricted discharge rate of 3.5 l/s to the surface water sewer, required by Yorkshire Water, would result in the requirement for excessive storage capacity.

Peak flow control

It is recommended that the peak surface water discharge rate from the development is limited to the mean annual greenfield runoff rate, Q_{bar} which, for the site is estimated to be 17.72 l/s, subject to the approval of Yorkshire Water if the discharge is to a public sewer.

Barnsley LLFA has confirmed its agreement in principle to the proposed discharge rate.

Attenuation storage

Attenuation storage will be required, and the form that this will take will be a matter for the detailed design of the drainage system.

The preliminary estimate of the attenuation storage capacity for a 1% AEP event with 20% CCA, based on a discharge rate of 17.72 l/s, is approximately 1,944 m³.

Note:

The above preliminary estimate of attenuation is provided for guidance only. The actual required storage will depend on the detailed drainage design.

14.3 Groundwater flood risk

No recommendations.

14.4 Sewer flooding risk

No recommendations.

14.5 Reservoir flood risk

No recommendations.

14.6 Access and egress

As the site is in flood zone 1 and is generally at a very low risk of surface water flooding, access and egress will not be impeded. The small area of low risk flooding at the site entrance from Essex Road can be mitigated in the detailed design of the drainage system.

15.0 RESIDUAL RISKS

Residual risks are those that remain after the implementation of the flood risk management measures.

15.1 Risk of 40% CCA

If the drainage design assumes a 20% CCA, the residual risk of a 40% CCA should be considered.

The preliminary estimate of the attenuation storage capacity for a 1% AEP event with 40% CCA, based on a discharge rate of 17.72 l/s, is approximately 2,337 m³, an increase over the 20% CCA volume of approximately 393m³. This risk can be mitigated by:

- allowing the additional volume to be stored within a controlled area, such as within the freeboard of a storage basin; and/or
- increasing the attenuation storage capacity; and/or
- allowing limited surface water flooding in controlled areas that does not result in a flood risk to buildings.

15.2 Risk of the 1% AEP design event being exceeded

Should the design event be exceeded, the additional runoff volume would initially be stored in the attenuation pond up to the limit of its capacity. When this is exceeded, there will be overland flow which should be constrained within designed exceedance routes shown on the detailed design drawings.

16.0 CONCLUSIONS

1. The development classification is **More Vulnerable**.
2. The site is in flood zone 1 where the annual probability of fluvial flooding is less than 0.1%.
3. There is no requirement for the Environment Agency to be consulted on this development.
4. There is no requirement for the Sequential Test or Exception Test to be applied to the development.

5. There is no evidence of the site having been affected by flooding in the past but some surface water flooding in the lowest parts of the site is likely to have occurred.
6. The risk of surface water flooding at the site is generally very low, but there is a medium risk in the valley area towards the north of the site with depths up to approximately 700mm.
7. The risk of groundwater flooding is assessed generally to be negligible but some emergence of groundwater at the lowest part of the site could occur at times when soil saturation is high.
8. Sewer flooding is unlikely to occur more than once in 30 years, due to storage in the sewerage system. It is unlikely that this type of flooding would affect the site more frequently than this, based on the required design criteria.
9. The site is not at risk of flooding from canals and is not in an area at risk from the uncontrolled release of water from reservoirs.
10. The development will reduce the pervious area of the site by up to 50% which will increase surface water runoff rates and volumes. This will be mitigated by restricting the peak surface water discharge rate to 17.72 l/s, subject to the approval of Yorkshire Water, if the discharge is to a public sewer and by providing attenuation storage, in accordance with sustainable drainage principles.
11. The preliminary estimates of attenuation storage based on a 20% CCA is approximately 1,944m³. This increases by 393m³ when 40% CCA is applied.

The actual storage capacity will be determined at the detailed design stage.
13. Subject to the implementation of the flood risk management measures recommended in this report, the development will not increase flood risk elsewhere.

RECOMMENDATIONS

A detailed drainage design should be prepared and submitted to Barnsley Council and Yorkshire Water for approval, prior to construction of the development. The actual attenuation storage capacities should be determined in the detailed design of the drainage scheme.

The flood risk management measures recommended in this report should be implemented in the design and construction of the development.

USE OF REPORT

This report is prepared specifically for Gleeson Developments Ltd for the purpose of the aforementioned planning application and the report may not be used for any other purpose and it may not be assigned to any third party without our written permission.

DISCLAIMER

This flood risk assessment is based on data available at the time of its preparation and JOC Consultants Ltd accepts no liability for the consequences of any changes to or re-assessment of this data in the future.

APPENDIX A

Figure 1: Location Plan

Development site east of Lockwood Road, Goldthorpe

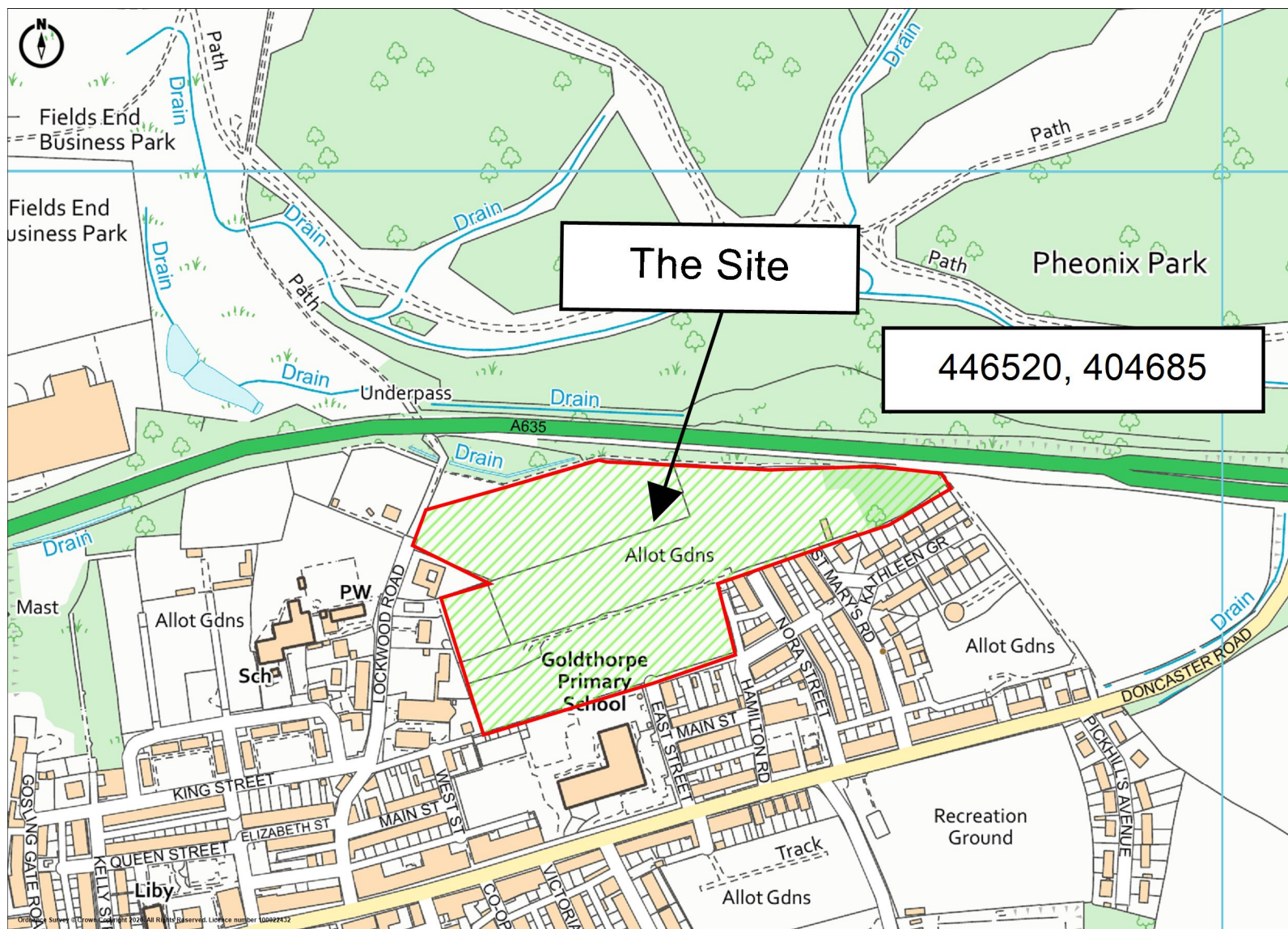


Figure 1: Location Plan

APPENDIX B

Topographical Survey Plan

[illegible]

APPENDIX C

Infiltration tests report and calculations

John O'Connor

From: Luke Wilson [luke.wilson@eastwoodandpartners.com]
Sent: 29 March 2021 11:53
To: Ben Parkins
Cc: Glen Burgin; Catherine Topliss
Subject: 44271 - Lockwood Road, Goldthorpe - Soakaway Summary
Attachments: 44271 - Soakaway Tests - Calculation of Infiltration Rates.pdf

CAUTION: This email originated outside of Gleeson. You should NOT open attachments or click links unless you are certain of its origin. If in doubt, please contact Gleeson IT.

Good morning Ben,

We write to provide a brief summary of the soakaway works undertaken on the above site. Eastwood & Partners conducted the tests on the 9 December 2020. The tests were carried out at depths of between 0.6 m and 1.6 m below ground level (bgl).

The results of the testing are summarised in the following table:

Trial Pit	Test	Base of Trial Pit (m BGL)	BRE365 Infiltration Rate ($\times 10^{-6}$) m/s	Average Infiltration Rate ($\times 10^{-6}$) m/s
SA1	1	1.6	18	21
	2		N/A	8
SA2	1	1.2	15	17
SA3	1	1.6	N/A	1.3
SA4	1	1.4	N/A	1.2

An infiltration rate was unable to be calculated in accordance with BRE365 for the majority of tests. The subsequent test in SA1 showed a reduction in the average infiltration rate, suggesting that the sides and base of the test pit had become saturated and/or silted up during the previous test.

Groundwater was not typically encountered during the investigation works. The exception to this was in trial pits TP101 to TP104 in the central northern part of the site where slow ingress was noted between 1.8 m and 2.2 m bgl. Subsequent monitoring has recorded groundwater to be standing between around 1 and 2 m bgl.

Given the above, the natural residual soils are not considered suitable for soakaway drainage. Therefore, consideration should be given to a piped connection. An existing surface water sewer is noted to cross the site from south east to north west.

Notwithstanding the above, a limited volume of infiltration into the residual soils is still possible. The use of shallow create soakaways in conjunction with small scale permeable paving, or semi-permeable attenuation, could be considered.

Should you have any queries, please do not hesitate to contact us.

Kind Regards

Luke Wilson
Geotechnical & Geo-environmental Engineer

PROJECT:	Lockwood Road, Golthorpe	Job No. 44271	Date 09.12.20
SUBJECT:	Infiltration Test Results and Calculation of Infiltration Rates	Prepared LW	Checked

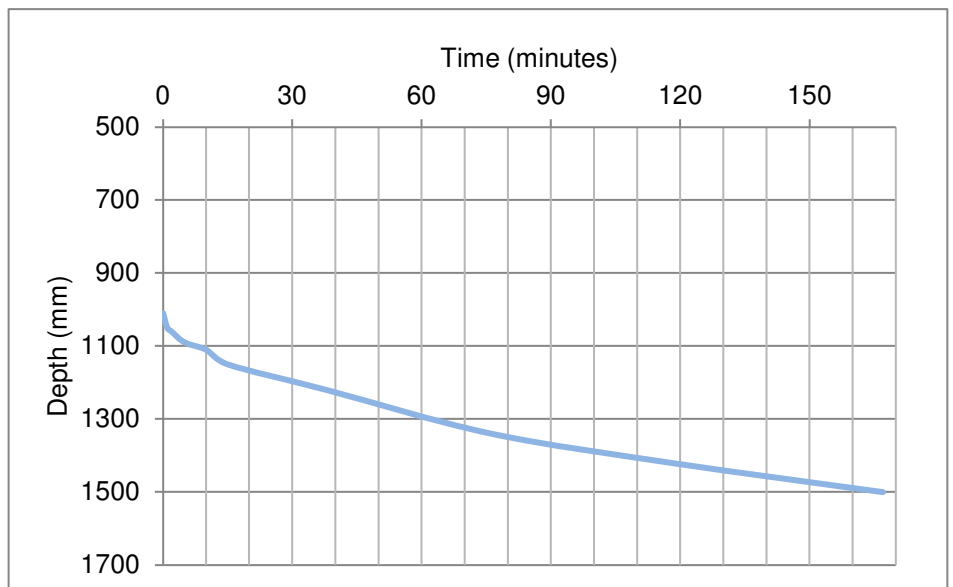
Test No.	SA1
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Test Pit Dimensions

Length = **1400** mm Plan area = **1.12** m²
Width = **800** mm
Depth = **1600** mm (Total depth)

Approximate time to discharge water into the hole: **20** Seconds
 Depth to water after completion of pumping: **1010** mm

Time (min)	Depth (mm)
0	1010
1	1050
2	1060
5	1090
10	1110
15	1150
38	1220
76	1340
118	1420
167	1500



Test Pit Log

Depth (m)	Description
0.0 - 0.3	TOPSOIL: slightly silty sandy CLAY
0.3 - 1.6	Slightly gravelly silty fine to coarse SAND. Gravel is sub angular to sub rounded fine to coarse o

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Test No. SA1

Soil Infiltration Rate in Accordance with BR365

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

Where:

V_{p75-25} is the effective storage volume of water in the trial pit between 75% and 25% effective depth;

a_{p50} is the internal surface area of the trial pit up to 50% effective depth and including the base area

t_{p75-25} is the time for the water level to fall from 75% to 25% effective depth

Initial parameters

Depth to water = **1010** mm Average water depth: **345** mm
 Start time = **0** min Change in water depth: **490** mm

Final parameters

Depth to water = **1500** mm Time interval: **167** min
 End time = **167** min

Effective Storage Volume of Water in the Trial Pit = **0.6608** m³
 75% Effective Depth = **1158** mm from ground level
 25% Effective Depth = **1453** mm from ground level
 Time at 75% Effective Depth = **17** minutes
 Time at 25% Effective Depth = **143** minutes

V_{p75-25} = **0.33** m³
 a_{p50} = **2.42** m²
 t_{p75-25} = **7560** sec
 f = **1.8E-05** m/sec

Average Soakaway Rate = **5.5E-05** m³/sec
 Average soakaway area = **2.64** m² (sides + base)

BR365 Soil Infiltration Rate = 1.8E-05 m/sec
Average Infiltration Rate = 2.1E-05 m/sec

f poorly cemented sandstone.

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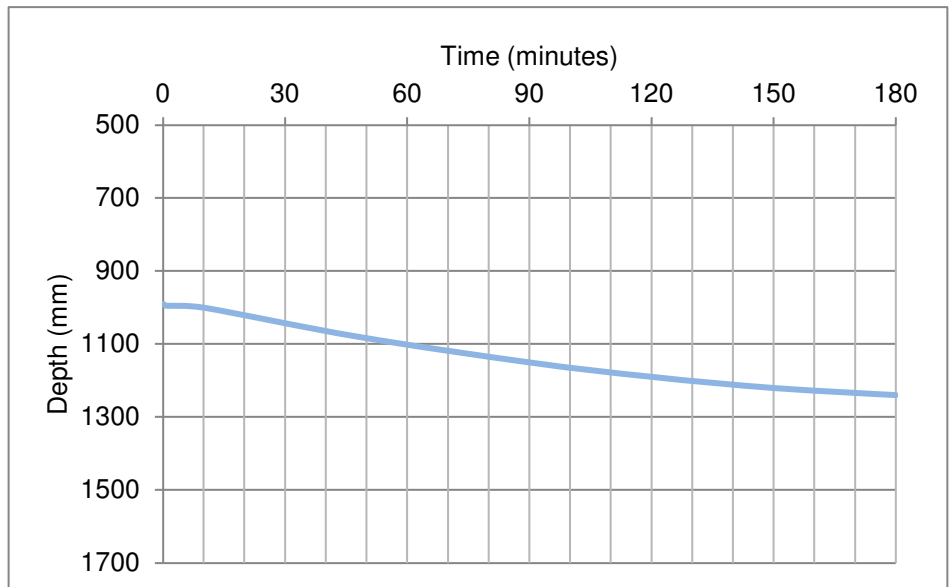
Test No. SA1 (Test 2)

Test Pit Dimensions

Length = **1400** mm Plan area = **1.12** m²
Width = **800** mm
Depth = **1600** mm (Total depth)

Approximate time to discharge water into the hole: **20** Seconds
Depth to water after completion of pumping: **990** mm

Time (min)	Depth (mm)
0	990
1	995
10	1000
48	1080
90	1150
120	1190
150	1220
180	1240



Test Pit Log

Depth (m)	Description
0.0 - 0.3	TOPSOIL: slightly silty sandy CLAY
0.3 - 1.6	Slightly gravelly silty fine to coarse SAND. Gravel is sub angular to sub rounded fine to coarse o

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Test No. SA1 (Test 2)

Soil Infiltration Rate in Accordance with BR365

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

Where:

V_{p75-25} is the effective storage volume of water in the trial pit between 75% and 25% effective depth;

a_{p50} is the internal surface area of the trial pit up to 50% effective depth and including the base area

t_{p75-25} is the time for the water level to fall from 75% to 25% effective depth

Initial parameters

Depth to water = **990** mm Average water depth: **485** mm
 Start time = **0** min Change in water depth: **250** mm

Final parameters

Depth to water = **1240** mm Time interval: **180** min
 End time = **180** min

Effective Storage Volume of Water in the Trial Pit = **0.6832** m³
 75% Effective Depth = **1143** mm from ground level
 25% Effective Depth = **1448** mm from ground level
 Time at 75% Effective Depth = **88** minutes
 Time at 25% Effective Depth = **N/A** minutes

V_{p75-25} = **0.34** m³
 a_{p50} = **2.46** m²
 t_{p75-25} = **-5280** sec
 f = **-2.6E-05** m/sec

Average Soakaway Rate = **2.6E-05** m³/sec
 Average soakaway area = **3.25** m² (sides + base)

BR365 Soil Infiltration Rate = N/A m/sec
Average Infiltration Rate = 8.0E-06 m/sec

f poorly cemented sandstone.

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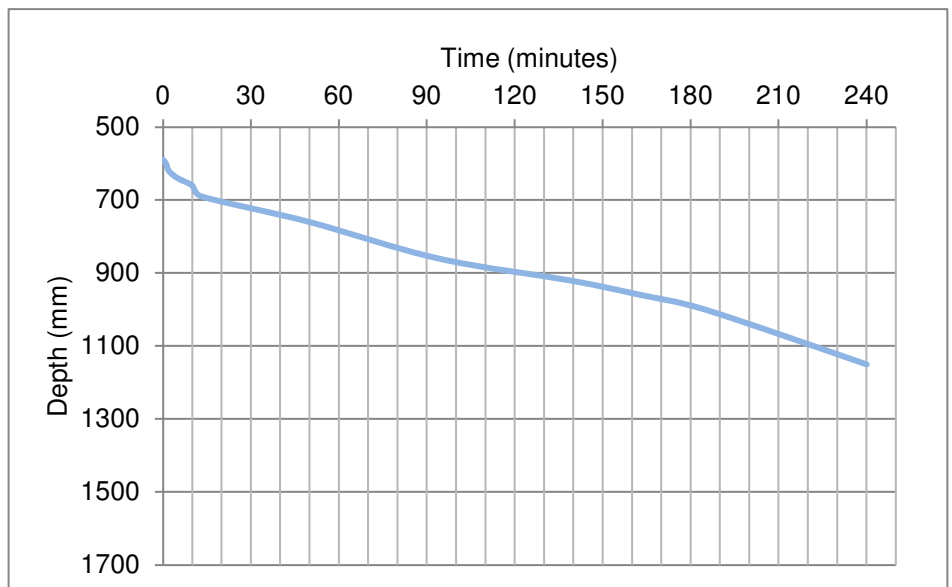
Test No. SA2

Test Pit Dimensions

Length = **1400** mm Plan area = **1.12** m²
Width = **800** mm
Depth = **1200** mm (Total depth)

Approximate time to discharge water into the hole: **20** Seconds
Depth to water after completion of pumping: **590** mm

Time (min)	Depth (mm)
0	590
1	600
2	620
5	640
10	660
13	690
50	760
94	860
139	920
163	960
185	1000
240	1150



Test Pit Log

Depth (m)	Description
0.0 - 0.3	TOPSOIL: slightly silty sandy CLAY
0.3 - 1.2	Slightly gravelly silty fine to coarse SAND. Gravel is sub angular to sub rounded fine to coarse o

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Test No. SA2

Soil Infiltration Rate in Accordance with BR365

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

Where: V_{p75-25} is the effective storage volume of water in the trial pit between 75% and 25% effective depth;

a_{p50} is the internal surface area of the trial pit up to 50% effective depth and including the base area

t_{p75-25} is the time for the water level to fall from 75% to 25% effective depth

Initial parameters

Depth to water = **590** mm Average water depth: **330** mm
 Start time = **0** min Change in water depth: **560** mm

Final parameters

Depth to water = **1150** mm Time interval: **240** min
 End time = **240** min

Effective Storage Volume of Water in the Trial Pit = **0.6832** m³
 75% Effective Depth = **743** mm from ground level
 25% Effective Depth = **1048** mm from ground level
 Time at 75% Effective Depth = **45** minutes
 Time at 25% Effective Depth = **200** minutes

V_{p75-25} = **0.34** m³
 a_{p50} = **2.46** m²
 t_{p75-25} = **9300** sec
 f = **1.5E-05** m/sec

Average Soakaway Rate = **4.4E-05** m³/sec
 Average soakaway area = **2.57** m² (sides + base)

BR365 Soil Infiltration Rate = 1.5E-05 m/sec
Average Infiltration Rate = 1.7E-05 m/sec

f poorly cemented sandstone.

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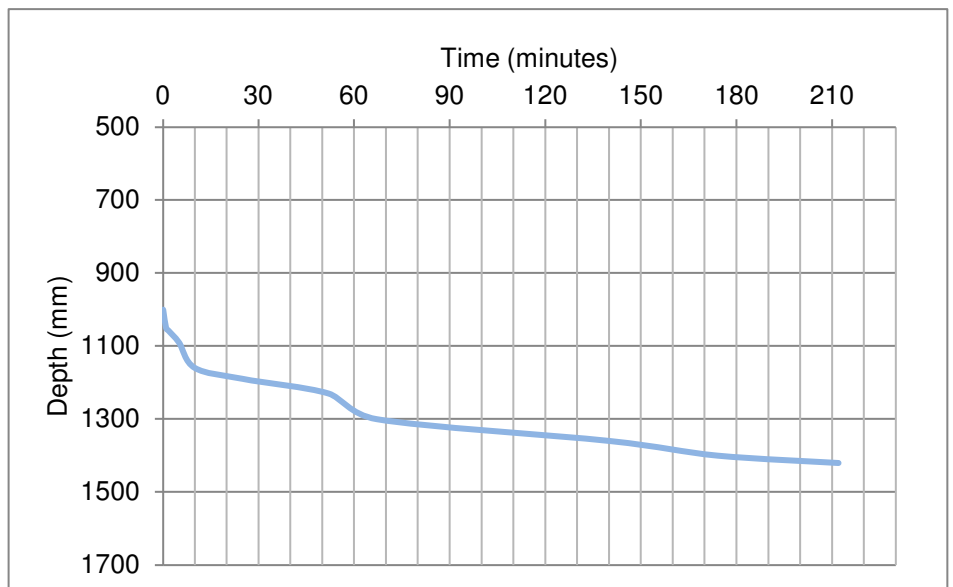
Test No. SA3

Test Pit Dimensions

Length = **1300** mm Plan area = **1.04** m²
 Width = **800** mm
 Depth = **1600** mm (Total depth)

Approximate time to discharge water into the hole: **20** Seconds
 Depth to water after completion of pumping: **1000** mm

Time (min)	Depth (mm)
0	1000
1	1050
2	1060
5	1090
10	1160
25	1190
52	1230
67	1300
140	1360
174	1400
212	1420



Test Pit Log

Depth (m)	Description
0.0 - 0.3	TOPSOIL: slightly silty sandy CLAY
0.3 - 1.6	Slightly gravelly silty fine to coarse SAND. Gravel is sub angular to sub rounded fine to coarse o

PROJECT:	Lockwood Road, Golthorpe	Job No. 44271	Date 09.12.20
SUBJECT:	Infiltration Test Results and Calculation of Infiltration Rates	Prepared LW	Checked

Test No. SA3

Soil Infiltration Rate in Accordance with BR365

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

Where:

V_{p75-25} is the effective storage volume of water in the trial pit between 75% and 25% effective depth;

a_{p50} is the internal surface area of the trial pit up to 50% effective depth and including the base area

t_{p75-25} is the time for the water level to fall from 75% to 25% effective depth

Initial parameters

Depth to water = **1000** mm Average water depth: **390** mm
 Start time = **0** min Change in water depth: **420** mm

Final parameters

Depth to water = **1420** mm Time interval: **212** min
 End time = **212** min

Effective Storage Volume of Water in the Trial Pit = **0.624** m³
 75% Effective Depth = **1150** mm from ground level
 25% Effective Depth = **1450** mm from ground level
 Time at 75% Effective Depth = **9** minutes
 Time at 25% Effective Depth = **N/A** minutes

V_{p75-25} = **0.31** m³
 a_{p50} = **2.30** m²
 t_{p75-25} = **-540** sec
 f = **-2.5E-04** m/sec

Average Soakaway Rate = **3.4E-05** m³/sec
 Average soakaway area = **2.68** m² (sides + base)

BR365 Soil Infiltration Rate = N/A m/sec
Average Infiltration Rate = 1.3E-05 m/sec

f poorly cemented sandstone.

PROJECT:	Lockwood Road, Golthorpe	Job No. 44271	Date 09.12.20
SUBJECT:	Infiltration Test Results and Calculation of Infiltration Rates	Prepared LW	Checked

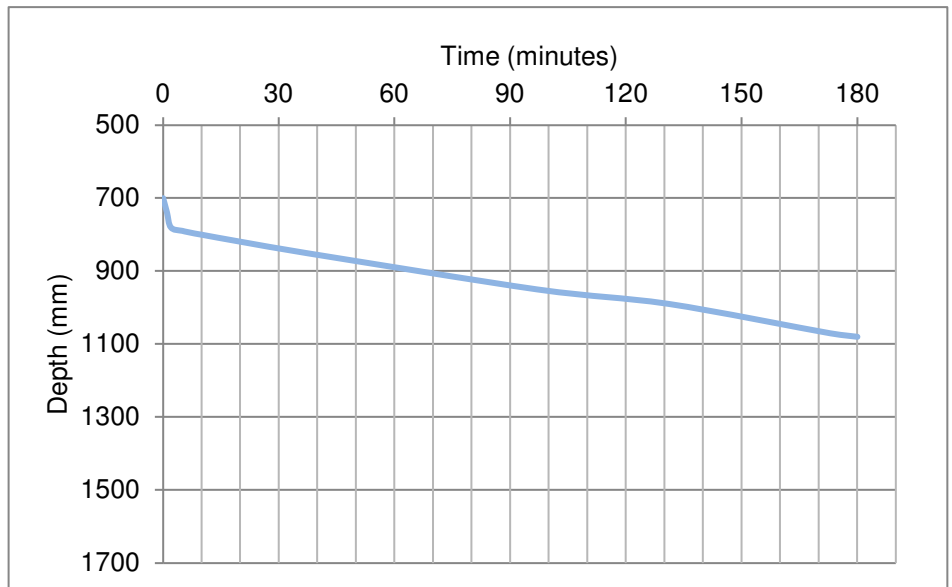
Test No. SA4

Test Pit Dimensions

Length = **1400** mm Plan area = **1.12** m²
Width = **800** mm
Depth = **1400** mm (Total depth)

Approximate time to discharge water into the hole: **20** Seconds
Depth to water after completion of pumping: **700** mm

Time (min)	Depth (mm)
0	700
1	740
2	780
5	790
10	800
37	850
97	950
131	990
173	1070
180	1080



Test Pit Log

Depth (m)	Description
0.0 - 0.3	TOPSOIL: slightly silty sandy CLAY
0.3 - 1.3	Slightly gravelly silty fine to coarse SAND. Gravel is sub angular to sub rounded fine to coarse o

PROJECT:	Lockwood Road, Golthorpe	Job No. 44271	Date 09.12.20
SUBJECT:	Infiltration Test Results and Calculation of Infiltration Rates	Prepared LW	Checked

Test No. SA4

Soil Infiltration Rate in Accordance with BR365

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

Where: V_{p75-25} is the effective storage volume of water in the trial pit between 75% and 25% effective depth;

a_{p50} is the internal surface area of the trial pit up to 50% effective depth and including the base area

t_{p75-25} is the time for the water level to fall from 75% to 25% effective depth

Initial parameters

Depth to water = **700** mm Average water depth: **510** mm
 Start time = **0** min Change in water depth: **380** mm

Final parameters

Depth to water = **1080** mm Time interval: **180** min
 End time = **180** min

Effective Storage Volume of Water in the Trial Pit = **0.784** m³
 75% Effective Depth = **875** mm from ground level
 25% Effective Depth = **1225** mm from ground level
 Time at 75% Effective Depth = **38** minutes
 Time at 25% Effective Depth = **N/A** minutes

V_{p75-25} = **0.39** m³
 a_{p50} = **2.66** m²
 t_{p75-25} = **-2280** sec
 f = **-6.5E-05** m/sec

Average Soakaway Rate = **3.9E-05** m³/sec
 Average soakaway area = **3.36** m² (sides + base)

BR365 Soil Infiltration Rate = N/A m/sec
Average Infiltration Rate = 1.2E-05 m/sec

APPENDIX D

Yorkshire Water pre-development advice



YorkshireWater

Mr J O'Connor
JOC Consultants Ltd
Park Farm House
Leatheley Lane
Leathley
LS21 2JU
john@jocconsultants.co.uk

Yorkshire Water Services
Developer Services
Pre-Development Team
PO BOX 52
Bradford
BD3 7AY

Tel: 0345 120 8482

Fax:

Your Ref:
Our Ref: W017931

Email:
technical.sewerage@yorkshirewater.co.uk

For telephone enquiries ring:
Chris Roberts on 0345 120 8482

11th January 2021

Dear Mr O'Connor,

**Land East Of Lockwood Road, Goldthorpe, S63 9FL – Pre Planning
Sewerage Enquiry U078790**

Thank you for your recent enquiry and remittance. Our official VAT receipt has been sent to you under separate cover. Please find enclosed a complimentary extract from the Statutory Sewer Map which indicates the recorded position of the public sewers. Please note that as of October 2011 and the private to public sewer transfer, there are many uncharted Yorkshire Water assets currently not shown on our records.

The following comments reflect our view, with regard to the public sewer network only, based on a 'desk top' study of the site and are valid for a maximum period of twelve months:



YorkshireWater

Existing Infrastructure

There is a 225 mm diameter public surface water sewer recorded crossing the site. No buildings, or other obstructions, are to be erected within 3 (three) metres, nor trees planted within 5 (five) metres of this public sewer.

There is a 525 mm diameter public surface water sewer recorded crossing the site. No buildings, or other obstructions, are to be erected within 3.5 (three point five) metres, nor trees planted within 5 (five) metres of this public sewer.

It may not be acceptable to raise or lower ground levels over the sewer, nor to restrict access to the manholes on the sewer. If you wish to have this sewer diverted under Section 185 of the Water Industry Act 1991 an application should be made in writing. To discuss this matter, please telephone 0345 120 84 82.

Foul Water

Development of the site should take place with separate systems for foul and surface water drainage. The separate systems should extend to the points of discharge to be agreed.

Foul water domestic waste can discharge to the 375 mm diameter public combined sewer recorded in Hamilton Road, at a point to the south of the site.

From the information supplied, it is not possible to determine if the whole site will drain by gravity to the public sewer network. If the site, or part of it, will not drain by gravity, then it is likely that a sewage pumping station will be required to facilitate connection to the public sewer network. If sewage pumping is required foul water discharge must not exceed 4.7 (four point seven) litres per second. This permission is not an acceptance in respect to any planning conditions imposed under the Grant of Planning Permission.



Surface Water

The developer's attention is drawn to Requirement H3 of the Building Regulations 2000. This establishes a preferred hierarchy for surface water disposal. Consideration should firstly be given to discharge to soakaway, infiltration system and watercourse in that priority order.

Sustainable Drainage Systems (SuDS), for example the use of soakaways and/or permeable hardstanding etc, may be a suitable solution for surface water disposal appropriate in this situation. You are advised to seek comments on the suitability of SuDS in this instance from the appropriate authorities.

As the proposed site is currently undeveloped no surface water is known to have previously discharged to the public sewer network

As such, the local public sewer network does not have capacity to accept any surface water from the proposed site. If SuDS are not viable, the developer is advised to contact the Environment Agency/local Land Drainage Authority/Internal Drainage Board* with a view to establishing a suitable watercourse (if any nearby*) for discharge.

It is understood that a watercourse is located to the north west of the site. This appears to be the obvious place for surface water disposal (if SuDS are not viable). Please note Yorkshire Water cannot provide plans of culverted watercourses or highway drains. To obtain plans please contact the Lead Local Flood Authority for more details.

As a last resort and subject to providing satisfactory evidence as to why the other methods of surface water disposal have been discounted, curtilage surface water may discharge to the 525 mm diameter public surface water sewer recorded crossing the site.

The surface water discharge from the site to be restricted to not greater than 3.5 (three point five) litres/second. This permission is not an acceptance in respect to any planning conditions imposed under the Grant of Planning Permission.



Please note further restrictions on surface water disposal from the site may be imposed by other parties. You are strongly advised to seek advice/comments from the Environment Agency/Land Drainage Authority/Internal Drainage Board, with regard to surface water disposal from the site.

Other Observations

Any new connection to an existing public sewer will require the prior approval of Yorkshire Water. You may apply on line or obtain an application form from our website (www.yorkshirewater.com) or by telephoning 0345 120 84 82.

An off-site foul and surface water sewer may be required which may be provided by the developer and considered for adoption under Section 104 of the Water Industry Act 1991. Please telephone 0345 120 84 82 for advice on sewer adoptions. Alternatively, the developer may in certain circumstances be able to requisition off-site sewers under Section 98 of the Water Industry Act 1991 for which an application must be made in writing. For further information, please telephone 0345 120 84 82.

Prospectively adoptable sewers and pumping stations must be designed and constructed in accordance with the WRc publication "Sewers for Adoption – a design and construction guide for developers" 6th Edition as supplemented by Yorkshire Water's requirements, pursuant to an agreement under Section 104 of the Water Industry Act 1991. An application to enter into a Section 104 agreement must be made in writing prior to any works commencing on site. Please contact our Developer Services Team (telephone 0345 120 84 82) for further information.

All the above comments are based upon the information and records available at the present time and is subject to formal planning approval agreement. The information contained in this letter together with that shown on any extract from the Statutory Sewer Map that may be enclosed is believed to be correct and is supplied in good faith.

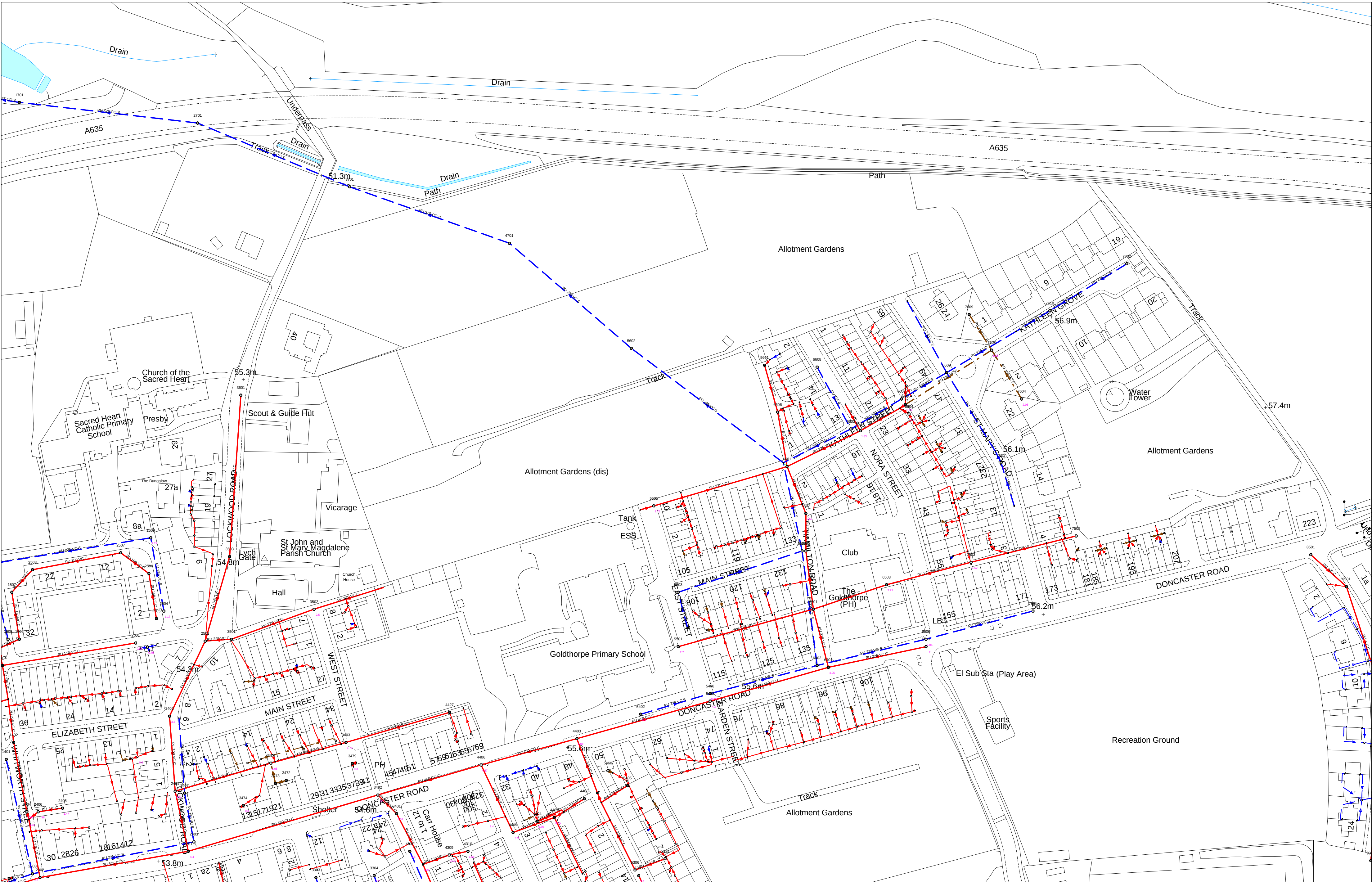


YorkshireWater

Please note that capacity in the public sewer network is not reserved for specific future development. It is used up on a 'first come, first served' basis. You should visit the site and establish the line and level of any public sewers affecting your proposals before the commencement of any design work.

Yours sincerely

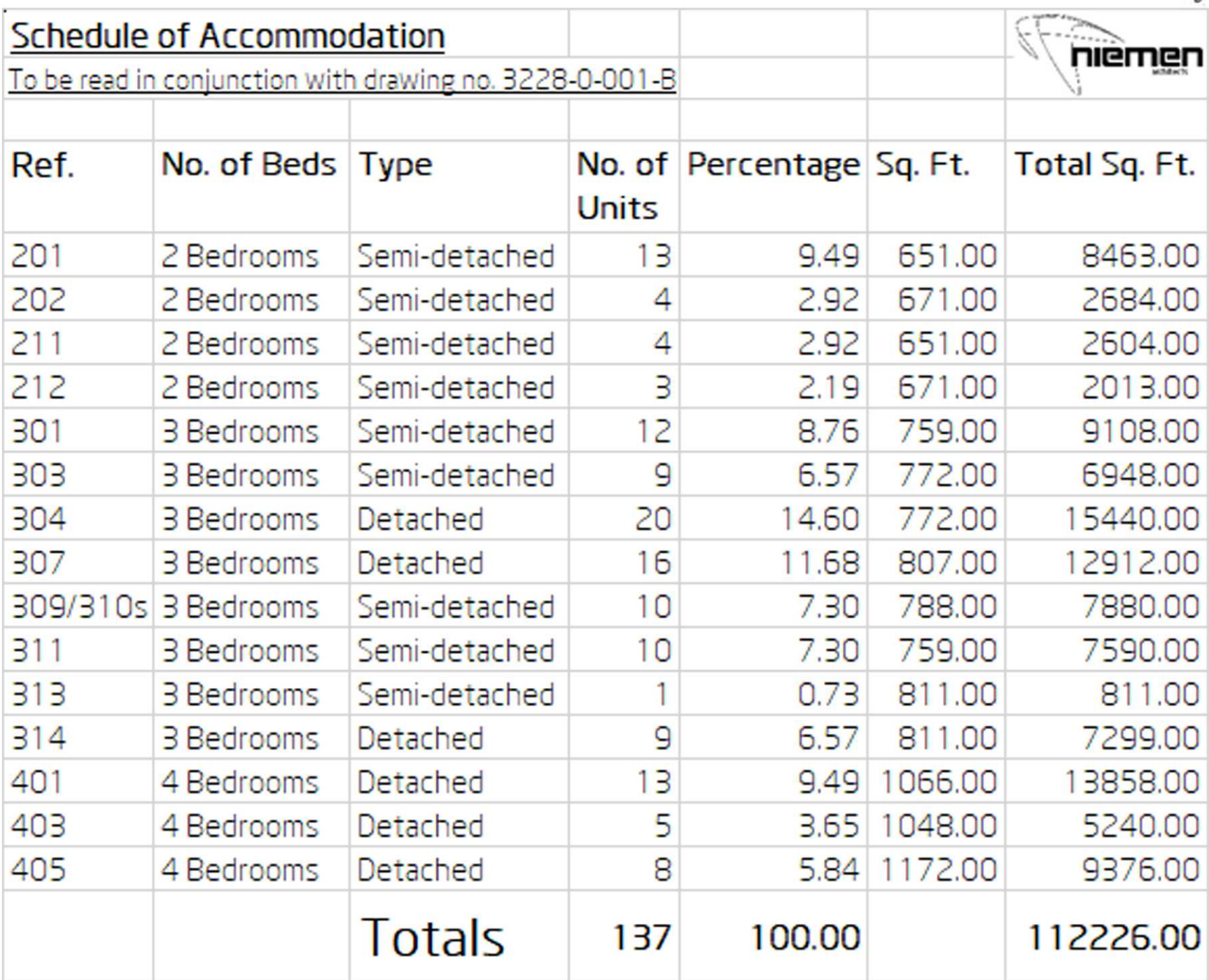
Chris Roberts
Development Services Technician



446454 : 404553		Map Name : SE4604SW	Title	Partial Key		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.	
		Yorkshire Water, PO Box 500, Halifax Road, Bradford BD6 2LZ Contact Name : YorMap Advisor C ROBERTS Contact Tel : 87 2582	Notes	Foul Sewer = F Combined Sewer = C Surface Water Sewer = SW Trade Sewer = TD Partially Separate = PS			
			(Ody) COPYRIGHT STATEMENTS: Reproduced by permission of Ordnance Survey on behalf of HMSO © Crown copyright and database 2014. All rights reserved Ordnance Survey Licence number 100022432	Date Req : 11/01/2021, 14:10:25			Date Gen : 11/01/2021, 14:19:08
				Source : Sewer Network Enquiry			

APPENDIX E

Schematic Site Layout Plan



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



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

APPENDIX F

Fluvial Flood Map

Flood map for planning

Your reference
20/032

Location (easting/northing)
446520/404685

Created
22 Mar 2021 9:24

Your selected location is in flood zone 1, an area with a low probability of flooding.

This means:

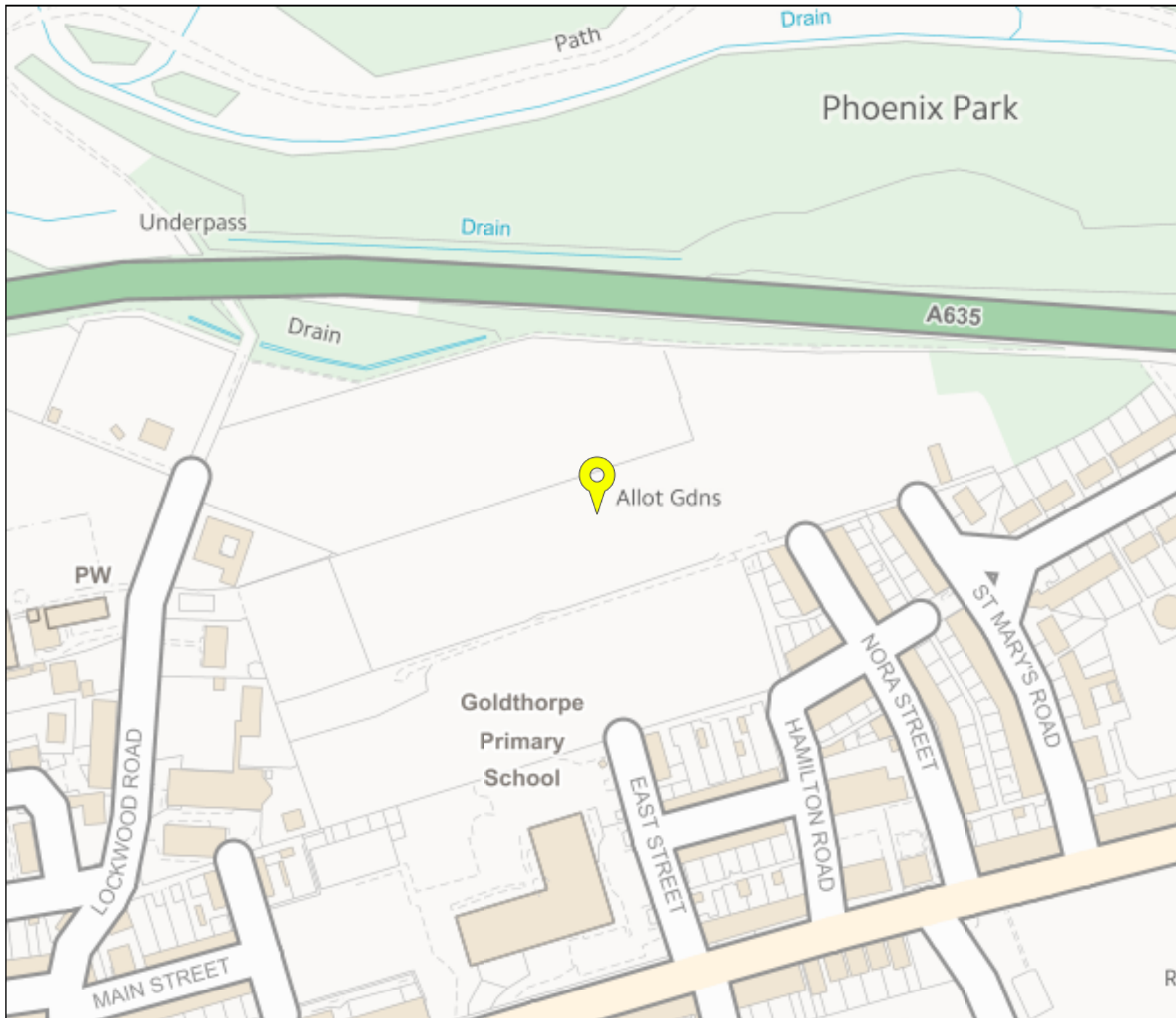
- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

The Open Government Licence sets out the terms and conditions for using government data.
<https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>



Flood map for planning

Your reference
20/032

Location (easting/northing)
446520/404685

Scale
1:2500

Created
22 Mar 2021 9:24

-  Selected point
-  Flood zone 3
-  Flood zone 3: areas benefitting from flood defences
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Flood storage area



 0 20 40 60m

APPENDIX G

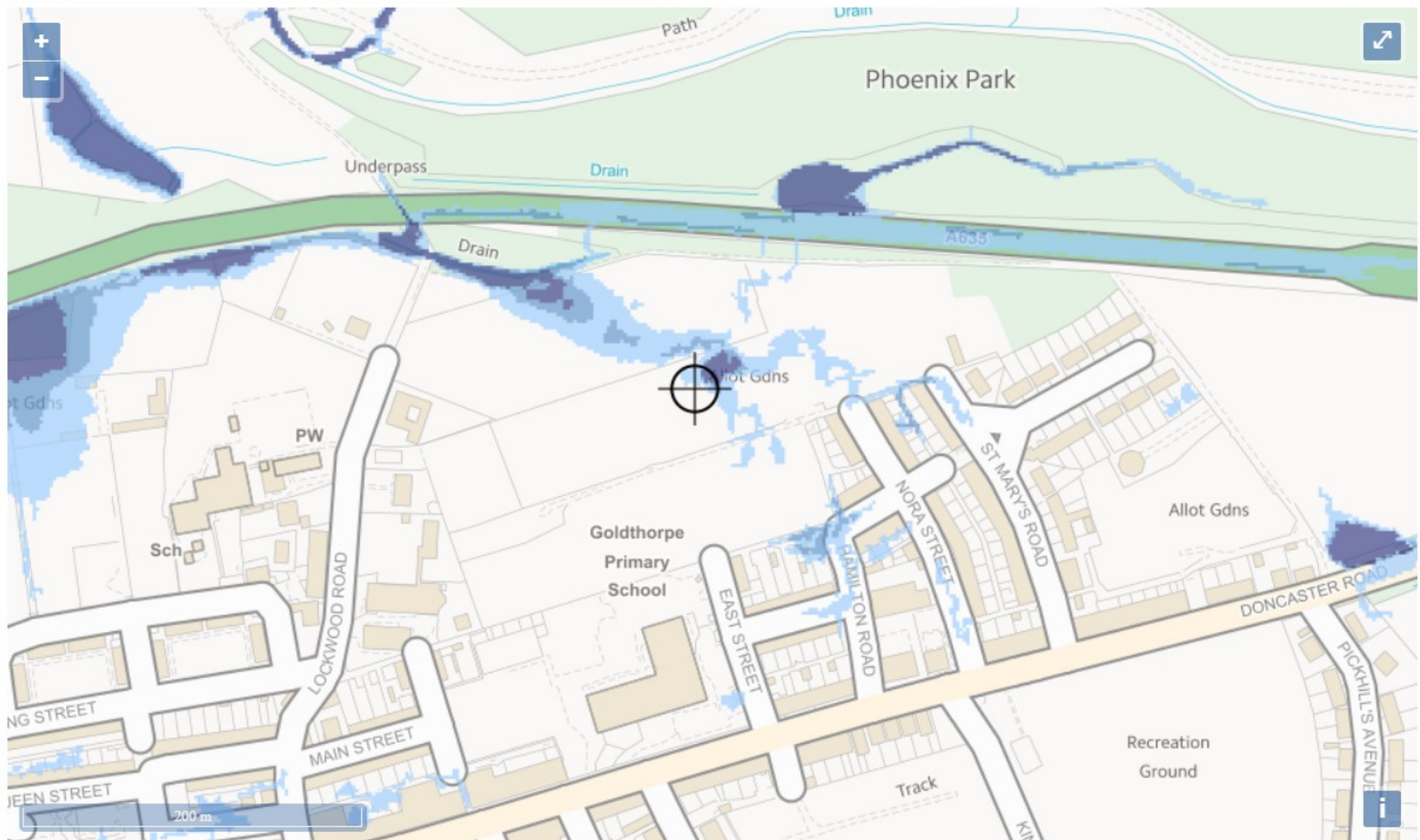
Surface water flood map

Flood risk

Location

Extent of flooding

Lockwood Road, Goldthorpe



Extent of flooding from surface water

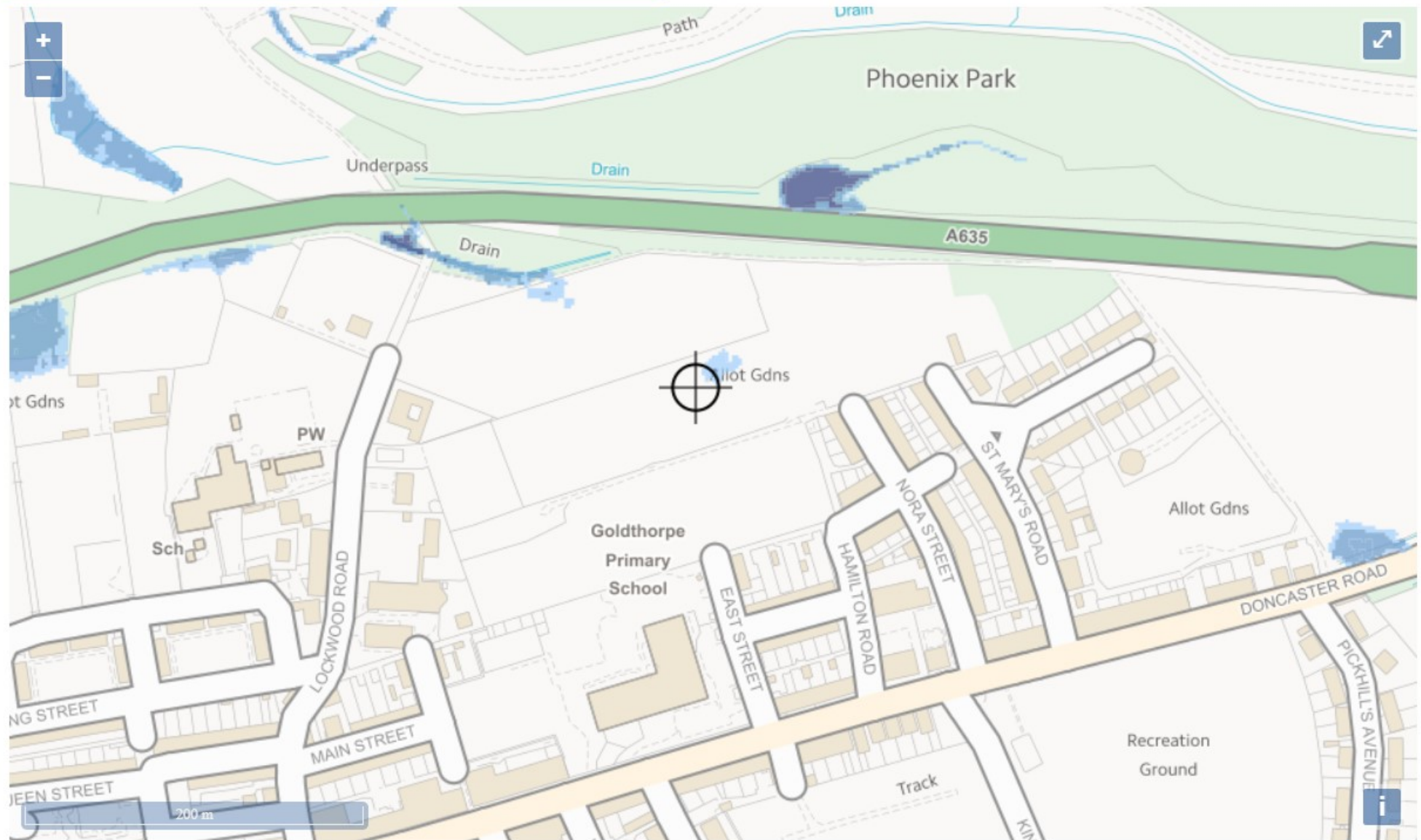
● [High](#) ● [Medium](#) ● [Low](#) ○ [Very low](#) ⊕ Location you selected

Flood risk

Location

High risk: depth

Lockwood Road, Goldthorpe



Surface water flood risk: water depth in a high risk scenario

Flood depth (millimetres)

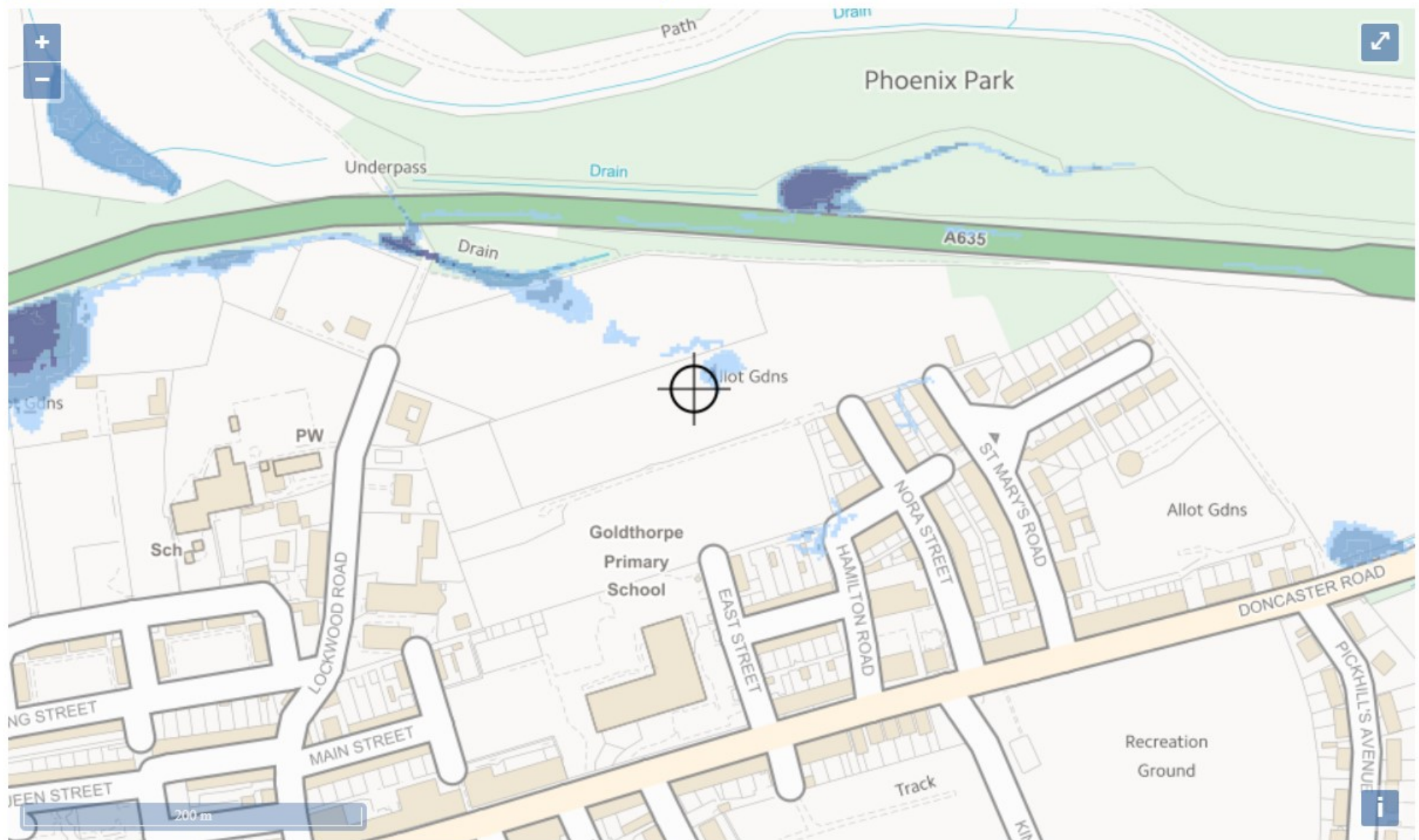
Over 900mm 300 to 900mm Below 300mm Location you selected

Flood risk

Location

Medium risk: depth

Lockwood Road, Goldthorpe



Surface water flood risk: water depth in a medium risk scenario

Flood depth (millimetres)

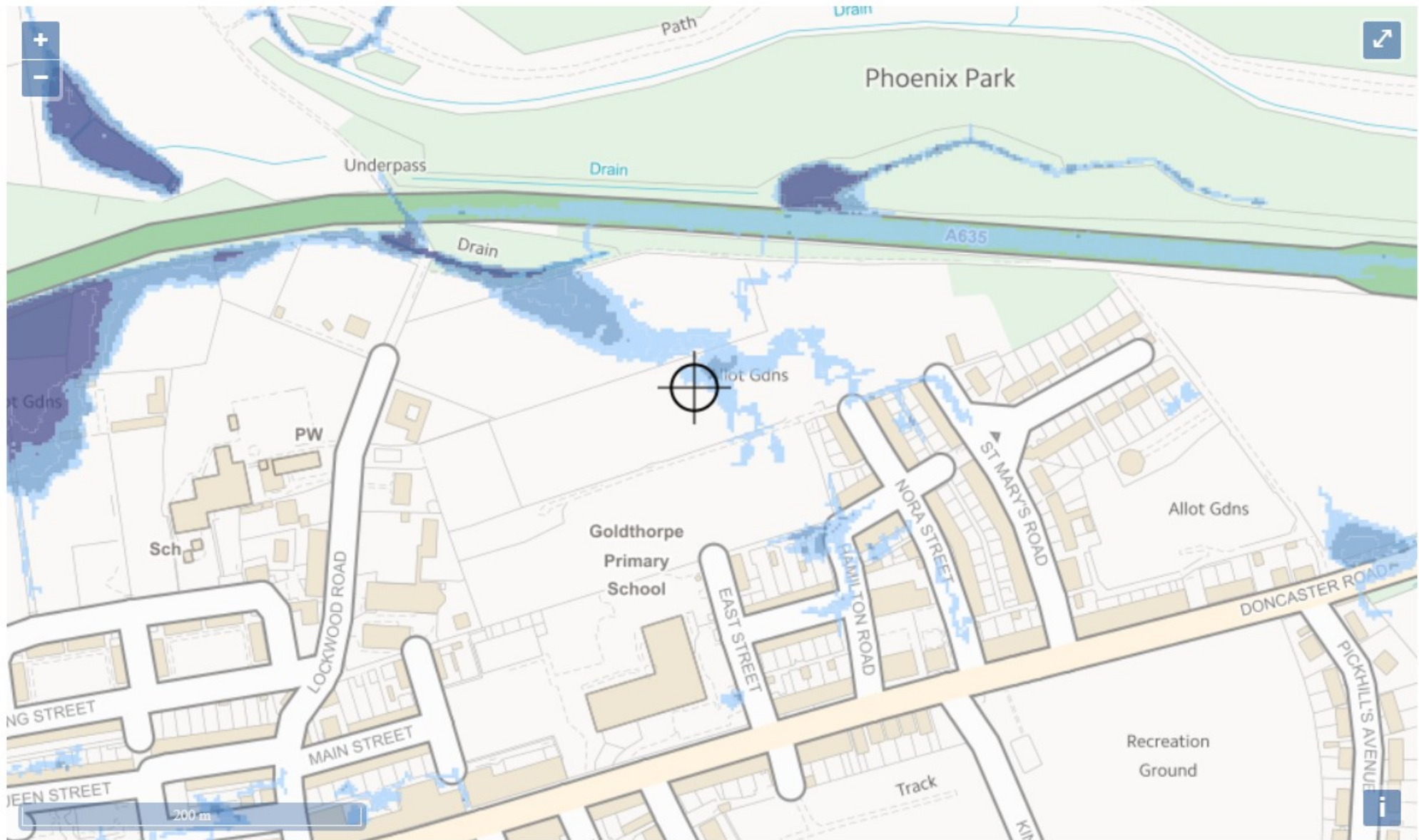
Over 900mm 300 to 900mm Below 300mm Location you selected

Flood risk

Location

Low risk: depth

Lockwood Road, Goldthorpe



Surface water flood risk: water depth in a low risk scenario

Flood depth (millimetres)

Over 900mm 300 to 900mm Below 300mm Location you selected

APPENDIX H

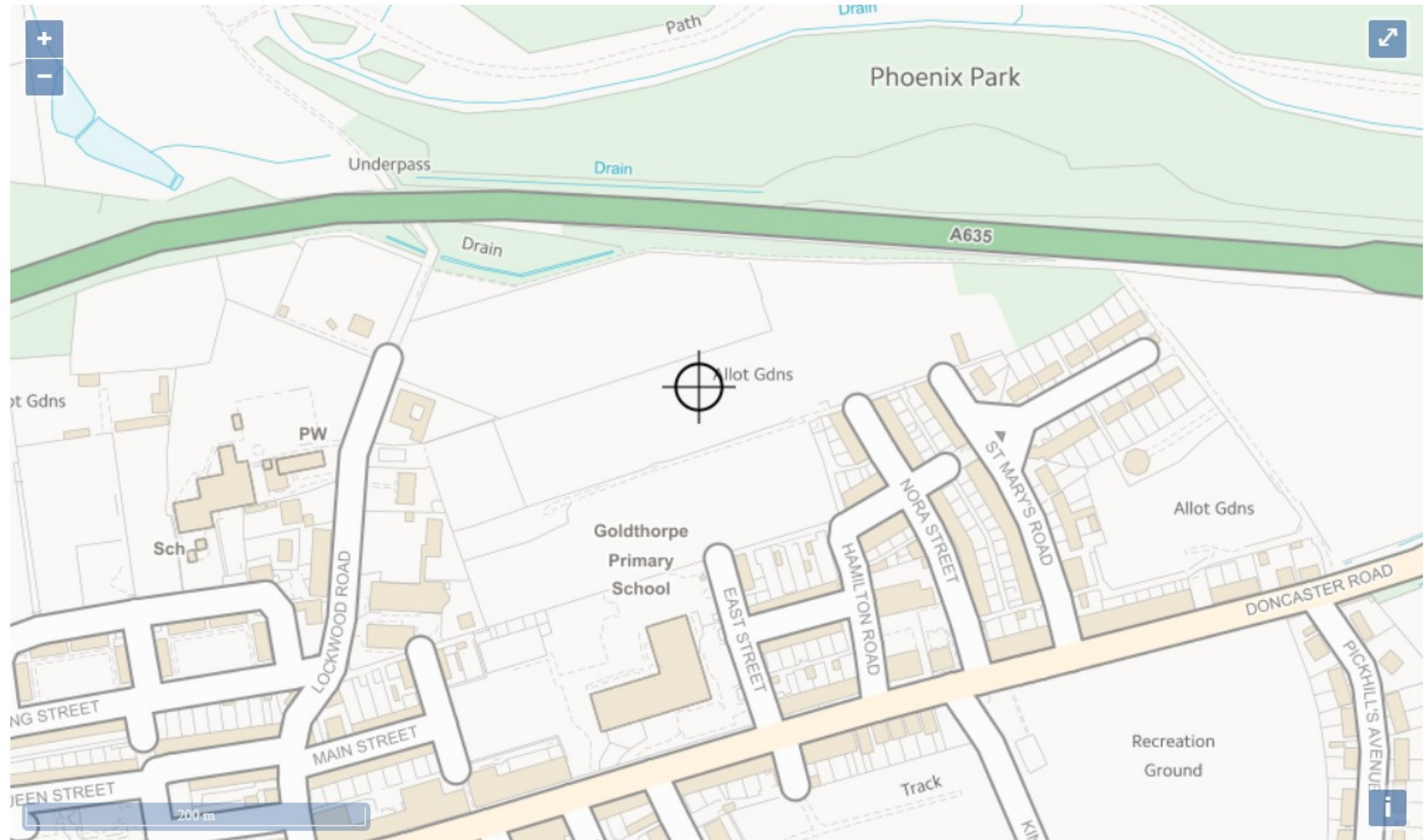
Reservoirs flood map

Flood risk

Location

Extent of flooding

Lockwood Road, Goldthorpe



Extent of flooding from reservoirs

● Maximum extent of flooding ⊕ Location you selected

APPENDIX I

ReFH2 estimates of runoff rates and volumes

20/032: Lockwood Road, Goldthorpe

APPENDIX I: REFH estimates of runoff rates and volumes

Description	Return period (yrs)	Urbanised peak flow (l/s)	Urbanised direct runoff (m ³)	As-rural peak flow (l/s)	As-rural direct runoff (m ³)	Increase factor in peak flow rate	Increase factor in volume
1 year	1	39.31	481.62	14.54	180.37	2.29	2.21
2 year	2	44.82	550.19	16.65	208.37	2.31	2.20
5 year	5	63.69	786.38	24.20	308.96	2.33	2.16
10 year	10	77.89	965.12	30.17	389.22	2.32	2.12
30 year	30	103.64	1291.25	41.61	544.41	2.30	2.07
50 year	50	118.18	1476.49	48.40	637.34	2.28	2.04
75 year	75	131.54	1647.50	54.86	726.09	2.26	2.02
100 year	100	142.16	1783.86	60.13	798.81	2.24	2.00
100 year 1.2 CC	100	171.86	2167.54	75.53	1012.40	2.19	1.95
100 year 1.4 CC	100	202.02	2560.20	92.10	1243.93	2.14	1.90
200 year	200	171.96	2168.85	75.58	1013.15	2.19	1.95
1000 year	1000	258.12	3298.53	125.33	1711.81	2.06	1.82
					Average:	2.24	2.04
Hydrological Region		3					
QMED/Qbar factor		0.94					
Qbar		17.72 l/s					
Area		4.68 ha					
Rate/ha		3.79 l/s per ha					

Attenuation storage estimate

Discharge rate		17.72 l/s
Duration		3.5 h
Discharge volume		223.22 m3
Storage volume	20% CCA	1,944.32
	40% CCA	2,336.98
Additional storage: 40% CCA:		392.66 m3

End of Report