Haigh Huddleston & Associates
Civil Structural Engineering Consultants

Firth Buildings, 99-101 Leeds Road, Dewsbury, WF12 7BU t 01924 464342 f 01924 450662
e trevor.haigh@haighhuddleston.co.uk

FLOOD RISK ASSESSMENT

ON

WAKEFIELD ROAD/MILL HILL ROAD, PONTEFRACT

FOR

Mr R Wheatherhead

E19/7533/FRA001

July 2019

T. Haigh B.Sc., C.Eng., M.I.C.E.

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1.0 INTRODUCTION

1.1 This report is commissioned to investigate and report on the Flood Risk for this site in accordance with Planning Practise Guidance- Flood Risk and Coastal Change April 2015 (PPG-FRCC) . The report is based on information supplied by the client and from relevant authorities in both written and verbal format. Some of this information is in verbal form only. No liability can be accepted for information supplied by third parties which is subsequently found to be inaccurate or incorrect.

2.0 THE SITE

2.1 The site is located to the south of Wakefield Road, Pontefract and is situated around Ordnance Survey grid reference 445279, 421457. A site location plan is included in Appendix A.

2.2 The site is L-shaped, with one leg connecting onto Wakefield Road to the North. The other leg extends to the west behind properties fronting onto Wakefield Road. There are residential properties to the south, north and east, while to the west is allotments. The site area is approximately 1.1ha.

2.3 Adjacent Wakefield Road in the north of the site is the dilapidated remains of a two storey brick building with a surrounding tarmac area. In the west of the site there were several brick and wood built garages/shed, some with asbestos sheet roofing and an unmade access track.

2.4 A boarded up opening was noted on site to the south of The Priory, this has been marked on the site location plan. This could be an adit/shaft used to access the Basal Permean Sand workings to the south of the site.

2.5 The remainder of the site was heavily overgrown, with mature tree growth throughout the site. There were exposed sandstone outcrops from the former quarrying works on site up to 8m in height. There was evidence of fly tipping throughout the site, and at the time of the site visit there was a small unsupervised bonfire alight toward the west of the site. The location of this has been indicated on the site survey in Appendix A.

2.6 The site generally falls from the south-west to the north-east. The site is extensively terraced from the former quarrying works. A high point of 74.70m is located in the south western corner of the site and a low point of 59.50m on the northern boundary.

2.7 A number of historical Ordnance Survey plans from 1854-2012 have been consulted. These generally show that prior to 1890 the site was not developed for any uses but then was used as a sand quarry.

3.0 SITE GEOLOGY & MINING

3.1 The BGS Digital Geological Map of Great Britain at 1:50,000 scale has been consulted and we would report as follows:-

3.2 No made or infilled ground is shown within 1000m of the site. However, there are several areas of unspecified ground workings, pits and quarries located in the southern half of the site and just to the south of the site associated with sandstone and silica sand workings. It is possible that these have been infilled historically.

3.3 The majority of the site is shown to be underlain by Newstead Rock consisting of sandstone. The south west corner of the site is underlain by the Cadeby Formation consisting of dolostone, and the south east corner of the site is underlain by the Yellow Sands Formation consisting of sandstone. There is a low possibility of running sands in the south of the site.

3.4 The nearest fault line is shown starting on the eastern boundary and heading to the east.

3.5 The property is in the likely zone of influence from workings in 2 seams of coal at 420m to 650m depth, and last worked in 1985. Any ground movement from these coal workings should have stopped by now. The property is not in an area that is likely to be affected at the surface from any planned future workings. However, reserves of coal exist in the local area which could be worked at some time in the future.There are two coal mining subsidence claims 20m to the north of the site. There are no known coal

mine entries within, or within 20m, of the site boundary but there is an adit found on site that may access the sand and sandstone workings..

3.6 In addition to the coal mining, there has been Basal Permean Sand mining immediately to the south of the site. It is highly likely there is underground workings located on site.

3.7 BGS surveys confirm exposed Basal Permean Sand adjacent the southern site boundary, and there are two known adits located to the south east of the site. The site walkover identified a possible adit/shaft on site. This has been indicated on the site survey in Appendix A.

4.0 EXISTING DRAINAGE

4.1 Groundwater

The majority of the bedrock underlying the site is classified as a Secondary (A) Aquifers. Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers. Immediately to the south of the site, and encroaching onto the southern boundary, the bedrock is classified as a Primary Aquifer. This is geology of high intergranular and/or fracture permeability, usually providing a high level of water storage and may support water supply/river base flow on a strategic scale. There are no groundwater abstraction licences recorded within 250m of the site. There are no recorded discharge consents within 250m of the site. There are no recorded surface water abstractions within 250m of the site. There are no recorded pollution incidents in controlled waters within 250m of the site. The site is not in a source protection zone.

4.2 The nearest open surface water feature is Wash Dike watercourse located 244m to the north east. This is classified as a primary river and is part of the River Calder system.

5.0 PROPOSED SURFACE WATER DRAINAGE

5.1 The nearest Public sewers are the existing combined and surface water sewers in Wakefield Road. These are shown as 300mm increasing to 675mm diameter for the surface water and 450mm for the combined water pipes. These run along the highway to the east away from the site to the east. These sewers currently service the site and should be able to service the site.

5.2 The depth of the existing sewers should be confirmed to determine whether a pumping station will be required at some point on the site.

5.3 Yorkshire Water report that there is no capacity for any additional surface water discharges from the site into the existing public sewerage system. They would prefer that surface water is routed to watercourses were possible. City of Wakefield - Land Drainage will require that any discharge of surface water from the site will have to be attenuated down to agricultural discharge rates of between 2.5 to 5Lit/sec/ha. If connected directly to a watercourse.

5.4 In the first instance and in line with the EA and City of Wakefield - Land Drainage Sustainable Development Policy, the use of infiltration methods have been investigated on site.

5.4.1 Previously a series of soakaway test were carried out on site. The fieldwork included four trial holes undertaken using a JCB equipped with a 600mm wide bucket. Access to areas of the site was restricted by the dense undergrowth, stone retaining walls and the steep banks on site.

5.4.2 Generally, the trial pits revealed made ground and top soils overlying a sand layer, with sandstone bedrock encountered in one of the trial pits. Soakaway testing was only undertaken in three of the trial pits due to the depth of made ground encountered in TP02.

5.4.3 In all soakaway tests, the water level within the trial pit fell with infiltration rates between 0.23×10^{-4} m/s and 0.61×10^{-4} m/s recorded.

5.4.4 Copy correspondence giving detailed information regarding the site geology encountered and the soakaway testing is included in Appendix E.

5.5 The current requirement from Land Drainage Authority in this area would be to limit the site discharges to agricultural levels if infiltration systems are not used or there is a new connection to a watercourse.

5.6 They have not reported any capacity problems for foul water flows into the systems. Yorkshire Water are unlikely to reduce any requirement for storm water storage on the site if it is only partially using infiltration systems. They would wish the developer to follow the hierarchy of the requirements of H3 of the Building Regulations 2000. The preferred hierarchy being soak-aways, infiltration systems and watercourses or main sewers, in that priority order. In this instance we consider that the reduction in surface water discharge rates to agricultural rates will be acceptable to all parties subject to a suitable outfall being determined.

5.7 In the first instance the use of soakaways and infiltration systems should be investigated further following site remediation, and if it appears to be unsuitable based on the testing carried out, then some attenuation of surface water flows would be necessary. The un-attenuated surface water run off from this site could overload the downstream sewers and/or land drainage catchment during severe storms therefore discharges should be managed by the use of surface water storage systems.

5.8 The site currently does not have any significant existing impermeable areas. A full drainage survey should be undertaken to confirm or otherwise what discharges are emanating from the site. If it is the intention to utilise any discharge found as part of the new surface water system for proposed development then attenuation of flows will be required. Further discussions with Yorkshire Water, and City of Wakefield - Land Drainage Department, and the Environment Agency will be necessary to formerly agree discharge rates.

5.9 For the purposes of this report the impermeable area of the original site has been presumed to be zero. We have calculated the agricultural run-off from the existing site to be based on an agricultural rate of 5lit/sec/h.

5.10 The impermeable area for the proposed development is approximately 5500sq.m. This would equate to a peak annual storm run off of around 60lit/sec.

5.11 If the use of infiltration techniques in this area is not agreed then the flows from the site would therefore have to be attenuated to the agricultural discharge rates. The flows will be controlled by a hydraulic flow device such as a Hydrobrake or similar. This would mean that storm-water storage would have to be provided on site. Prior to this however a point of discharge to a surface water sewer or watercourse would have to be agreed with a right to discharge in perpetuity granted. The EA would /may also need to approve any such discharge rate and water quality.

5.12 It is proposed to provide storage in oversize pipes/ detention basins or a tank at the lower south western end of the site prior to discharge off site to the drain. This will be designed to cater for storms up to and including the 100year storm with due allowances for climate change. In accordance with NPPF this would mean an extra 20% based on the site usage and possible duration of development. The levels of the outfall discharge points to the watercourse should allow gravitational discharges for the whole site. The connection to the watercourse may have to be requisitioned and an agreement to discharge in perpetuity obtained from the riparian owner of the watercourse.

5.13 The sizes of the storm water storage facilities would need to determined accurately in the final designs but preliminary calculations have been made and are attached to this report in appendix D. These show that the volumes of storage required would be 173cum for the 30 year storm, 250cum for the 100 year storm, and 372 cu.m for the 100 year storm with 30% allowance for climatic change. This is all in accordance with the National Planning policy Framework Technical guidance issued in March 2012 and previously in PPS 25. The volumes of storage for the 100 year plus climate change can include flooding to roads and designated areas but must ensure that no buildings are flooded. The most economic way of providing this would be in detention basins but these do take up significant areas of land and on a site such as this can become uneconomic. The 100 year plus climate would probably take up and area of 600 sq m once the slopes and planting is introduced which would be excessive on this site.

5.14 If on-site balancing is utilised then the risk to downstream properties would be negligible in relation to flood water flows in the downstream catchment.

5.15 If the measures outlined above are implemented we would consider that the site can be developed in accordance with current Water Authority and Land Drainage Authority requirements. The systems can also be adopted as part of the Public Sewer systems.

6.0 FLOOD RISK

6.1 The site currently falls with flood zone 1 with zone 2 and 3 some distance from the site. The development for residential use is classified as More Vulnerable in Table 2 of the Planning Practise Guidance- Flood Risk and Coastal Change April 2015 (PPG-FRCC) and Table 3 of that document also states that the development is appropriate within zone 1.

6.2 Due to the size of the development under 1Ha it would not be necessary to prepare a site Specific Flood risk Assessment for the site.

6.3 There are a number of potential flooding mechanisms that PPG-FRCC now requires are evaluated for each proposed development site. Each method of flooding requires an assessment to be made on its probability relative to the site development. The normal requirement of the document is for no flooding of properties for storms up to a 1% probability or a once in a 100 years storm. The risk assessment also includes for flooding both on site and off site, and the effects of the development on the downstream catchment or the flow regime of the watercourse. PPG-FRCC also requires that the effects of severe storms above the normal 1% probability are reviewed together with the effects of climatic change relating to the design life of the development.

6.4 It also requires that the effects of climate change are taken into account together with the impacts of extreme events and flood defence failures. Prior to this the Sequential Test outlined in PPG-FRCC, must also be applied to each development site.

6.5 Based on the published Environment Agency Flood Risk Maps the site does not fall within the 0.1% Flood Risk nor does it fall within the 1% Flood Risk area. The whole of the site therefore falls within the low probability zone 1. The proposed residential development falls within the More Vulnerable Classification in Table 02 Technical Guidance to NPPF. The development is considered appropriate in accordance with Table 3 Technical Guidance to NPPF.

6.6 NPPF requires that each flooding mechanism is addressed and levels of risk evaluated. We consider there are three main risks of flooding to the site the alternative mechanisms are not applicable to this site.

6.6.1 Inundation from floodwaters leaving watercourses or rivers entering the site. This can include the effects on culverted watercourses and where the risk of blockage can occur and from breach scenarios.

6.6.2 Rainwater falling on the site and not being able to leave the site at sufficient rate to prevent flooding on the site.

6.6.3 Overland flows from adjacent land sites due to surcharging of sewerage systems or other watercourses.

6.6.4 The impact of the developed site on the existing drainage systems and off-site surface water systems must also be assessed as part of this flood risk assessment.

6.7 Discussion of Flood risks

6.7.1 Flood Risk from Watercourses, River & Tidal

6.7.2 The site appears not to fall within the 1% probability Flood Risk Maps as published by the Environment Agency nor does it fall within the 0.1% Flood Risk Area. The site is therefore considered not at risk from fluvial flooding. The DEFRA long term flood risk information does however show that much of the site is at risk of flooding due to reservoirs breaking or breeching. This is discussed later.

6.7.3 The site falls from east to west and from south to north. There are no recorded flood events on site.

6.7.4 The site falls outside all recorded flood zones from fluvial sources. The risk of flooding from river or tidal water is therefore considered acceptable for the type of development.

6.7.5 The DEFRA flood risk maps shows no risk of flooding from reservoirs failing with much of the site shown as flooding. The site is classed as flood zone 1 on the flood risk map for planning. The requirements for reservoirs to be regularly inspected and maintained suggests that the level of risk for this scenario is less than 1 in 100 years and therefore make the site use acceptable.

6.8 Risk of Flooding from overland flows from adjacent land.

6.8.1 The site lies on a slightly sloping site with residential development to the western and southern side. To the south of the site the land is slightly lower than the site. To the west the existing development site is slightly higher than the site but has been developed and fully drained. The extent of land falling towards the site is very limited and would not generate significant overland flows towards the site. In addition the existing drainage system would provide a measure of flood water relief with storms up to the 1 in 30 year being catered for by the existing sewerage system.

6.8.2 The surrounding area to east is served by adopted drainage systems and as such the level of risk of flooding from surcharged sewers is considered to be less than 1%.

6.8.3 It would be prudent to ensure there is an overland flood route through the site to cater for extreme storms. We would suggest that if external levels are designed so as to provide such a route, this will effectively reduce this risk to an acceptable level.

6.9 Risk of Flooding from Rainwater Falling on Site

6.9.1 The risk of flooding from water falling on site and not being able to leave is considered to be low due to the topography of the site and the topography around the site. These flows would however need to be attenuated to ensure no surcharging of systems down stream.

6.9.2 Storms up to the once in 100 year risk, and allowances to be made for climatic change, can be managed by the use of storm water storage systems. The design of these systems would be dependant on the agreed discharge for the site as noted earlier in this report. Suffice that the design can be detailed to cater for storm up to the 100 year return period with an allowance made for climatic change. This would currently suggest an 30 to 40% increase in flood water storage volume requirements. With this system in place the flows from the site into the surface water systems are considered acceptable.

6.9.3 Further investigation following remediation recommended to determine if the underlying ground is suitable for percolation. If not then the system should be made to connect to the existing surface water system serving the adjacent developments subject to approval from Yorkshire Water. The discharge from this system would be limited to agreed, but reduced, existing discharge rates. If the discharge is limited to this level then it will be necessary to provide above or under-ground storm water attenuation tanks/basins on site. The storage system should be designed to cater for a 100 year storm and additional storage to cater for climatic change could be catered for above ground in designated flood areas such as car parks or shallow swales or public open spaces. The space for these would however be extremely limited and not considered as a suitable alternative for this site

6.9.4 The storage volumes can be provided by the use of oversized pipes or underground tanks as discussed earlier in this report. The flows would have to be controlled by a “Hydrobrake” or similar low maintenance flow control device. If these are provided the risk of onsite flooding from rainfall would be effectively controlled to acceptable levels.

6.9.5 The effects of the development on adjacent land should also be considered as part of this risk assessment.

6.9.6 The development of the site would increase the impermeable area of the site and hence surface water run off from its current status. This in itself will increase the flood risk to adjacent properties and those in the downstream catchment if flows are not attenuated. The limitation on the proposed final off site discharge, and the use of infiltration systems for the site, would reduce the off-site flood risk further to an acceptable level.

6.9.7 We therefore consider the effects on flood risk to adjacent properties are not significantly affect ted by the proposed development if attenuation or infiltration systems are employed.

7.0 CONCLUSIONS

7.1 In our opinion the site is not at risk of flooding from river or tidal water up to a 1% return period nor is it at risk for storms in excess of the 0.1% risk level.

7.2 The soakaway tests undertaken on site recorded infiltration rates of between 0.23×10^{-4} and 0.61×10^{-4} m/s. We would therefore suggest that, based on the current information available, that infiltration techniques will provide a viable long term surface water drainage solution for the development, where natural ground is encountered. We would recommend further investigations and testing following remediation to ensure the whole of the site can be serviced in this way to all Authority requirements.

7.3 However, the site investigation revealed depths of made ground of up to 2.7m in the centre of the site, which would be unsuitable for soakaway construction. The extents of this made ground should be confirmed on site through further investigation, and the proposed soakaways sited accordingly. This work should also take into account final plots and road levels.

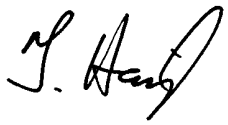
7.4 There is anecdotal evidence that the historical sand workings beneath the site were regularly flooded. Dependent upon the depth of these workings, it is possible that the ground water table may be encountered within excavations once the site levels are lowered.

7.5 We would therefore recommend that additional soakaway tests are undertaken once the site levels have been lowered and final proposed site levels established. This will give a more accurate representation of the infiltration rates at the soakaway construction level.

7.6 If further investigation works following site remediation proves infiltration systems are not feasible, then it would then be necessary to provide storm water attenuation facilities on site. Discharges would have to be limited to agreed rates of discharge, probably agricultural rates of 2.5 to 5 lit/sec/ha, to ensure flood risks downstream are not increased.

7.7 If the measures outlined above are implemented we would consider that the requirements of NPPF can be satisfied.

Prepared by



Trevor Haigh B.Sc., C.Eng., M.I.C.E.

APPENDIX A

SITE LOCATION PLAN
&
SITE SURVEY
&
PROPOSED SITE LAYOUT

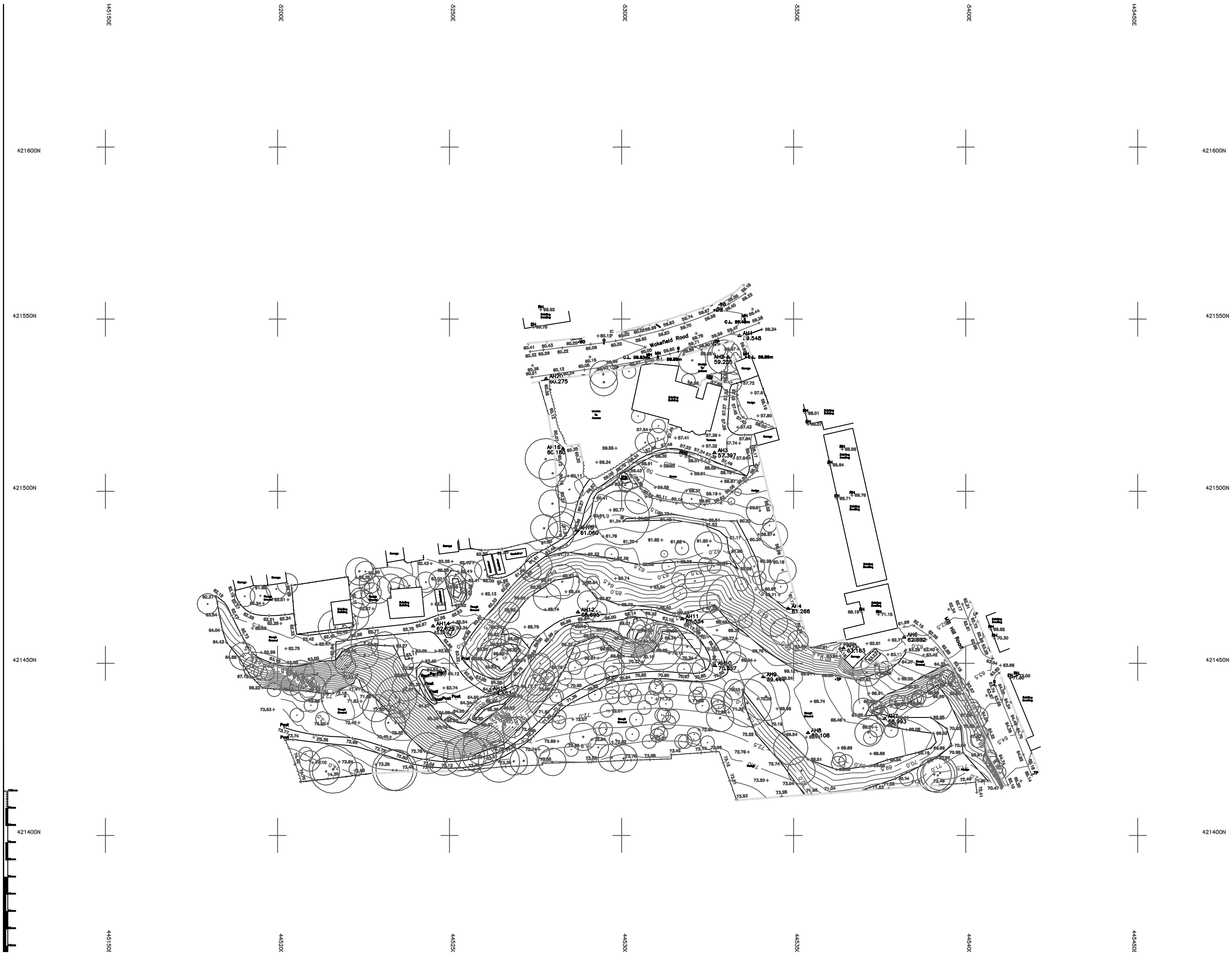
Aerial Photograph of Study Site

NW N NE

W E

SW S SE

Site Name: MILL HILL ROAD,PONTEFRACT, WF8 4HR
Grid Reference: 445279,421457
Size of Site: 1.42 ha



Notes:

1. The accuracy and content of this drawing are dependent on the surveyed scale and survey specification, care should be taken when working with other plotted scales or from CAD.

Station Co-Ordinates:

[illegible]

Survey Control Data:

Datum for Levels:	OS GPS Datum (OSGM02)
Bench Mark:	AH1
Value:	59.548m
Grid:	Local Grid Based on OSGB36(02) at AH1

Standard Symbols:

MH	Manhole Cover
IC	Inspection Cover
WOH	Water Outlet Hydrant
FH	Fire Hydrant
SV	Stop Valve
GV	Gas Valve
WM	Water Meter
UC	Unidentified Cover
BT	Telecom Cover
LP	Lamp Post
TP	Telegraph Pole
EP	Electricity Pole
SIGN	Sign Post
BUS	Bus Stop
FP	Flag Pole
RTS	Road Traffic Sign
TL	Traffic Light
CB	Control Box (Traffic)
G	Gully
RE	Rodding Eye
BH	Borehole
TrP	Trial Pit
JB	Junction Box
BOL	Bollard
LB	Litter Bin
PB	Pillar Box
TCB	Telephone Call Box
MILE	Milestone
MP	Marker Post
EC	Electricity Cable
GP	Gas Pipe
RWP	Rain Water Pipe
SVP	Soil and Vent Pipe
SP	Soil Pipe
VP	Vent Pipe
WP	Waste Pipe
S/COB	Stone Cobbles
SPS	Stone Paving Slabs
CPS	Concrete Paving Slabs
B/S	Brick Setts
ELEC	Electricity Cover
OhW	Overhead Wire
FL	Floor Level
SL	Step Level
CL	Cover Level
IL	Invert Level
B/W	Barbed Wire
C/B	Close Boarded
C/L	Chain Link
W/P	Wood Paling
H/R	Hand Rail
I/R	Iron Railing
I/W	Interwoven
O/B	Open Boarded
WP/R	Wood Post and Rail
CP/R	Concrete Post and Rail
CP/T	Concrete Post and Timber Panel
P/W	Post and Wire
CP/D	Concrete Post and Dropper
PAL	Palisade
T/S	Tube Steel
R/W	Retaining Wall
EH	Eaves Height
RH	Ridge Height
TH	Tree Height
SH	Sill Height
WH	Wall Height

Existing Contour

Existing Tree

Tree Stump

Canopy Line

Rev	Description of revision	Date

Stamford Geomatics Ltd

LAND SURVEYING AND VOLUMETRICS
Onward Business Park
Ackworth, Pontefract
WF7 7BE
Tel: 01977 613042, 07710 348886
email: surveys@stamfordgeomatics.co.uk

Site Name:

**Mill Hill,
Pontefract,
West Yorkshire.**

Surveyed: AH	Drawn: AH	Checked: CSm

Title

Topographical Survey.

Plotted Scale:	Date:	Sheet Size:
1:1000	12 Apr 13	A3

Drawing No.	Revision
1665/001	

Schedule of Accommodation

To be read in conjunction with drawing no. 3132-0-001 - A

Housetype	Type	No. of Units	Percentage	Sq. Ft.	Total Sq. Ft.
A	Mews/Semi-detached	9	40.91	710.00	6390.00
B	Mews/Semi-detached	5	22.73	870.00	4350.00
B1	Mews/Semi-detached	4	18.18	870.00	3480.00
C	Detached	2	9.09	1000.00	2000.00
C1	Detached	2	9.09	1000.00	2000.00
Totals		**22**	**100.00**		**18220.00**

LEGEND:

- 1.8M (h) TIMBER FENCE
- PROPOSED TREES
- EXISTING TREES
- EXISTING TREES TO BE REMOVED
- EXISTING BUILDING / STRUCTURE
- EXISTING BUILDING / STRUCTURE TO BE DEMOLISHED

EXISTING WALL TO BE DEMOLISHED TO ACCOMMODATE NEW JUNCTION & VISIBILITY SPLAYS

TREE ROUTE PROTECTION ZONES HIGHLIGHTED, FOR FURTHER DETAIL PLEASE REFER TO BOWLAND TREE CONSULTANCY SURVEY / LAYOUT

WAKEFIELD ROAD

Wakefield Road, PONTEFRACT

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
B	20.06.19	Site boundaries corrected	OB
A	03.06.19	Plots 1 & 2 moved to avoid tree protection zones	OB

project: PROPOSED RESIDENTIAL WAKEFIELD ROAD, PONTEFRACT

client: MR DUFFY, MR DUFFY & MR DAVIES

title: PROPOSED SITE LAYOUT

date: 02.05.19 | scale: 1:500@A3 | drawn: JB | checked:

drawing number: 3132-1-001-B

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

APPENDIX B

FLOOD RISK MAPS

Flood map for planning

Your reference	Location (easting/northing)	Created
7353millhill	**445289/421462**	**5 Aug 2019 8:37**

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.

Environment Agency

Flood map for planning

Your reference
7353millhill

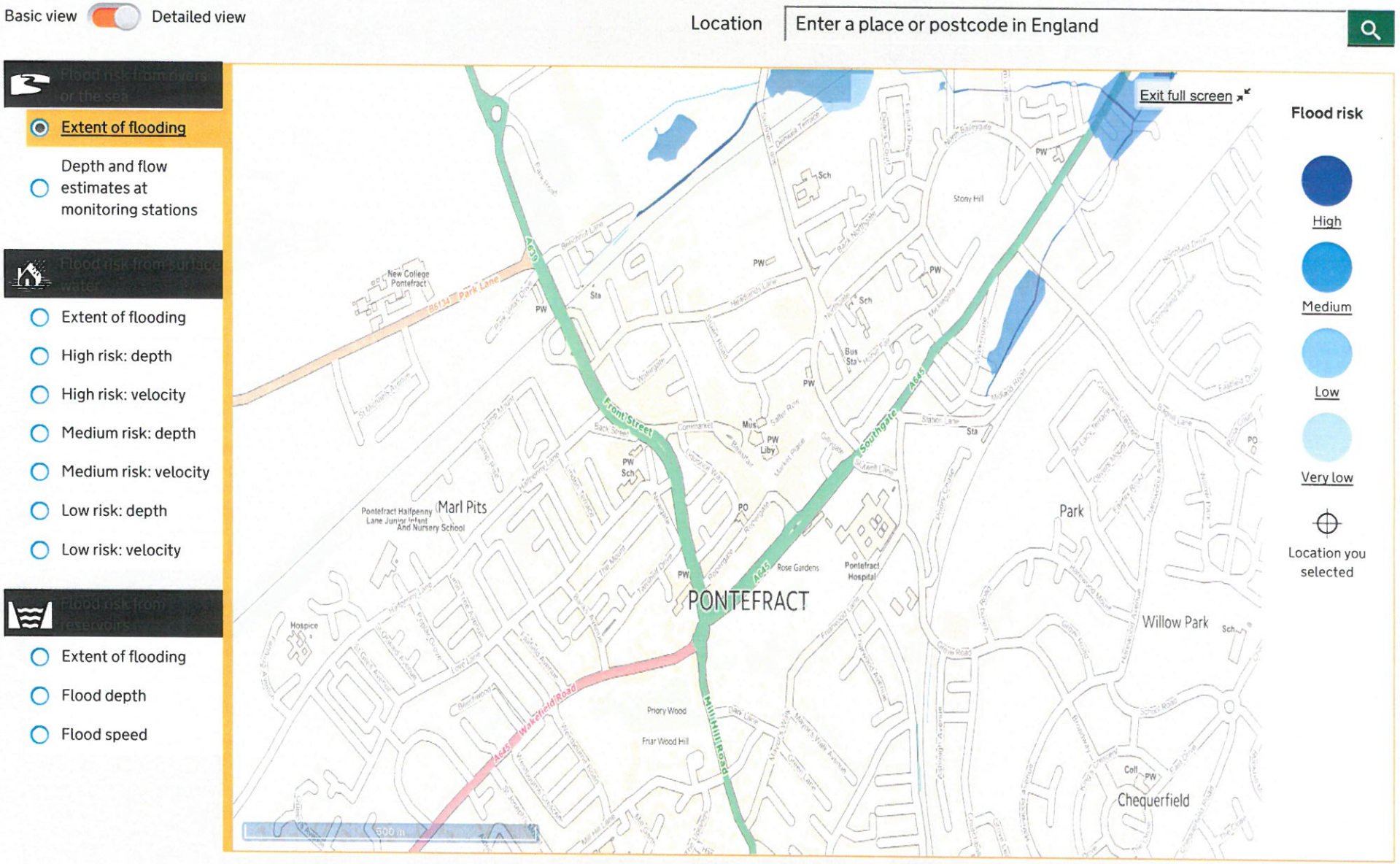
Location (easting/northing)
445289/421462

Scale
1:2500

Created
5 Aug 2019 8:37

- 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


Basic view
Detailed view
Location
Enter a place or postcode in England
Flood risk from rivers or the sea
Extent of flooding
Depth and flow estimates at monitoring stations
Flood risk from surface water
Extent of flooding
High risk: depth
High risk: velocity
Medium risk: depth
Medium risk: velocity
Low risk: depth
Low risk: velocity
Flood risk from reservoirs
Extent of flooding
Flood depth
Flood speed
Exit full screen
Flood risk
High
Medium
Low
Very low
Location you selected
PONTEFRACT
Marl Pits
Park
Willow Park
Chequerfield
Front Street
Southgate
Wakefield Road
Hillhouse Road
A639
A645
Park Lane
B6134
Pontefract Hospital
Rose Gardens
Priory Wood
Friar Wood Hill
Hospice
New College Pontefract
Pontefract Halfpenny Lane Junior Infant And Nursery School
500 m

Basic view Detailed view

Location Enter a place or postcode in England

Flood risk from rivers or the sea

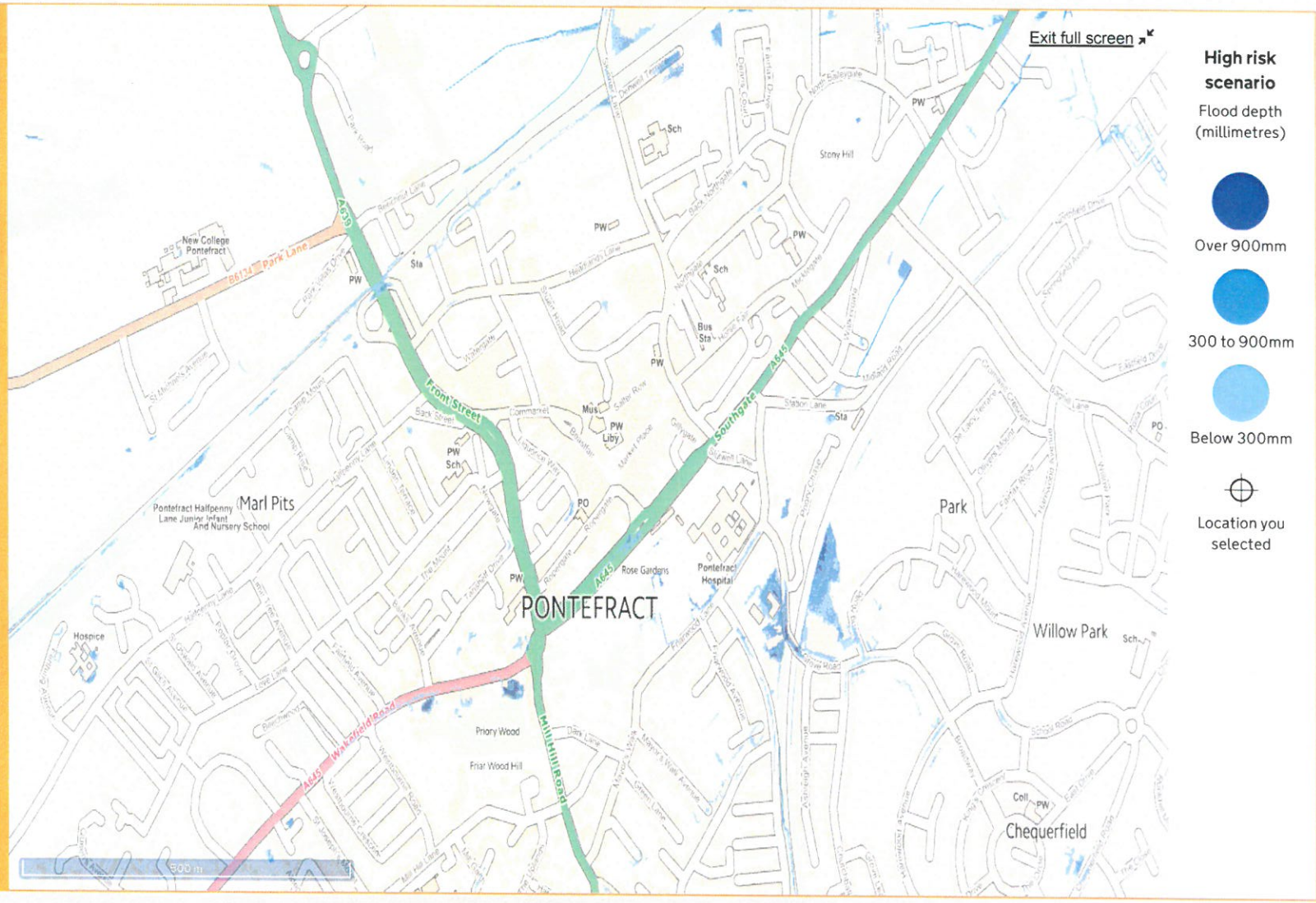
- Extent of flooding
- Depth and flow estimates at monitoring stations

Flood risk from surface water

- Extent of flooding
- High risk: depth
- High risk: velocity
- Medium risk: depth
- Medium risk: velocity
- Low risk: depth
- Low risk: velocity

Flood risk from reservoirs

- Extent of flooding
- Flood depth
- Flood speed



Basic view Detailed view

Location Enter a place or postcode in England

Flood risk from rivers or the sea

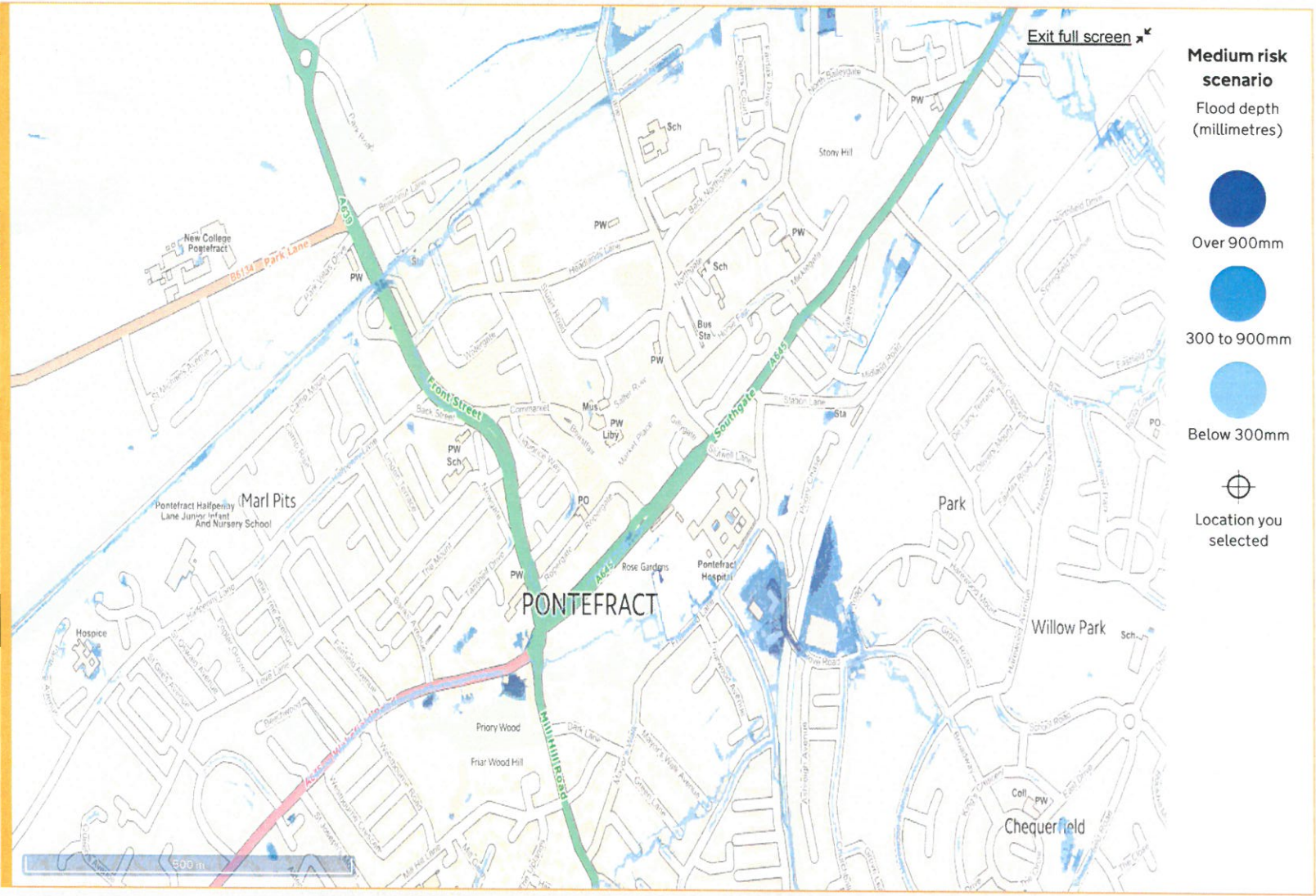
- Extent of flooding
- Depth and flow estimates at monitoring stations

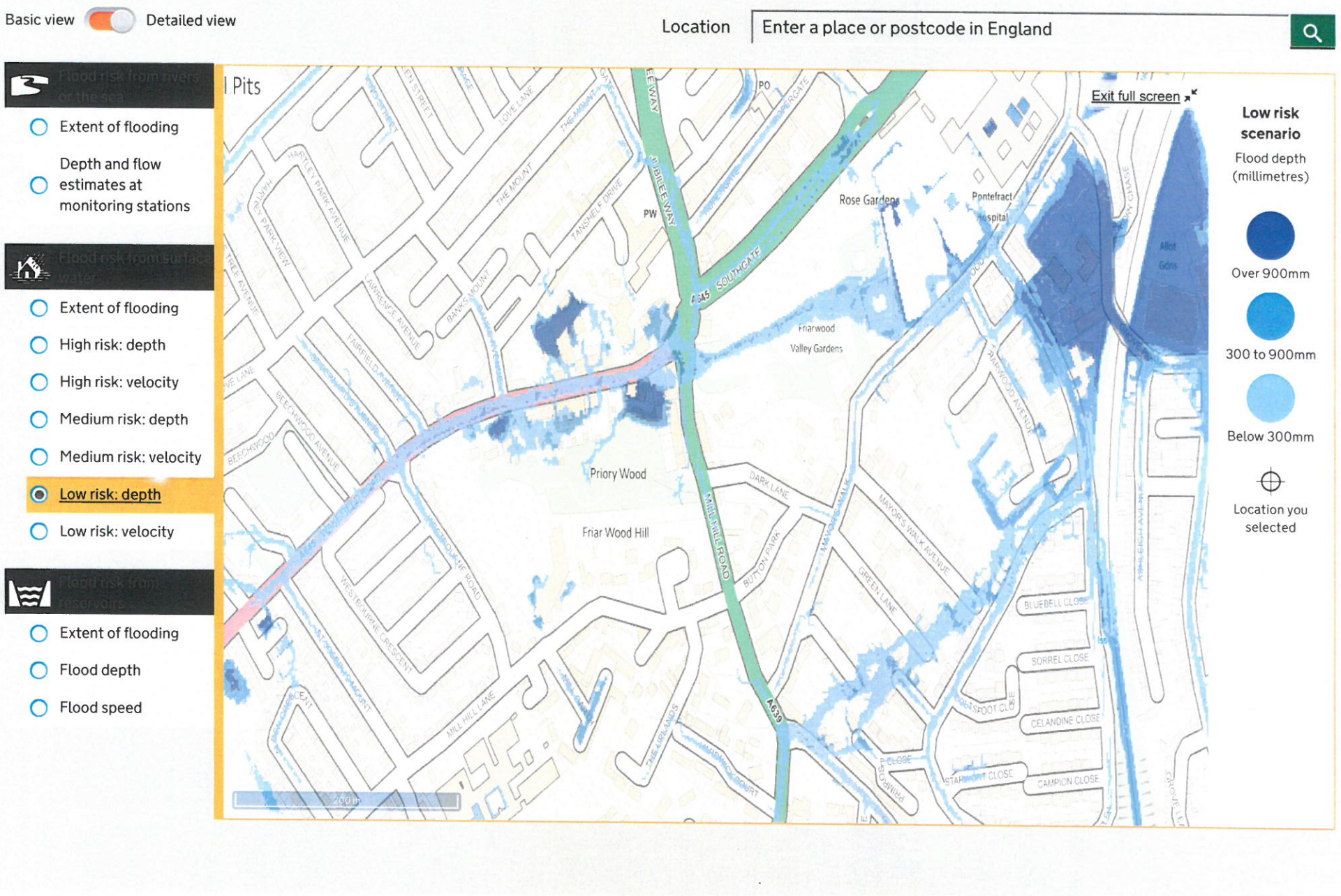
Flood risk from surface water

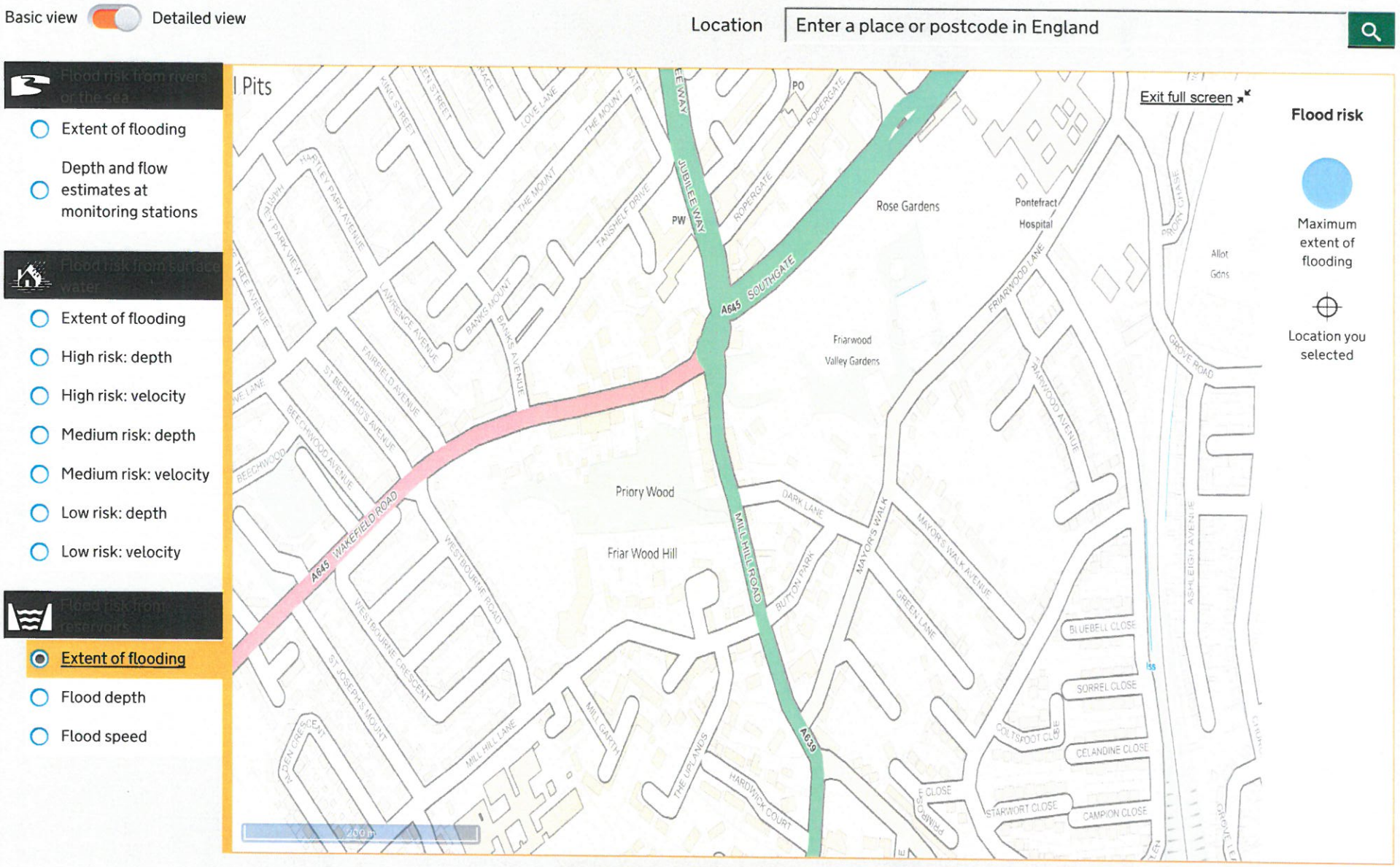
- Extent of flooding
- High risk: depth
- High risk: velocity
- Medium risk: depth
- Medium risk: velocity
- Low risk: depth
- Low risk: velocity

Flood risk from reservoirs

- Extent of flooding
- Flood depth
- Flood speed

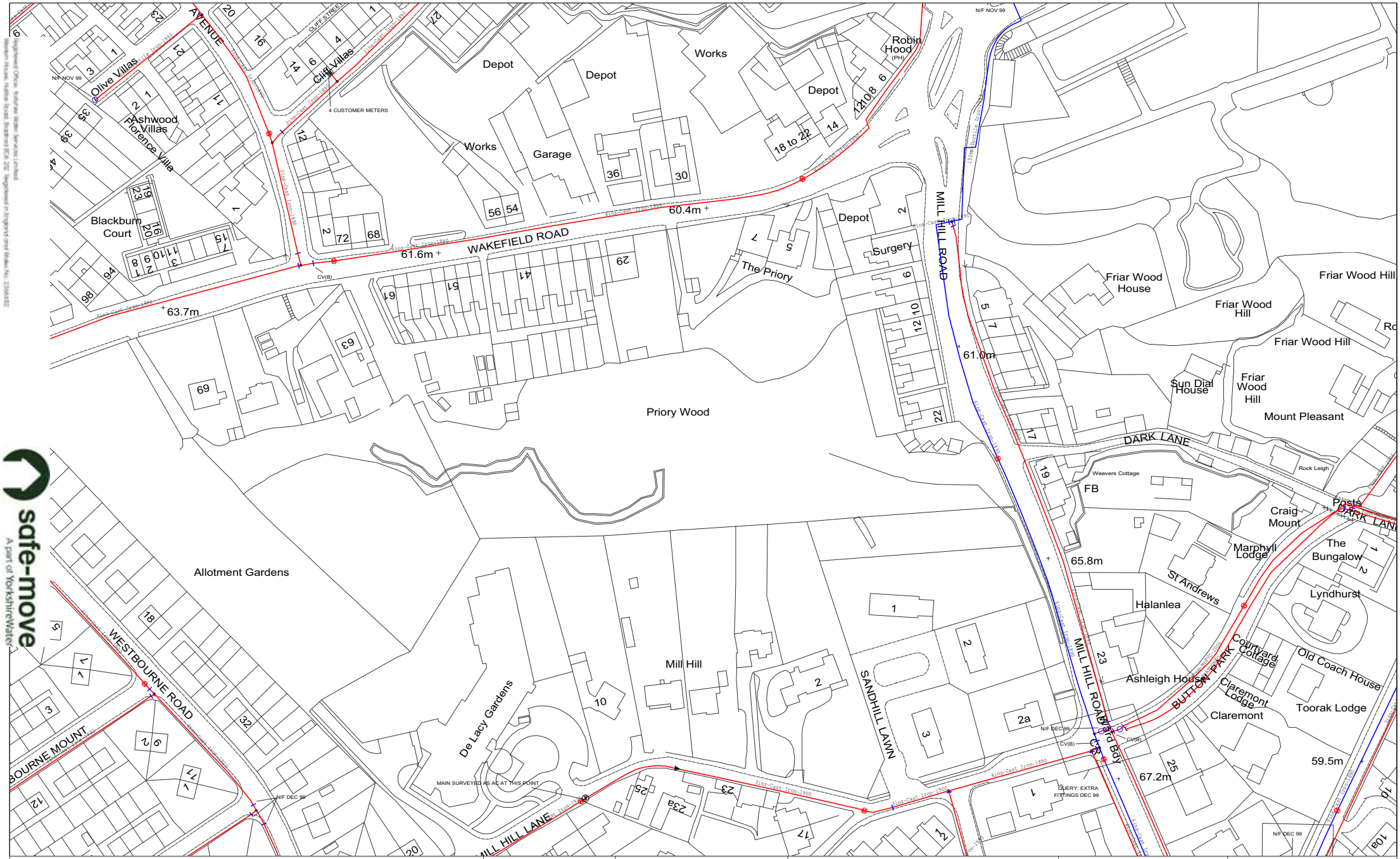



Basic view
Detailed view
Location
Enter a place or postcode in England
Flood risk from rivers or the sea
Extent of flooding
Depth and flow estimates at monitoring stations
Flood risk from surface water
Extent of flooding
High risk: depth
High risk: velocity
Medium risk: depth
Medium risk: velocity
Low risk: depth
Low risk: velocity
Flood risk from reservoirs
Extent of flooding
Flood depth
Flood speed
Exit full screen
Low risk scenario
Flood depth (millimetres)
Over 900mm
300 to 900mm
Below 300mm
Location you selected
Priory Wood
Friar Wood Hill
Friarwood Valley Gardens
Rose Gardens
Pontefract Hospital
A645 SOUTHGATE
A639
MILL HILL ROAD
JUBILEE WAY
DARK LANE
GREEN LANE
MAYOR'S WALK AVENUE
BLUEBELL CLOSE
SORREL CLOSE
CELANDINE CLOSE
CAMPION CLOSE
MILL HILL LANE
200m


Basic view
Detailed view
Location
Enter a place or postcode in England
Flood risk from rivers or the sea
Extent of flooding
Depth and flow estimates at monitoring stations
Flood risk from surface water
Extent of flooding
High risk: depth
High risk: velocity
Medium risk: depth
Medium risk: velocity
Low risk: depth
Low risk: velocity
Flood risk from reservoirs
Extent of flooding
Flood depth
Flood speed
Exit full screen
Flood risk
Maximum extent of flooding
Location you selected
Rose Gardens
Pontefract Hospital
Friarwood Valley Gardens
Priory Wood
Friar Wood Hill
A645 SOUTHGATE
A645 WAKEFIELD ROAD
A639
JUBILEE WAY
MILL HILL ROAD
FRIARWOOD LANE
MAYORS WALK
MAYORS WALK AVENUE
GREEN LANE
DARK LANE
BUTTON PARK
GROVE ROAD
ASHLEIGH AVENUE
BLUEBELL CLOSE
SORREL CLOSE
CELANDINE CLOSE
CAMPION CLOSE
STARWORT CLOSE
COLTSFOOT CLOSE
HARDWICK COURT
THE UPLANDS
MILL GARTH
MILL HILL LANE
WESTBOURNE ROAD
WESTBOURNE CRESCENT
ST JOSEPHS MOUNT
BEECHWOOD AVENUE
ST BERNARDS AVENUE
FAIRFIELD AVENUE
LAWRENCE AVENUE
BANKS AVENUE
BANKS MOUNT
HARTLEY PARK AVENUE
THE MOUNT
TANSHELF DRIVE
ROPERGATE
LOVE LANE
KING STREET
QUEEN STREET
PO
PW
200m

APPENDIX C

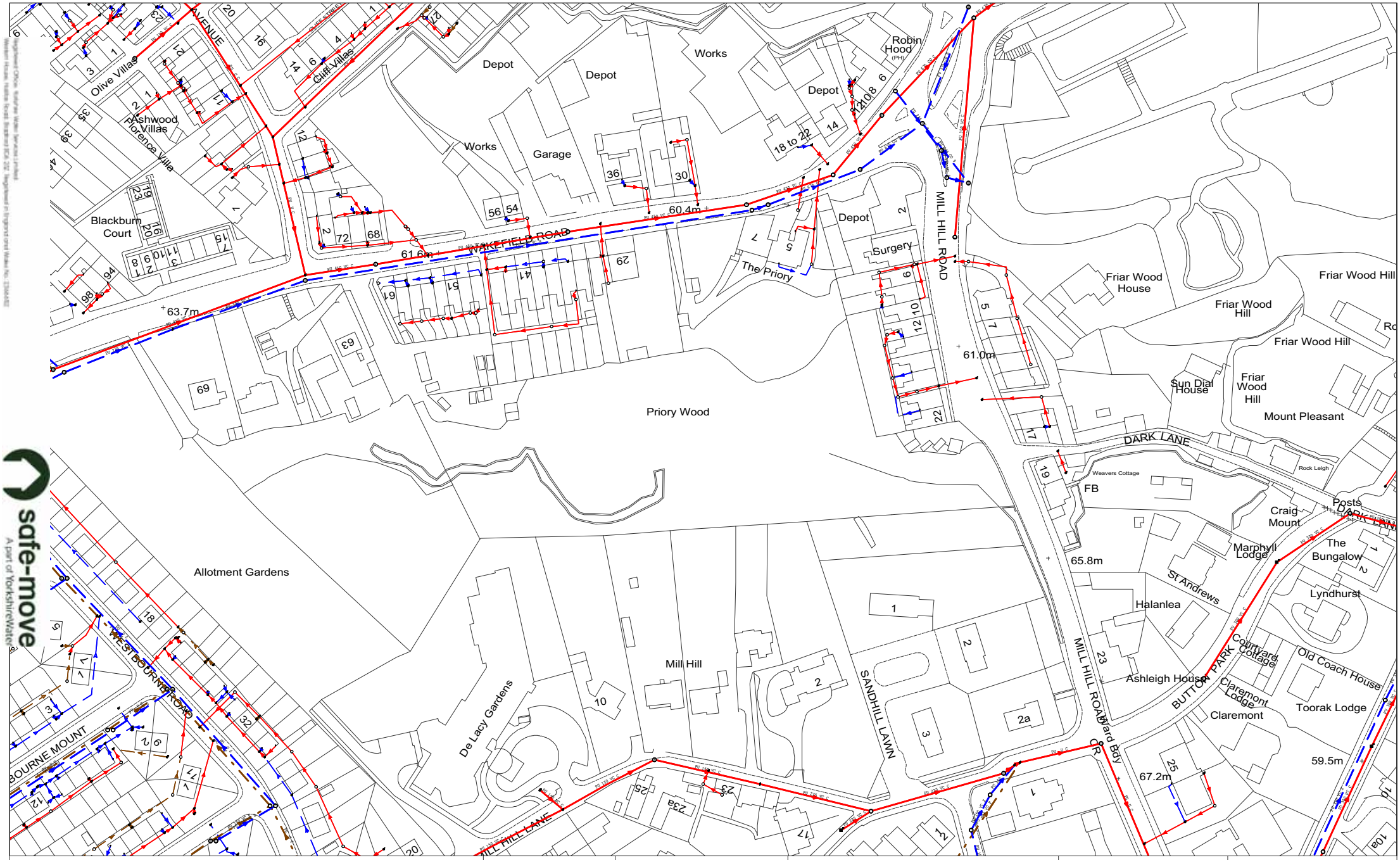
YORKSHIRE WATER RECORDS



safe-move
A part of YorkshireWater

445065 : 421319	Map Name : SE4521SW	Title	Partial Key Water mains up to 4" in diameter Water mains over 4" in diameter Raw water mains Private water mains
YorkshireWater	Yorkshire Water, PO Box 500, Halifax Road, Bradford BD6 2LZ Contact Name : Ms H Webster Contact Tel :	Notes	The position and depths of apparatus shown on this plan are approximate only. The exact positions and depths should be obtained by excavation trial holes.
		(Ody) COPYRIGHT STATEMENTS: Reproduced by permission of Ordnance Survey on behalf of HMSO © Crown copyright and database 2004. All rights reserved Ordnance Survey Licence number 100019559	Scale : 1:1250 Drg No : Maris No : Date Req : 23/07/2013, 14:41:14 Date Gen : 23/07/2013, 14:41:16 Source : Water Network Enquiry

UPN: Undefined Originator: H Webster, Safe Move,



safe-move
A part of YorkshireWater

445290 : 421458	Map Name : SE4521SW	Title	Partial Key
		Notes	Foul Sewer = F Combined Sewer = C Surface Water Sewer = SW Trade Sewer = TD Partially Separate = PS

YorkshireWater

Yorkshire Water,
PO Box 500,
Halifax Road,
Bradford BD6 2LZ
Contact Name :
Ms H Webster
Contact Tel :

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

Date Req : 23/07/2013, 14:41:27

Date Gen : 23/07/2013, 14:41:29

Source : Sewer Network Enquiry

UPN: Undefined

Originator: H Webster, Safe Move,

Sewer Legend


Combined Sewer


S24 Combined Sewer


Surface Water Sewer


S24 Surface Water Sewer


Foul Sewer


S24 Foul Sewer


Section 104 Sewer

Public Rising Main


Pumping Station


Abandoned Sewer

Public Sewage
Treatment Works


Syphon Sewer &
Vacuum Sewer

\+ Property Identifier

Water Legend

Water Main 4" and below

Water Main 4" and above

Raw Water Main

Private Water Main


Fire Hydrant


Pumping Station

APPENDIX D

STORMWATER STORAGE CALCULATIONS

HAIGH HUDDLESTON ASSOCIATES **Stormwater Storage Calculations**

Client **Richard Wheatherhead**

Site **MILL HILL PONTEFRACT** **E19/7533**

Design storm 100 M5-60 20 mm
r 0.45
Site area sq m. 11000
Imp Area sq m. 5500
T of Conc min 4 Time to Flow
Allow Discharge 5.5 Lit / sec Imp Ratio 0.50

								100 year storm					100year plus 30% climate				
Storm Duration	**Intensity**	**Depth**	**Vol In**	**Vol Out**	**Storage**	**Q**	**t**	**Intensity**	**Depth**	**Vol In**	**Vol Out**	**Storage**	**Intensity**	**Depth**	**Vol In**	**Vol Out**	**Storage**
Mins	**mm/hr**	**mm**	**cu.m**	**cu.m**	**cu.m.**			**mm/hr**	**mm**	**cu.m**	**cu.m**	**cu.m.**	**mm/hr**	**mm**	**cu.m**	**cu.m**	**cu.m.**
10	81.8	13.63	74.98	4.56	70.42	125.07	0.2	101.27	16.88	92.83	4.56	88.27	131.65	21.94	120.68	4.56	116.12
20	59.8	19.93	109.63	7.84	101.79	91.43	0.2	74.03	24.68	135.73	7.84	127.89	96.24	32.08	176.44	7.84	168.60
30	47.6	23.80	130.90	11.12	119.78	72.78	0.3	58.93	29.46	162.05	11.12	150.93	76.61	38.30	210.67	11.12	199.55
50	34.4	28.67	157.67	17.68	139.98	52.60	0.4	42.59	35.49	195.19	17.68	177.51	55.36	46.14	253.75	17.68	236.07
60	30.3	30.30	166.65	20.96	145.69	46.33	0.5	37.51	37.51	206.31	20.96	185.35	48.76	48.76	268.21	20.96	247.24
120	18.7	37.40	205.70	40.67	165.03	28.59	0.8	23.15	46.30	254.66	40.67	213.99	30.10	60.19	331.05	40.67	290.39
180	14.1	42.30	232.65	60.38	172.27	21.56	1.0	17.46	52.37	288.02	60.38	227.64	22.69	68.08	374.43	60.38	314.04
240	11.5	46.00	253.00	80.11	172.89	17.58	1.3	14.24	56.95	313.21	80.11	233.11	18.51	74.03	407.18	80.11	327.07
300	9.8	49.00	269.50	99.84	169.66	14.98	1.5	12.13	60.66	333.64	99.84	233.81	15.77	78.86	433.73	99.84	333.90
360	8.7	52.20	287.10	119.57	167.53	13.30	1.7	10.77	64.62	355.43	119.57	235.86	14.00	84.01	462.06	119.57	342.48
420	7.9	55.30	304.15	139.32	164.83	12.08	1.8	9.78	68.46	376.54	139.32	237.22	12.71	89.00	489.50	139.32	350.18
480	7.5	60.00	330.00	159.09	170.91	11.47	1.9	9.29	74.28	408.54	159.09	249.45	12.07	96.56	531.10	159.09	372.02
540	6.9	62.10	341.55	178.83	162.72	10.55	2.1	8.54	76.88	422.84	178.83	244.01	11.10	99.94	549.69	178.83	370.86
600	6.38	63.80	350.90	198.58	152.32	9.76	2.3	7.90	78.98	434.41	198.58	235.84	10.27	102.68	564.74	198.58	366.16

				Storage	**172.89**						**Storage**	**249.45**				**Storage**	**372.02**
Length of 1800		67.94						Length of 1800	98.0285				Length of 1800	146.192			
Length of 1500		97.85	Culvert	2.4*1.5m	48.03			Length of 1500	141.173				Length of 1500	210.535			
Length of 1200		152.87	culvert	3.6*1.8m	26.68			Length of 1200	220.56				Length of 1200	328.926			
Length of 1050		199.65						Length of 1050	288.05				Length of 1050	429.579			
Length of 900		271.84						Length of 900	392.22				Length of 900	584.929			
Length of 750		391.16						Length of 750	564.37				Length of 750	841.663			
Length of 600		610.93						Length of 600	881.46				Length of 600	1314.54			

	Footprint Area (m)				
Aquacell Storage Crates	454.981	30 year	Pond 900mm deep	192.103	30 year
(400mm deep)	656.456	100 year		277.17	100 year
	978.987	100 year plus climatic		413.35	100 year plus climatic

APPENDIX E

SOAKAWAY INVESTIGATION

Haigh Huddleston & Associates
Civil & Structural Engineering Consultants
Firth Buildings, 99 -101 Leeds Road, Dewsbury, WF12 7BU
t 01924 464342 f 01924 450662 e trevor.haigh@haighhuddleston.co.uk

E13/5816/MD/004

20 August 2013

FAO Mr. M Townsend
Townsend Planning Consultants
10 Rishworth Street
Wakefield
WF1 3BY

Dear Sir,

Re: Proposed development off Wakefield Road, Pontefract for Mr Duffy, Mr Duffy & Mr Davies

Further to the Flood Risk Assessment and Phase 1 Desk Top Study, in which it was stated that a sandstone stratum underlay the above site, Haigh Huddleston Associates were requested to undertake further investigation works to determine whether soak-a-ways would be a suitable long term method of surface water dispersal.

Please find attached our findings in relation to these additional investigation works.

1. FIELDWORK

1.1 The fieldwork comprised of four trial holes undertaken using a JCB equipped with a 600mm wide bucket. The location of the trial pits are indicated on drawing E13/5816/01.

1.2 Access to areas of the site was restricted by the dense undergrowth, stone retaining walls and the steep bankings on site.

1.3 Materials encountered within the trial pits were examined and categorised. The trial pit logs, along with a trial pit location plan, are at the rear of the report.

1.4 Three of the trial pits were used to undertake soak-a-way tests. The soak-a-way tests were undertaken in accordance with the method specified in BRE Digest 365 Soak-a-way Design. An instantaneous supply of water was provided via a bowser. In general the trial pits were filled and the water levels were recorded against time as the water permeated into the natural strata.

1.5 The water level was monitored over an extended time period to determine the infiltration rate for the sand/sandstone strata. The infiltration rate has been calculated in each case between the 75% and 25% full values as recommended in the BRE Digest 365.

1.6 The soakaway test results are attached to the rear of this report.

Haigh Huddleston & Associates
Civil & Structural Engineering Consultants
Firth Buildings, 99 -101 Leeds Road, Dewsbury, WF12 7BU
t 01924 464342 f 01924 450662 e trevor.haigh@haighhuddleston.co.uk

2. RESULTS OF THE INVESTIGATION

2.1 Generally, the trial pits revealed made ground and topsoils overlying a sand layer, with sandstone bedrock encountered in one of the trial pits.

2.2 TP01 and TP02 had a surface strata consisting of made ground. The made ground consisted of dark brown sandy soils containing a mixture of burnt material, sandstone cobbles, bricks, gravels, tiles, pieces of concrete, pockets of soft/firm yellow mottled grey clay and broken glass. The depth of made ground varied between 1.6m and 2.7m between the trial pits.

2.3 In TP03 and TP04 the surface strata consisted of a heavily overgrown dark brown topsoil with numerous rootlets. In TP03 the topsoil was also noted to contain bricks, timber, glass and asbestos sheeting that had been fly-tipped. The topsoil strata varied in depth from 0.15-0.3m between the trial pits.

2.4 Beneath the topsoil and made ground there was a medium dense orange sand containing numerous sandstone gravels. The thickness of the sand strata varied from 0.3-1.7m across site. TP01, TP02 and TP03 were terminated in this strata at depths of 2.0-3.0m below existing ground levels.

2.5 In TP04 the medium dense orange sand became a highly weathered sandstone at depth. At a depth of 1.5m below existing ground levels this became a sandstone that was difficult to excavate. The trial pit was stopped at a depth of 1.65m below existing ground levels.

2.6 No ground water was encountered during the trial pit excavations. There was seepage from surface water noted in TP02.

2.7 All but TP02 was used for soak-a-way testing due to the depth of made ground encountered.

SOAKAWAY NUMBER	INFILTRATION RATE m/s $x10^{-4}$
TP01	0.24
TP03	0.23
TP04	0.61

2.8 In all soakaway tests, the water level within the trial pit fell with infiltration rates between 0.23 x 10^{-4} m/s and 0.61 x 10^{-4} m/s recorded.

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3. CONCLUSIONS

3.1 The soakaway tests undertaken on site recorded infiltration rates of between 0.23×10^{-4} and 0.61×10^{-4} m/s. We would therefore recommend that, based on the current information available, that infiltration techniques will provide a viable long term surface water drainage solution for the development.

3.2 However, the site investigation revealed depths of made ground of up to 2.7m in the centre of the site, which would be unsuitable for soakaway construction. The extents of the made ground should be confirmed on site through further investigation, and the proposed soakaways sited accordingly.

3.3 In the east of the site where TP03 and TP04 were excavated, it is likely that site levels will be lowered as part of the remediation works for the development.

3.4 There is anecdotal evidence that the historical sand workings beneath the site were regularly flooded. Dependent upon the depth of these workings, it is possible that the ground water table may be encountered within excavations once the site levels are lowered.

3.5 We would therefore recommend that additional soakaway tests are undertaken once the site levels have been lowered. This will give a more accurate representation of the infiltration rates at the soakaway construction level.

We trust that the above is sufficient for your current requirements, however should you need any further information please do not hesitate to contact me direct.

Yours faithfully,

MICHAEL DEAN

Enclosures.

CC Damien Duffy

Haigh Huddleston & Associates
Civil Structural Engineering Consultants
Firth Building,
99-101, Leeds Road,
Dewsbury, WF12 7BU
t 01924 464342
f 01924 450662
e trevor.haigh@haighhuddleston.co.uk

FORM HHA 5

TRIAL HOLE NO. 4

Client :	**Mr Duffy, Mr Duffy & Mr Davies**	**Job No :**	**E13/5816**
Site :	**Wakefield Road/Mill Hill Road, Pontefract**	**Date :**	**6th August 2013**

0.0		
	0.15	Dark brown overgrown topsoil with numerous rootlets.
0.5	**0.6**	Loose dark brown sand.
1.0		Medium dense orange sand, numerous sandstone gravels, becoming highly weathered sandstone.
1.5	**1.5**	
	1.65	Yellow sandstone unable to excavate. End of trial pit.
2.0		
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation	NO
Sample taken	NO
Sides of excavation remained stable	YES
Level	……..

NOTES:

…….

…….

Haigh Huddleston & Associates
Civil Structural Engineering Consultants
Firth Building,
99-101, Leeds Road,
Dewsbury, WF12 7BU
t 01924 464342
f 01924 450662
e trevor.haigh@haighhuddleston.co.uk

FORM HHA 5

TRIAL HOLE NO. 3

Client :	**Mr Duffy, Mr Duffy & Mr Davies**	**Job No :**	**E13/5816**
Site :	**Wakefield Road/Mill Hill Road, Pontefract**	**Date :**	**6th August 2013**

0.0		
	0.3	Overgrown dark brown topsoil, numerous rootlets and occasional roots, bricks, glass, timber, asbestos sheet on surface.
0.5		Medium dense orange sand with sandstone gravels up to 10cm diameter.
1.0		
1.5		
2.0	**2.0**	End of trial pit.
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation	NO
Sample taken	NO
Sides of excavation remained stable	NO
Level	……..

NOTES:

…….

…….

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Civil Structural Engineering Consultants
Firth Building,
99-101, Leeds Road,
Dewsbury, WF12 7BU
t 01924 464342
f 01924 450662
e trevor.haigh@haighhuddleston.co.uk

FORM HHA 5

TRIAL HOLE NO. 2

Client :	**Mr Duffy, Mr Duffy & Mr Davies**	**Job No :**	**E13/5816**
Site :	**Wakefield Road/Mill Hill Road, Pontefract**	**Date :**	**6th August 2013**

0.0		
0.5		Overgrown dark brown soil containing burnt material, bricks, sandstone cobbles, ash, tile, pieces of concrete, gravels, pockets of soft-firm yellow mottled grey clay.
1.0		
1.5		
2.0		
2.5		
	2.7	
3.0	**3.0**	Medium dense orange sand with numerous sandstone gravels. End of trial pit.
3.5		
4.0		

REMARKS:

Ground water encountered during excavation	Seepage from surface
Sample taken	NO
Sides of excavation remained stable	YES
Level	……..

NOTES:

…….

…….

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Dewsbury, WF12 7BU
t 01924 464342
f 01924 450662
e trevor.haigh@haighhuddleston.co.uk

FORM HHA 5

TRIAL HOLE NO. 1

Client :	**Mr Duffy, Mr Duffy & Mr Davies**	**Job No :**	**E13/5816**
Site :	**Wakefield Road/Mill Hill Road, Pontefract**	**Date :**	**6th August 2013**

0.0		
	0.4	Made ground consisting of sandstone blocks, bricks, concrete, sand.
0.5		Dark brown sandy soil with numerous gravels, brick, broken glass, pieces of concrete.
1.0		
1.5		
	1.6	
		Medium dense yellow sand with numerous sandstone gravels
2.0		
2.5		
	2.9	End of trial pit.
3.0		
3.5		
4.0		

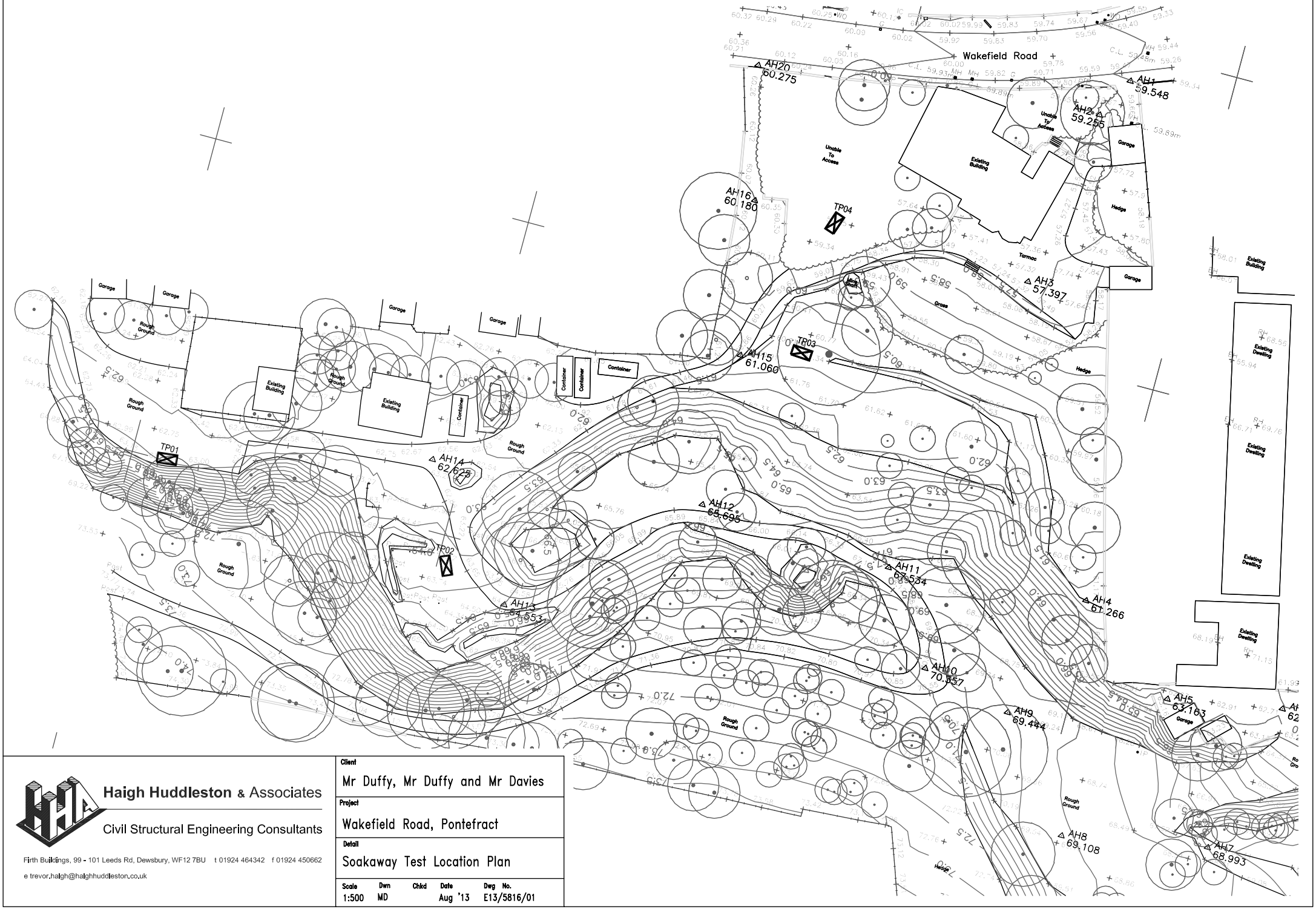
REMARKS:

Ground water encountered during excavation	NO
Sample taken	NO
Sides of excavation remained stable	YES
Level	……..

NOTES:

…….

…….



Haigh Huddleston & Associates

Civil Structural Engineering Consultants

Firth Buildings, 99 - 101 Leeds Rd, Dewsbury, WF12 7BU t 01924 464342 f 01924 450662

e trevor.haigh@haighhuddleston.co.uk

Client	Mr Duffy, Mr Duffy and Mr Davies
Project	Wakefield Road, Pontefract
Detail	Soakaway Test Location Plan

Scale	Dwn	Chkd	Date	Dwg No.
1:500	MD		Aug '13	E13/5816/01

Soil Permeability test

Soakaway Test 3 TP04

Site **Wakefield Road, Mill Hill Road, Pontefract** **Date** 06.08.2013

Client **Mr Duffy, Mr Duffy & Mr Davies** **Job No.** 5816

Pit dimensions m

Length	2.1
Width	0.7
Depth	1.6

Time	Time into Test Mlns	Dip Reading mm	Vol cu.m	Vol Change cu.m	Contact area Avge sq.m	Permeability lit/ sq.m/sec
11.48	0	1450	0.22050		2.31000	
11.49	1	1500	0.14700	0.07350	2.03000	0.56452
11.51	3	1520	0.11760	0.02940	1.91800	0.12411
11.54	6	1550	0.07350	0.04410	1.75000	0.13359
11.56	8	1560	0.05880	0.01470	1.69400	0.07114
11.59	11	1580	0.02940	0.02940	1.58200	0.09972
12.03	15	1590	0.01470	0.01470	1.52600	0.03941
12.21	33	1610	-0.01470	0.02940	1.41400	0.01852
12.43	55	1650	-0.07350	0.05880	1.19000	0.03421

BRE Value 0.0608696 lit/ sq.m/sec

Average Permeabilty Value: 0.135652092 lit/ sq.m/sec

Soil Permeability test

Soakaway Test 2 TP03

Site **Wakefield Road, Mill Hill Road, Pontefract** **Date** 06.08.2013

Client **Mr Duffy, Mr Duffy & Mr Davies** **Job No.** 5816

Pit dimensions m

Length	2
Width	0.7
Depth	2

Time	Time into Test Mlns	Dip Reading mm	Vol cu.m	Vol Change cu.m	Contact area Avge sq.m	Permeability lit/ sq.m/sec
10.15	0	1330	0.93800		5.01800	
10.17	2	1360	0.89600	0.04200	4.85600	0.07089
10.19	4	1380	0.86800	0.02800	4.74800	0.04859
10.21	6	1400	0.84000	0.02800	4.64000	0.04971
10.28	13	1450	0.77000	0.07000	4.37000	0.03700
10.58	43	1600	0.56000	0.21000	3.56000	0.02942
11.18	63	1660	0.47600	0.08400	3.23600	0.02060
11.34	79	1700	0.42000	0.05600	3.02000	0.01865
12.09	114	1790	0.29400	0.12600	2.53400	0.02161
12.22	127	1820	0.25200	0.04200	2.37200	0.02195
12.48	153	1860	0.19600	0.05600	2.15600	0.01586
13.08	173	1900	0.14000	0.05600	1.94000	0.02279

BRE Value 0.0227933 lit/ sq.m/sec

Average Permeabilty Value: 0.032460141 lit/ sq.m/sec

Soil Permeability test

Soakaway Test 1 TP01

Site **Wakefield Road, Mill Hill Road, Pontefract** **Date** 06.08.2013

Client **Mr Duffy, Mr Duffy & Mr Davies** **Job No.** 5816

Pit dimensions m

Length	1.9
Width	0.8
Depth	2.9

Time	Time into Test Mlns	Dip Reading mm	Vol cu.m	Vol Change cu.m	Contact area Avge sq.m	Permeability lit/ sq.m/sec
9.01	0	2360	0.82080		4.43600	
9.09	8	2430	0.71440	0.10640	4.05800	0.05219
9.11	10	2530	0.56240	0.15200	3.51800	0.33439
9.13	12	2580	0.48640	0.07600	3.24800	0.18721
9.20	19	2640	0.39520	0.09120	2.92400	0.07036
9.38	37	2690	0.31920	0.07600	2.65400	0.02523
10.06	65	2710	0.28880	0.03040	2.54600	0.00696
10.25	84	2740	0.24320	0.04560	2.38400	0.01623
11.01	120	2780	0.18240	0.06080	2.16800	0.01237
11.16	135	2800	0.15200	0.03040	2.06000	0.01598
11.30	149	2820	0.12160	0.03040	1.95200	0.01804
12.12	191	2860	0.06080	0.06080	1.73600	0.01308
12.51	230	2900	0.00000	0.06080	1.52000	0.01596

BRE Value 0.02363010 lit/ sq.m/sec

Average Permeabilty Value: 0.064000533 lit/ sq.m/sec