FLOOD RISK ASSESSMENT REPORT

AT

BARNSLEY ROAD
FLOCKTON

ON BEHALF OF

BDW YORKSHIRE WEST

OCTOBER 2015

Report No: 1048/77r1	Name	Signature	Date
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1.0 INTRODUCTION

1.1 BDW Yorkshire West is proposing to develop a piece of land located in a central position in the village of Flockton with residential properties. As part of the consultations for the Planning Application, a Flood Risk Assessment Report is required.

1.2 It is within the general development strategy of the country for development in areas where there is a risk of flooding to be assessed to avoid unnecessary increase in the requirement for flood defence. Under the National Planning Policy Framework (NPPF) and the Planning Practice Guidance (PPG), consultation is required with the Environment Agency, Land Drainage Authority and Water Authority and a Flood Risk Assessment Report should be prepared considering the development proposals and make recommendations for any flood mitigation measures.

1.3 ARP Associates have been appointed to carry out an assessment of the site, implement appropriate consultations and prepare a Flood Risk Assessment Report, in accordance with NPPF, to satisfy the requirements of the Planning Authority.

1.4 The consultations and walkover survey have been carried out in October 2015.

1.5 This assessment has been prepared for the sole use and reliance of the Client and shall not be relied upon or transferred to any other parties without the written authorisation of ARP Associates. No responsibility will be accepted where this report is used, either in its entirety or in part, by any other party.

2.0 WALKOVER SURVEY

General

2.1 The site, which is centred on Ordnance Survey grid reference SE 241 151, is located in a central position in the small village of Flockton. The site is an irregular shaped piece of land extending to an area of approximately 2.5Ha.

2.2 A site location plan is presented in Appendix A.

Current Use

2.3 The site is presently an unused grassfield.

Site Features and Boundaries

2.4 The site is bounded by a mixture of stone walls and dense vegetation. A 6ft high palisade fence follows the majority of the western boundary, with Flockton Church of England First School and playing fields located beyond. The full extent of the northern boundary is occupied by fields of varying use, from children's play areas to horse paddocks and a football pitch. Located to the east, there are existing residential dwellings with further residential dwellings located to the south, beyond Barnsley Road, which follows most of the southern boundary. Several residential dwellings also form part of the southern boundary, with Flockton Green Working Men's Club located in the southeast corner.

Topography and Vegetation

2.5 The site falls gradually in a southerly direction, and this becomes more pronounced to the west of the site. A slight fall is also noticeable in a westerly direction, and again this becomes more pronounced to the west of the site, resulting in the low point of the site being located in the southwestern corner. Levels along the northern boundary range from approximately 166.27m AOD to approximately 161.5m AOD. The southern boundary ranges from approximately 158.2m AOD to 150.84m AOD. A topographical survey is presented in Appendix B.

2.6 The central area of the site has no vegetation other than rough grassland. However, extensive mature vegetation in the form of mature trees and bushes form the full extent of the western boundary and the northwestern boundary. Further dense vegetation is located to the south of the site with various sporadically located bushes and shrubs located to the east.

Drainage

2.7 Flockton Green Working Men's Club has a positive drainage system with rainwater pipes discharging to an underground drainage system. However, the remainder of the site has no obvious positive drainage system, although land drainage may be present. Surface water run-off clearly discharges in a southwesterly direction, and ultimately outfalls into the watercourse located running along the western boundary.

2.8 The watercourse flows in a southerly direction in an open channel before becoming culverted in the southwest corner of the site. The outfall of this culvert is unknown. A small ditch is located along part of the northern boundary which also outfalls into the watercourse on the western boundary.

3.0 ENVIRONMENT AGENCY CONSULTATION

3.1 A consultation was requested from the Environment Agency and a copy of their response, reference RFI/2015/34078 dated 15th October 2015, is presented in Appendix C for reference.

3.2 The Environment Agency has provided a Flood Map, which shows areas of land that could flood from rivers or the sea and are shaded blue. These areas do not take into account defences as water can overtop or can fail in extreme conditions.

3.2.1 Flood Zone 1 - 'Low Probability' is assessed as having a less than 1 in 1,000 annual probability of river or sea flooding in any year (less than 0.1%).

3.2.2 Flood Zone 2 - 'Medium Probability' is assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding in any year (1% - 0.1%) and between a 1 in 200 and 1 in 1,000 annual probability of flooding from the sea (0.5% - 0.1%).

3.2.3 Flood Zone 3 - 'High Probability' is assessed as having a 1 in 100 or greater annual probability of river flooding in any year (greater than 1%) and a 1 in 200 chance or greater annual probability of flooding from the sea (less than 0.5%).

3.3 The Environment Agency Flood Map confirms that the site falls within Flood Zone 1.

3.4 Modelled flood levels in the vicinity of the site have been provided on Mill Beck located to the south of the site. The position of the node points where the levels were taken was provided and shows that the nearest node point location, reference EA 1231396_DEAR01_088, gives a 1 in 100 year flood level of 94.54m AOD.

3.5 A copy of the surface water flood map for the area has also been provided. This shows areas where surface water only would be expected to flow or pond. All land in England and Wales will be within one of a possible four categories. The four categories shown on the map are:-

High - this area has a chance of flooding greater than 1 in 30 in any given year (annual probability of flooding 3.3%).

Medium - this area has a chance of flooding between 1 in 100 (1%) and 1 in 30 (3.3%) in any given year.

Low - this area has a chance of flooding between 1 in 1,000 (0.1%) and 1 in 100 (1%) in any given year.

Very Low - this area has a chance of flooding of less than 1 in 1,000 (0.1%) in any given year.

3.6 The surface water flood map shows that the majority of the site is not at risk of flooding. However, a flow of surface water run-off is present along the western boundary.

3.7 According to the Environment Agency records, there is no history of flooding for the site.

3.8 No information is related to restrictions on surface water run-off, but this will be set at greenfield run-off rates.

4.0 WATER AUTHORITY CONSULTATION

4.1 A consultation was requested from Yorkshire Water, who is the Water Authority for this area, and a copy of their response, reference R014463 dated 17th September 2015, is presented in Appendix D for reference.

4.2 Due to the change in legislation on 01/10/11, there may be public sewers within the site boundary which are not recorded on the statutory sewer map, the presence of which should be taken into account in the design of the site.

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

4.4 Foul water domestic waste should discharge to the 150mm diameter public foul sewer recorded in Barnsley Road, at a point approximately 25m from the site.

4.5 In respect of surface water, reference is made to Requirement H3 of Building Regulations 2000 and Sustainable Drainage Systems. This establishes a hierarchy of surface water disposal. Consideration should firstly be given to discharge to soakaway, infiltration and watercourse, in that priority order, before connection to sewers will be considered. Where appropriate, soakaways, swales and infiltration trenches (SUDS) may be adopted as part of the public sewer network.

4.6 The local public sewer network does not have capacity to accept any discharge of surface water from the proposal site. If SUDS are not viable, the Developer is advised to contact the Environment Agency/Local Land Drainage Authority with a view to establishing a suitable watercourse for discharge.

4.7 It is understood that a watercourse, Flockton Beck is located 200m to the south of the site. This appears to be the obvious place for surface water disposal (if SUDS are not viable).

4.8 Further restrictions on surface water disposal from the site may be imposed by other parties. It is strongly advised to seek advice/comments from the Environment Agency/Local Land Drainage Authority with regards to surface water disposal on the development.

5.0 LAND DRAINAGE AUTHORITY CONSULTATION

5.1 A consultation was requested from Kirklees Council, who is the Land Drainage Authority for this area, and a copy of their response, dated 20th October 2015, is presented in Appendix E for reference.

5.2 The site is located in Main River, Flood Zone 1 - low risk.

5.3 Third generation surface water flood risk maps show a linear flooding pattern at the western boundary with Flockton Church of England First School. This route should be kept clear. Such linear routing, as opposed to ponding, usually indicates the presence of an above ground or culverted watercourse. Kirklees Council do not have any watercourses shown on their records, but would strongly advise further investigation. There are no known flood incidents in the immediate vicinity of the site.

5.4 SUDS need to be considered in line with Leeds City Region advice on submissions. A quick scan at the British Geological Survey data indicates a mixed bag for infiltration potential, and testing is expected. SUDS can still be used for water quality improvements if a connection to watercourse, as opposed to treatment works (via sewer) is available.

5.5 A highway drain is shown immediately outside the site. However, this is a private pipe for highway purposes and Kirklees Council would only consider a connection if no other suitable system is available. Its condition is considered fit for purpose and is deemed to have capacity. It should be noted that a recent survey to the west of 'The Sun' Public House along Barnsley Road revealed that lengthy sections needed urgent attention. It is not clear whether this connects to watercourse or combined sewer at this stage.

5.6 A foul only sewer is shown outside the site, although it is possible that combined connection from properties are present. It is depicted as combined adjacent to Pinfold Court. Connections to either of these sewers could be restricted to much less than greenfield run-off rates (e.g.3l/s -5l/s).

5.7 Flow routing for surface water from the north (e.g. saturated field run-off) has to be considered, as does exceedance events and blockage scenarios for on-site drainage. This should mimic current run-off directions, but the increases in volume could affect routes through third party land negatively and needs careful consideration.

6.0 MATERIAL CONSIDERATION IN RESPECT OF THE NPPF AND PPG

Flood Classification

6.1 The Environment Agency confirmed that the site falls within land assessed as having less than a 1 in 1,000 annual probability of river or sea flooding in any year (less than 0.1%). Therefore, in accordance with Table 1 of the PPG, the site falls within Flood Zone 1 "low probability".

6.2 Therefore, all uses of land are appropriate within this Zone, but an assessment of the effect of surface water run-off will need to be incorporated in any Flood Risk Assessment.

End Use

6.3 The development proposal is for the construction of residential dwellings on the development site and a copy of the proposed sketch layout is presented in Appendix F for reference purposes.

6.4 When applying Table 2 of the PPG, the flood risk vulnerability classification shows that the proposed end use will fall into a "More Vulnerable" classification.

Sequential Test

6.5 As set out in the NPPF, the aim of the Sequential Test is to steer new development to areas with the lowest probability of flooding (Zone 1).

6.6 When the development site is evaluated in accordance with Table 3 of the PPG, the Sequential Test is satisfied and the Exception Test is not required in this instance.

Flood Sources

6.7 Flooding from Rivers - The River Calder is located approximately 4.7km northeast from the site boundary at its nearest location and the River Dearne approximately 3.8km to the southeast. Due to the distance of the Rivers from the site, flooding from this source is considered to be low risk.

6.8 Flooding from Local Watercourses - The nearest watercourse is an unnamed watercourse, which is located running along the western boundary of the site. The watercourse flows in a southerly direction and ultimately becomes culverted in the southwest of the site. The Land Drainage Authority have not provided any information regarding the watercourse, but, due to the topography of the site and surrounding area, flooding of the site is considered to be low risk, but will need to be considered as part of the development proposals. A CCTV survey of the culvert will also be required to confirm that it is in a suitable condition. The outfall location would also be advantageous.

6.9 Flooding from the Sea - The site is not located near enough to the sea to cause a problem of flooding from this source.

6.10 Flooding from Land - The site is situated adjacent to residential dwellings to the east, with the topography of the site falling generally in a southwesterly direction. All paved areas will be serviced by a positive drainage system throughout and, therefore, it is highly unlikely that flooding will occur from this direction. However, land to the immediate north of the site is higher than the site itself and, therefore, overland flooding will need to be considered as part of the proposed development. A small ditch is located running along part of the northern boundary, which communicates with the watercourse recorded running along the western boundary of the site. This will ultimately intercept any overland flooding, but will need further consideration as part of the site development.

6.11 Flooding from Groundwater - The Geological Survey Map of Great Britain shows the site to be underlain by the Pennine Lower Coal Measures formation of mudstone, siltstone and sandstone. A small part of the site also appears to be underlain by the Birstall Rock

sandstone formation. Although the sandstone may be impermeable, with the potential for groundwater to rise and flood the site, the presence of the watercourse along the western boundary suggests that the site is impermeable and therefore, flooding from this source is considered to be low risk. Furthermore, due to the topography of the site, it is considered highly unlikely that groundwater flooding will occur.

6.12 Flooding from Sewer - There are existing sewers recorded adjacent to the site and a new drainage system for the development will need to be introduced. It is possible therefore, that any blockage of the sewers will result in flooding from the lowest cover levels of manholes or gullies and this will need to be considered as part of any proposed development.

6.13 Flooding from Reservoirs, Canals or Artificial Sources - There are no other reservoirs, canals or artificial sources which will result in flooding from the site.

Climate Change

6.14 The NPPF and PPG have indicated that the Global sea level will continue to rise, depending on greenhouse gas emissions, and the sensitivity of the climate system and there will be an increase in rainfall across the country. The PPG makes reference to the Environment Agency guidance for Climate Change and Table 2 makes an assessment of the increase in peak rainfall intensity and that this is likely to increase by 20% between 2055 and 2085 and by 30% between 2085 and 2115.

6.15 Due to the topography of the land, overland run-off from adjoining land may be an issue. Therefore, any run-off from outside the site will need to be considered in respect of climate change. However, an appropriate solution to this would be to deal with any overland run-off from third party land at the site boundary. On this basis, only rainfall falling within the site boundaries will need to be considered in respect of climate change.

6.16 In accordance with the PPG, the published figures show that for an expected life of greater than 50 years for any new development, the anticipated increase in rainfall will be around 30%. It will be necessary to design any new positive drainage system with a 30% increase in capacity to accommodate this requirement.

Flood Mitigation

6.17 As the proposed development is to be restricted to Flood Zone 1, flood mitigation measures are only required in the event of a catastrophic storm, overland flooding or blockage of the existing watercourse or proposed sewers. The following precautionary mitigation measures are therefore recommended:-

6.17.1 The finished floor levels to the properties should be raised above external levels by a minimum of 150mm wherever possible.

6.17.2 Properties shall be designed without any basements and ground floors shall comprise solid concrete slabs or beam and block with screed construction.

6.17.3 Incoming electricity supplies shall be raised above ground floor level and ground floor electric sockets shall be served by loops from the first floor level.

6.17.4 In the unlikely event of flooding on the site, it would be appropriate to design external levels with falls to non-critical areas, such as landscaping, where the water can pond without causing flooding to buildings.

6.17.5 In the event of flooding of the site from any existing watercourse, it will be necessary to ensure there is a route for floodwater through the site without causing flood of buildings or gardens (if possible).

Sustainable Drainage

6.18 In order to comply with the requirements of NPPF, it will be necessary to consider aspects of Sustainable Drainage techniques for the new development. Whilst no intrusive soil investigation has been carried out at the time of writing the FRA, a review of the Geological Survey Map of Great Britain shows the majority of the site to be underlain by the Pennine Lower Coal Measures formation consisting of mudstone, siltstone and sandstone. This material is likely to be impermeable and therefore, unsuitable of the disposal of surface water using infiltration techniques. However, part of the site may be underlain by the Birstall Rock sandstone formation, which may be suitable for infiltration techniques. It will be necessary to carry out appropriate infiltration tests in accordance with BRE Digest 365 'Soakaway Design' prior to construction on site and the results presented in a report for the approval of the Planning Authority. However, for the purpose of this report, a positive drainage system to watercourse for surface water drainage will be required.

Drainage

6.19 It is a requirement to ensure that surface water run-off from any proposed development has negligible consequence on downstream areas either in sewer capacity or discharge to watercourse.

Existing Surface Water Run-off

6.20 The site is greenfield and, therefore, in accordance with current guidelines and regulations, indicative surface water calculations have been undertaken using the IH124 method of calculating greenfield run-off rates. This shows that a rate of 3.5l/s has been calculated for the existing 1 in 1 year storm for the site that positively communicates with the watercourse. This will need to be confirmed and agreed as part of the drainage strategy for the site. The calculations and run-off assessment are presented in Appendix G.

Proposed Surface Water Drainage

6.21 Consideration for the proposed drainage should firstly be given to infiltration techniques (to ground). However, based on information available, the disposal of surface water using infiltration techniques may not be feasible, subject to the results of the infiltration tests. Therefore, it will be necessary to provide a positive drainage system to watercourse.

6.22 The proposed sketch layout, which is presented in Appendix F, has been assessed as having a proposed impermeable area of approximately 1.25ha for semi-detached and detached properties. Indicative calculations have been carried out using the WinDES Source Control Computer Program. The proposed surface water system should be designed to accommodate the 1 in 30 year storm event without flooding and the 1 in 100 year storm plus climate change event should be retained within the site in an area which will not affect the new buildings or third parties from flooding.

6.23 Restricting the discharge rate to no greater than 3.5l/s, on-site storage of 494.9m³ will need to be provided for a 1 in 30 year storm. The drainage system will also need to accommodate the 1 in 100 year storm plus 30% climate change event without causing flooding of property or third party land. In the event that levels dictate that the 1 in 100 year plus climate change flood water would flow off site, an additional or larger storage facility will be required. In these circumstances, on-site storage could increase to 947.3m³. This can be achieved by several methods including oversized pipes, underground tanks or balance ponds. One such option would be to provide the attenuation in a balance pond 30.8m x 30.8m at 1m deep or equivalent, with side slopes of 1 in 6, to the southwest of the development site. However, due to the topography of the site, this may prove impractical and an alternative underground solution will be required. The indicative surface water calculations are presented in Appendix H. However, detailed calculations and proposals will need to be prepared and submitted to the Planning Authority for approval prior to construction.

6.24 Providing an adoptable surface water pumping station is not a suitable option for dealing with surface water run-off. Therefore, subject to detailed level design, if the lower lying properties are not able to drain by gravity, the proposed layout will need to be revised and levels raised accordingly.

Watercourse Conditions

6.25 The discharge of surface water to the watercourse will require the introduction of headwalls or works to the watercourse. This will need the Consent of the Land Drainage Authority by submitting an Application for Consent to Work Within a Watercourse. There is also a requirement for a 9m strip to be provided from the top of the banking where no development can take place and access arrangements will need to be agreed with the Land Drainage Authority for future improvements or maintenance. A CCTV survey of the culverted watercourse will also be required.

Foul Water Drainage

6.26 Foul water domestic waste should discharge to the 150mm diameter public foul sewer recorded in Barnsley Road, at a point approximately 25m from the site.

Emergency Egress During Times of Flood

6.27 It is a requirement under the PPG that occupants should be able to egress any building during times of flood, without being trapped by flood conditions.

6.28 As the site falls within Flood Zone 1, no special mitigation measures are required for emergency egress during times of flood.

7.0 COMMENTS

7.1 The site is to be restricted to Flood Zone 1 and the Sequential Test is satisfied. However, in order to accommodate the possibilities of flood from a catastrophic storm, overland flooding or blockage of the existing watercourse or proposed sewers, the following mitigation measures are recommended:-

7.1.1 The finished floor levels to the properties should be raised above external levels by a minimum of 150mm wherever possible.

7.1.2 Properties shall be designed without any basements and ground floors shall comprise solid concrete slabs or beam and block with screed construction.

7.1.3 Incoming electricity supplies shall be raised above ground floor level and ground floor electric sockets shall be served by loops from the first floor level.

7.1.4 In the unlikely event of flooding on the site, it would be appropriate to design external levels with falls to non-critical areas, such as landscaping, where the water can pond without causing flooding to buildings.

7.1.5 In the event of flooding of the site from any existing watercourse, it will be necessary to ensure these is a route for floodwater through the site without causing flood of buildings or gardens (if possible).

7.2 A 30% increase in rainfall shall be incorporated into any new positive drainage system to satisfy the requirements of climate change.

7.3 Sustainable Drainage Systems of infiltration techniques have been assumed to be unsuitable on this particular site, for the purpose of the report. It will be necessary to carry out appropriate infiltration tests in accordance with BRE Digest 365 'Soakaway Design' prior to construction on site and the results presented in a report for the approval of the Planning Authority.

7.4 Surface water discharge shall be restricted to greenfield run-off rates of 3.5l/s, based on IH124 calculation, with outfall to the on-site watercourse. This will need to be confirmed and agreed as part of the drainage strategy for the site.

7.5 The proposed surface water drainage system shall be designed with an allowance for climate change and restricted to the agreed discharge rate with appropriate attenuation incorporated into the design. A detailed design and calculations shall be submitted to the Planning Authority for approval prior to construction on site.

7.6 The discharge of surface water, the construction of the headwalls or regrading of the watercourse will require the consent of the Land Drainage Authority by submitting an Application for Consent to Work with a Watercourse prior to construction on site. A CCTV survey of the culverted watercourse will also be required.

7.7 No properties or other restrictions shall be constructed within 9m of the watercourse banking, and the development shall comply with all Land Drainage Bye-laws and the Land Drainage Act 1991.

7.8 Foul water domestic waste should discharge to the 150mm diameter public foul sewer recorded in Barnsley Road, at a point approximately 25m from the site.

7.9 No special mitigation measures are required for emergency egress during times of flood.

7.10 Subject to compliance with the above, the proposed development can satisfy the requirements of the National Planning Policy Framework and the Planning Practice Guidance in relation to flood risk.

A P P E N D I X A

SITE LOCATION PLAN



Levels and grid relative to OS – as surveyed with GPS – scale factor of 1 grid set at 50 meter

OS Grid Reference: SE 24131 15062

Rev	By	Date	Amendment	Chk
/	DJG	03.09.15	Issued for approval	WMW

Title

SITE LOCATION PLAN

Project/Client

FLOCKTON GREEN WORKING MENS CLUB
BDW YORKSHIRE WEST

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Scale	1:5000 @ A4
Drawn	DJG
Date	SEPTEMBER '15
Chk.	WMW
Drg. No.	1048/77/NA
Rev	/

A P P E N D I X B

TOPOGRAPHICAL SURVEY



Station	Easting	Northing	Level
A1	424205.159	415016.776	158.676
A2	424244.896	415025.333	159.236
A3	424259.963	414988.624	157.936
A4	424285.495	415011.679	158.370
A5	424197.404	414983.331	154.769

Benchmark
Bollard
Bus Stop
Electric Box
Electricity Pole
Fence Post
Gas Stop Valve
Gate Post
Gas Marker
Gully Drain
Electric Inspection Cover
Kerb Outlet
Litter Bin
BT Inspection chamber
Lamp Post
Manhole Point
MH Triangular
MH Square
MH Round
Marker Post
Pylon
Rodding Eye
BT Exchange Box
Sign Post
Spot Height
Eave Level
Ridge Level
Stile
Survey Station
Traffic Camera
Telephone Box
Trial Pit
Telegraph Pole
Deciduous Tree
Road Sign
GATE
Fire Hydrant
Water Meter
Letter Box
CATV Inspection Chamber
Water Stop Valve

Bottom of Bank
Building
Canopy Edge
Concrete Edge
Ditch
Drop Kerb
Overhead Cable
Grid
Tackile Paver
Kerb
Path
Pipe Line
FOUL SEWER
SURFACE WATER SEWER
Channel Line
Road Centre Line
Tarmac Edge
Top of Bank
Track
Wall
Verge
Flagstone Paving
Stone
Hedgeline
Grass Edge
Vegetation Line
Post and Rail Fence
Post and Wire Fence
Contour Normal
Contour Prominent

ABBREVIATIONS

LP.	Lamp Post
TP.	Telegraph Pole
EP.	Electricity Pole
SP.	Sign Post
TS.	Tarffic Sign
BS.	Bus Stop
GM.	Gas Marker

ABBREVIATIONS CONTINUED

MH.	Manhole
GU.	Gully
FH.	Fire Hydrant
CATV.	Cable Television Point
WM.	Water Meter
WSV.	Water Stop Valve
GSV.	Gas Stop Valve
RE.	Rodding Eye
GU.	Gully
FH.	Fire Hydrant
CATV.	Cable Television Point
WM.	Water Meter
WSV.	Water Stop Valve
GSV.	Gas Stop Valve
RE.	Rodding Eye

LEVELS AND GRID RELATIVE TO OS - AS SURVEYED WITH GPS - SCALE FACTOR OF 1 GRID SET AT 50 METER

THIS SURVEY SHOWS PHYSICAL SITE BOUNDARIES ONLY. CONFIRMATION OF LEGAL OWNERSHIP BOUNDARIES SHOULD BE OBTAINED BY REFERENCE TO THE H.M. LAND REGISTRY TITLE PLAN EVERY EFFORT IS MADE TO IDENTIFY ALL VISIBLE ABOVE GROUND FEATURES, HOWEVER, IT SHOULD BE BORNE IN MIND THAT THERE MAY BE ITEMS OBSCURED AT THE TIME OF SURVEY.

THE PLAN SCALE IS FOR GUIDANCE ONLY.
DO NOT SCALE DIRECTLY .
IF IN DOUBT, PLEASE ASK.

THE CONTRACTOR IS TO CHECK AND VERIFY ALL BUILDING AND SITE DIMENSIONS,LEVELS AND SEWER INVERT LEVELS AT CONNECTION POINTS BEFORE WORK STARTS. SHOULD THERE BE ANY CONFLICT BETWEEN THE DETAILS INDICATED ON THIS DRAWING AND THOSE INDICATED ON OTHER DRAWINGS, THE ENGINEER SHOULD BE INFORMED PRIOR TO CONSTRUCTION ON SITE.

REV.	DESCRIPTION	DATE
A	ADDITIONAL ROAD AND SITE DETAIL ADDED	27.08.15

PD SITE SURVEYS
The Old Coach House
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CLIENT

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Vico Court
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LS12 6AN

JOB TITLE

Flockton Green
Working Mens Club

DRAWING TITLE

FULL SITE TOPOGRAPHICAL SURVEY

DRAWN: AM	SIGNATURE	DATE: 28/07/2015	STATUS: FOR COMMENT ☐
APPROVED: PD	SIGNATURE	DATE: 28/07/2015	FOR APPROVAL ☐ DRAFT ☐ FINAL ◉
SCALE	SHEET	DRAWING NO.	REVISION

A P P E N D I X C

ENVIRONMENT AGENCY CONSULTATION

Wayne Walker

Subject: FW: Your Enquiry: RFI/2015/34078
Attachments: Standard_Notice sept 2012.pdf; flood risk & flood consequence assessments.pdf; SurfaceWaterFloodMap.pdf; FloodMap.pdf; ModelledFloodLevelNodePointLocationMap.pdf; ModelledFloodLevels.pdf; NPPF TG Climate Change extract.pdf

From: Jones, Kimberley [mailto:kimberley.jones@environment-agency.gov.uk]
Sent: Thursday 15 October, 2015 3:29pm
To: Dave Griffiths
Subject: Your Enquiry: RFI/2015/34078

Our Ref: RFI/2015/34078

Your Ref:

Dear David

Provision of Flood Risk Assessment for BDW Yorkshire West, Barnsley Road, Flockton

Thank you for your request of 3 September 2015 to use Environment Agency data, Flood Risk Assessment, in the development of the Yorkshire West, Barnsley Road, Flockton. The information is attached and below:-

Flood Map

We have provided you with a map which shows areas of land that we believe to be at risk of flooding from rivers and does not cover other sources of flooding such as local drainage, surface water or groundwater. These areas do not take into account defences as water can overtop or they can fail in extreme conditions.

- **Flood Zone 2 -** This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% – 0.1%) in any year

- **Flood Zone 3 -** This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) in any year

Model data

According to our records there are Modelled Flood Levels in the vicinity of the site.

Please see the PDF '**ModelledFloodLevels'**. The PDF **'ModelledFloodLevelNodePointLocationMap'** shows the location where the Levels were taken from.

The Levels are given in Metres above Ordnance Datum

The Flows are given in Cubic Metres per Second

Updated Flood Map for Surface Water

This shows areas where surface water only would be expected to flow or pond in England & Wales. It is shown on our website as the Risk of Flooding from Surface Water map. It supersedes earlier Environment Agency national scale maps, the Areas Susceptible to Surface Water Flooding (2008/9) and Flood Map for Surface Water (2010). All land in England and Wales will be within 'one' of a possible 'four' categories. The four categories shown on the map are:

- **High** - This area has a chance of flooding greater than 1 in 30 in any given year (annual probability of flooding 3.3%)
- **Medium** - This area has a chance of flooding between 1 in 100 (1%) and 1 in 30 (3.3%) in any given year
- **Low** - This area has a chance of flooding between 1 in 1000 (0.1%) and 1 in 100 (1%) in any given year
- **Very low** - This area has a chance of flooding of less than 1 in 1000 (0.1%) in any given year

Historic information

According to our records there is No Flood History for the site.

If you have requested this information to help inform a development proposal, then you should note the detail in the attached advisory text on the use of Environment Agency Information for Flood Risk Assessments.

If you have any queries or would like to discuss the content of this letter further please contact us on the telephone number below.

We would be really grateful if you could spare five minutes to help us improve our service. Please click on the link below and fill in our survey – we use every piece of feedback we receive:

http://www.smartsurvey.co.uk/s/EnvironmentAgencyCustomerSurvey/?a=Y

Yours sincerely,

Kimberley Jones
Customers and Engagement Team

Environment Agency
Lateral
8 City Walk
Leeds
LS11 9AT

Email: neyorkshire@environment-agency.gov.uk
External Number: 0113 8196359
Internal Number: 728 6359

Please note: my usual working days are Tuesday, Wednesday, Thursday and Friday

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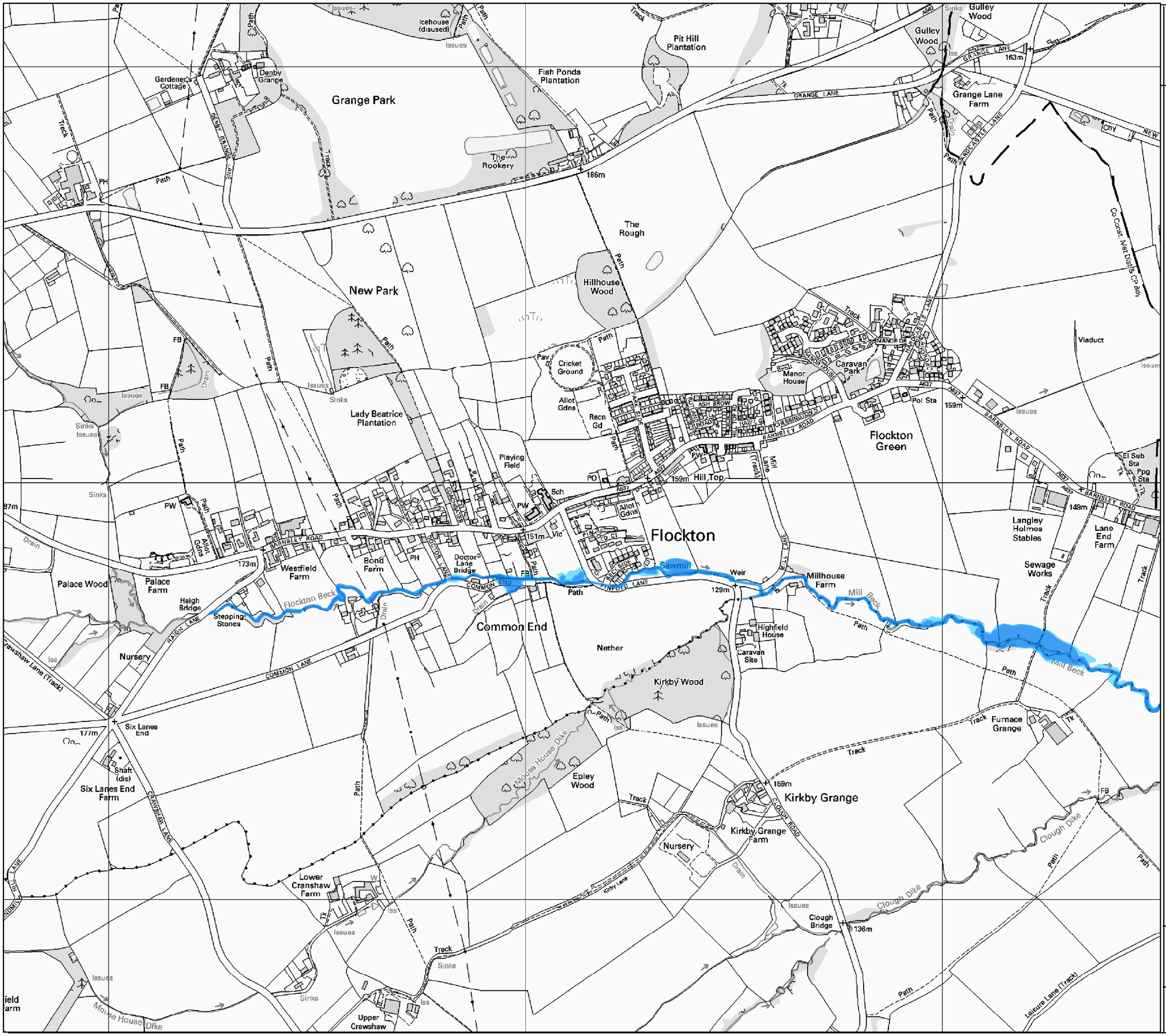

Environment Agency

North East Region - Yorkshire Area
Coverdale House
Amy Johnson Way
Aviator Court
York
YO30 4GZ

2014 FLOOD ZONE DATA FOR ENGLAND
Information - User Note

The Flood Zones have been produced in accordance with the requirements of Government Planning Policy on Development and Flood Risk).

Flood Zones are for planning consultation.

As the information is indicative rather than specific Local Planning Authorities will need to consult the Environment Agency in accordance with our standing advice for planning consultations.

The flood zones are based on information available at the time, and will benefit from updates as better information becomes available. For example changes in hydrological river response, observations following flood events or improved modelling techniques. No consideration has been given to climate change at this time.

It should be noted that locations adjacent to rivers, not included at this stage of the survey, may be at risk of flooding. When in doubt the Environment Agency should be consulted.

These maps may be also used by Local Authority Emergency Planners when producing Major Incident Flood Response Plans. The extents of any Flood Warning Service provided by the Agency is contained in the Local Flood Warning Plan.

Zone 3 (England) and Zone C (Wales) is the Agency's best estimate of the areas of land with a 100 to 1 (1%) chance or greater of flooding each year from rivers in catchments greater than 3 sq.km, or with 200 to 1 (0.5%) chance or greater of flooding each year from the sea without the presence of any defences.

Zone 2 (England) and Zone B (Wales) is the Agency's best estimate of the areas of land that could flood under extreme conditions with a 1000 to 1 (0.1%) chance of flooding each year from rivers or the sea, without the presence of defences.

Legend

Flood Zone 3

Flood Zone 2

Scale: 1:10,000

N

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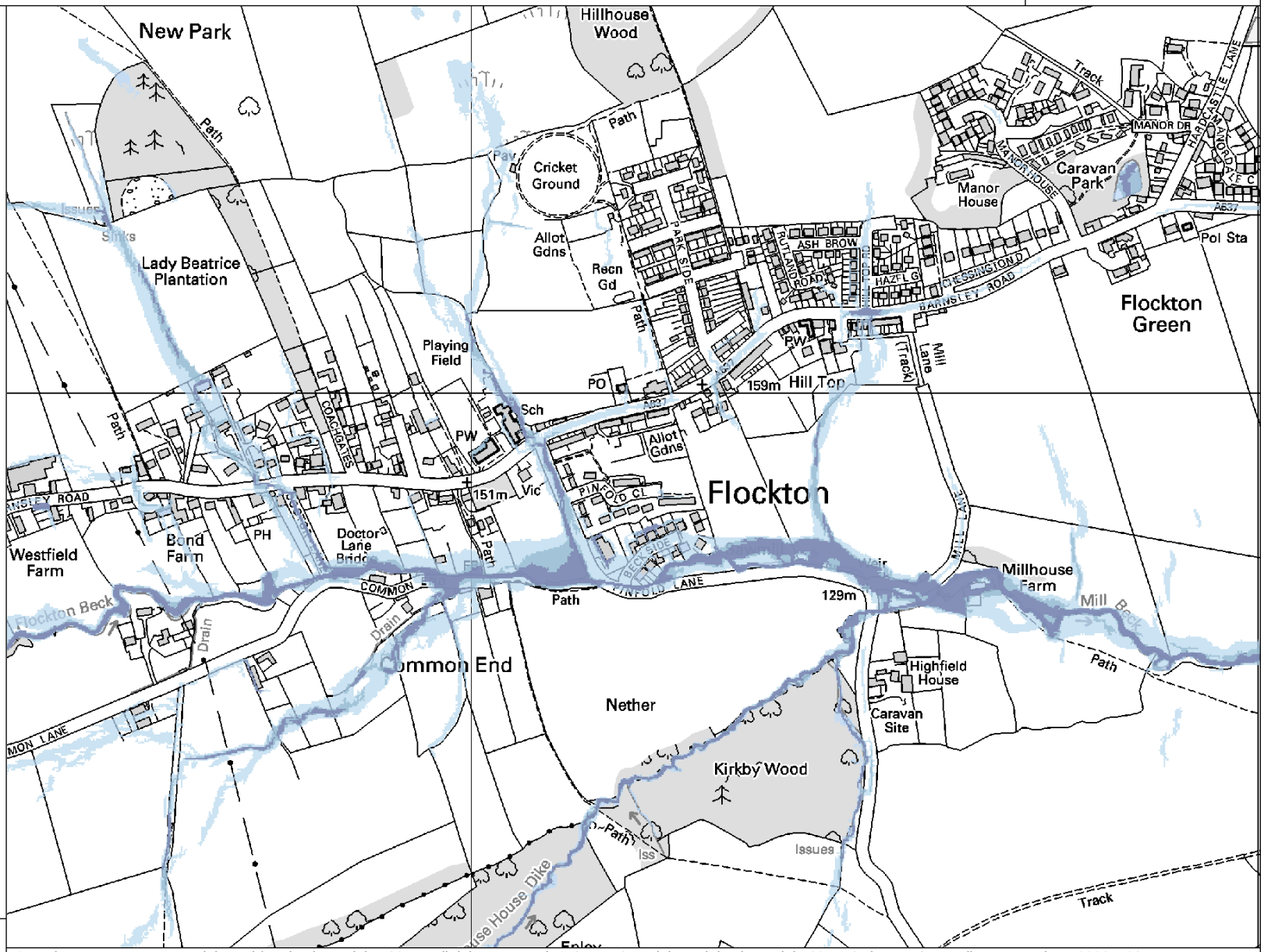
Easimap

Environment Agency

Legend

- uFMfSW (2013) – 1 in 30 chance rain
- uFMfSW (2013) – 1 in 100 chance rain
- uFMfSW (2013) – 1 in 1000 chance rain



0 70 140 210 m.

N W E S

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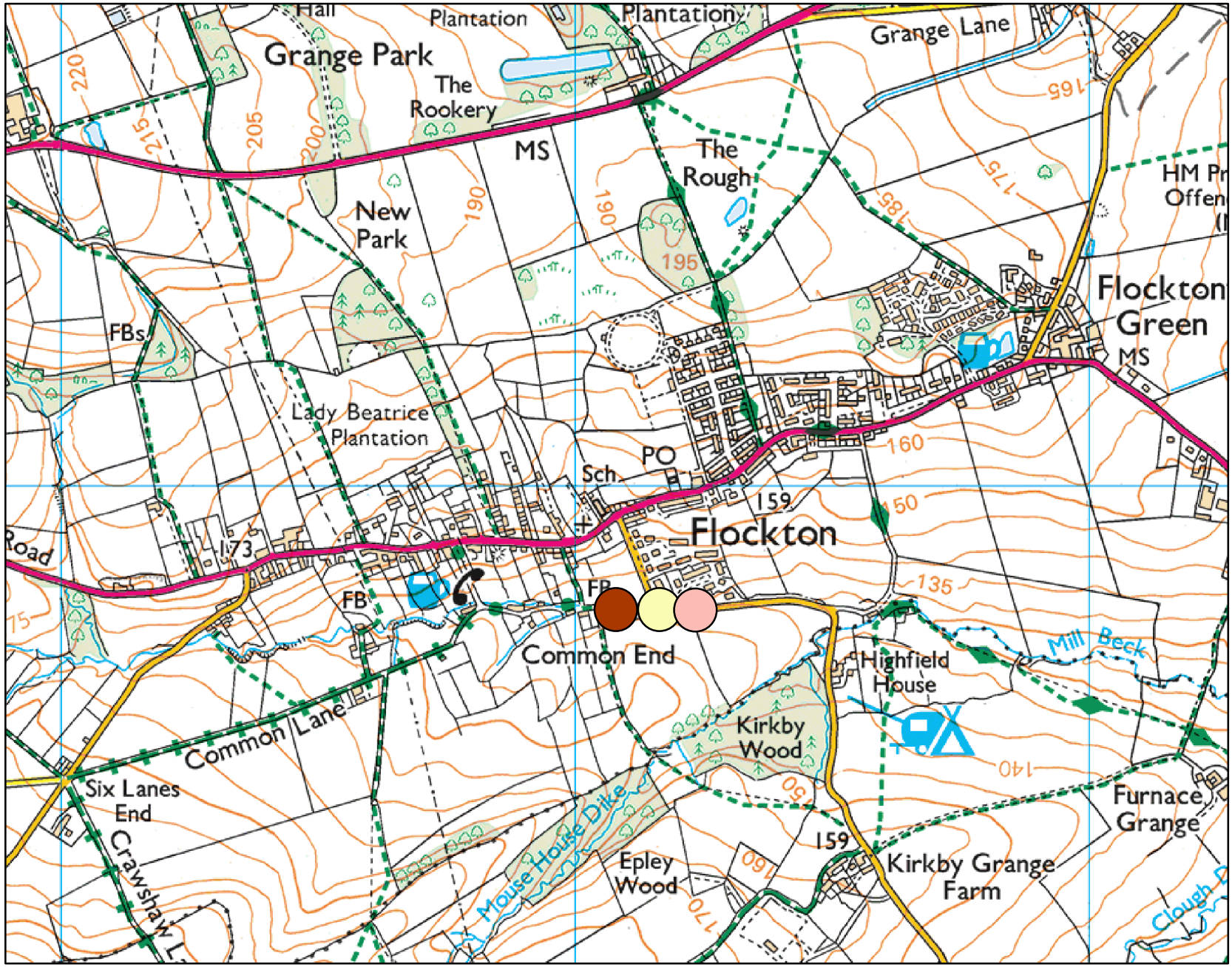
Modelled Flood Level Node Point Location Map centred on Flockton. [RFI/2015/34078]



Environment Agency

Scale 1:10,000

N

Please note that the supplied map is not considered by the Environment Agency to constitute a flood risk assessment on its own and may not be accepted by local planning authorities for that purpose. Using an inappropriate scale can in some instances result in a different indication of whether a particular point is within a flood zone.

Legend

NodePoint

- <all other values>

NODEPOINTN

- EA1231396_DEAR01_087
- EA1231396_DEAR01_088
- EA1231396_DEAR01_089

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Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 08708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

NodePointName	ModelledFloodGroupCode	ReturnPeriod	LevelValue	FlowValue
EA1231396_DEAR01_087	EA1231396	101	95.17	0.14
EA1231396_DEAR01_087	EA1231396	25	94.97	0.08
EA1231396_DEAR01_087	EA1231396	5	94.97	0.08
EA1231396_DEAR01_087	EA1231396	10	94.97	0.08
EA1231396_DEAR01_087	EA1231396	100	94.97	0.08
EA1231396_DEAR01_087	EA1231396	50	94.97	0.08
EA1231396_DEAR01_087	EA1231396	75	94.97	0.08
EA1231396_DEAR01_087	EA1231396	1000	95.64	3.66
EA1231396_DEAR01_088	EA1231396	100	94.54	0.08
EA1231396_DEAR01_088	EA1231396	75	94.54	0.08
EA1231396_DEAR01_088	EA1231396	50	94.54	0.08
EA1231396_DEAR01_088	EA1231396	1000	95.13	5.72
EA1231396_DEAR01_088	EA1231396	25	94.54	0.08
EA1231396_DEAR01_088	EA1231396	101	94.74	0.14
EA1231396_DEAR01_088	EA1231396	5	94.54	0.08
EA1231396_DEAR01_088	EA1231396	10	94.54	0.08
EA1231396_DEAR01_089	EA1231396	50	94.19	0.08
EA1231396_DEAR01_089	EA1231396	10	94.19	0.08
EA1231396_DEAR01_089	EA1231396	25	94.19	0.08
EA1231396_DEAR01_089	EA1231396	100	94.19	0.08
EA1231396_DEAR01_089	EA1231396	5	94.19	0.08
EA1231396_DEAR01_089	EA1231396	101	94.39	0.14
EA1231396_DEAR01_089	EA1231396	1000	95.03	7.06
EA1231396_DEAR01_089	EA1231396	75	94.19	0.08

Use of Environment Agency Information for Flood Risk / Flood Consequence Assessments

Important
If you have requested this information to help inform a development proposal, then we recommend that you undertake a formal pre-application enquiry using the form available from our website:-

http://www.environment-agency.gov.uk/research/planning/33580.aspx

Depending on the enquiry, we may also provide advice on other issues related to our responsibilities including flooding, waste, land contamination, water quality, biodiversity, navigation, pollution, water resources, foul drainage or Environmental Impact Assessment.

In **England**, you should refer to the Environment Agency's Flood Risk Standing Advice, the technical guidance to the National Planning Policy Framework and the existing PPS25 Practice Guide for information about what flood risk assessment is needed for new development in the different Flood Zones. These documents can be accessed via:

http://www.environment-agency.gov.uk/research/planning/82587.aspx

http://www.communities.gov.uk/publications/planningandbuilding/nppftechnicalguidance

http://www.communities.gov.uk/publications/planningandbuilding/pps25guideupdate

You should also consult the Strategic Flood Risk Assessment produced by your local planning authority.

In **Wales,** you should refer to TAN15 for information about what flood consequence assessment is needed for new development in the different flood zones
http://new.wales.gov.uk/splash;jsessionid=8ylGTfGZthmB0t2vhp6hS1GcB1LXvZzB3Ylczf20Xn7LK3zK0nMk!981825250?orig=/topics/planning/policy/tans/tan15/

You should also consult the Strategic Flood Consequence Assessment if one has been produced by your local planning authority.

In both **England and Wales** you should note that:

1. Information supplied by the Environment Agency may be used to assist in producing a Flood Risk / Consequence Assessment (FRA / FCA) where one is required, but does not constitute such an assessment on its own.

2. This information covers flood risk from main rivers and the sea, and you will need to consider other potential sources of flooding, such as groundwater or overland runoff. The information produced by the local planning authority referred to above may assist here.

3. Where a planning application requires a FRA / FCA and this is not submitted or deficient, the Environment Agency may well raise an objection.

4. For more significant proposals in higher flood risk areas, we would be pleased to discuss details with you ahead of making any planning application, and you should also discuss the matter with your local planning authority.

Taking climate change into account

11. Global sea level will continue to rise, depending on greenhouse gas emissions and the sensitivity of the climate system. The relative sea level rise in England also depends on the local vertical movement of the land, which is generally falling in the south-east and rising in the north and west. In preparing a Strategic Flood Risk Assessment or a site-specific flood risk assessment, the allowances for the rates of relative sea level rise shown in table 4 should be used as a starting point for considering flooding from the sea, along with the sensitivity ranges for wave height and wind speed in table 5.

Table 4: Recommended contingency allowances for net sea level rises

	Net sea level rise (mm per year) relative to 1990			
	1990 to 2025	**2025 to 2055**	**2055 to 2085**	**2085 to 2115**
East of England, east midlands, London, south-east England (south of Flamborough Head)	4.0	8.5	12.0	15.0
South-west England	3.5	8.0	11.5	14.5
North-west England, north-east England (north of Flamborough Head)	2.5	7.0	10.0	13.0

Notes to table 4:

a. For deriving sea levels up to 2025, the 4mm per year, 3mm per year and 2.5mm per year rates (covering the three geographical groups respectively), should be applied back to the 1990 base sea level year. From 2026 to 2055, the increase in sea level in this period is derived by adding the number of years on from 2025 (to 2055), multiplied by the respective rate shown in the table. Subsequent time periods 2056 to 2085 and 2086 to 2115 are treated similarly.

b. Refer to Department for Environment, Food and Rural Affairs *FCDPAG3 Economic Appraisal Supplementary Note to Operating Authorities – Climate Change Impacts,* October 2006, for details of the derivation of this table. In particular, Annex A1 of this Note shows examples of how to calculate sea level rise.

c. Vertical movement of the land is incorporated in the table and does not need to be calculated separately.

12. The rise in sea level will change the frequency of occurrence of high water levels relative to today's sea levels, assuming no change in storminess. There may also be secondary impacts such as changes in wave heights due to increased water depths, as well as possible changes in the frequency, duration and severity of storm events. A 10 per cent sensitivity allowance should be added to offshore wind speeds and wave heights by the 2080s.

13. In making an assessment of the impacts of climate change on flooding from the land, rivers and sea as part of a flood risk assessment, the sensitivity ranges in table 5 may provide an appropriate precautionary response to the uncertainty about climate change impacts on rainfall intensities, river flow, wave height and wind speed.

Table 5: Recommended national precautionary sensitivity ranges for peak rainfall intensities, peak river flows, offshore wind speeds and wave heights

Parameter	1990 to 2025	2025 to 2055	2055 to 2085	2085 to 2115
Peak rainfall intensity	*+5%*	*+10%*	*+20%*	*+30%*
Peak river flow	*+10%*	*+20%*		
Offshore wind speed	*+5%*		*+10%*	
Extreme wave height	*+5%*		*+10%*	

Notes to table 5:

a. Refer to Department for Environment, Food and Rural Affairs *FCDPAG3 Economic Appraisal Supplementary Note to Operating Authorities – Climate Change Impacts,* October 2006, for details of the derivation of this table.

b. For deriving peak rainfall, for example, between 2025 and 2055 multiply the rainfall measurement (in mm per hour) by 10 per cent and between 2055 and 2085 multiply the rainfall measurement by 20 per cent. So, if there is a 10mm per hour event, for the 2025 to 2055 period this would equate to 11mm per hour; and for the 2055 to 2085 period, this would equate to 12mm per hour. Other parameters in table 5 are treated similarly.

14. Sensitivity testing of the flood map produced by the Environment Agency, using the 20 per cent from 2025 to 2115 allowance for peak flows, suggests that changes in the extent of inundation are negligible in well-defined floodplains, but can be dramatic in very flat areas. However, changes in the depth of flooding under the same allowance will reduce the return period of a given flood. This

means that a site currently located within a lower risk zone (e.g. Zone 2 in table 1) could in future be re-classified as lying within a higher risk zone (e.g. Zone 3a in table 1). This in turn could have implications for the type of development that is appropriate according to its vulnerability to flooding (see table 2). It will therefore be important that developers, their advisors and local authorities refer to the current flood map and the Strategic Flood Risk Assessment when preparing and considering proposals.

15. Flooding in estuaries may result from the combined effects of high river flows and high sea surges. When taking account of impacts of climate change in flood risk assessments covering tidal estuaries, it will be necessary for the allowances for sea level rise in table 4 and the allowances for peak flow, wave height and wind speed in table 5 to be combined.[11]

---

[11] Refer to Defra *FCDPAG3 Economic Appraisal Supplementary Note to Operating Authorities – Climate Change Impacts*, October 2006. Annex A2 gives details of joint probability analysis. www.defra.gov.uk/environ/fcd/pubs/pagn/climatechangeupdate.pdf

A P P E N D I X D

WATER AUTHORITY CONSULTATION

Yorkshire Water Services
Developer Services
Sewerage Technical Team
PO BOX 52
Bradford
BD3 7AY

Tel: 0345 120 8482
Fax: (01274) 372 834

Email:
Technical.Sewerage@yorkshirewater.co.uk

Mr W Walker
Arp Associates
Unit 5/6 Northwest Business Pk
1ST FLR Servia Hill
Woodhouse
Leeds
LS6 2QH

Your Ref: 1048/77
Our Ref: R014463

For telephone enquiries ring:
Chris Roberts on 0345 120 8482

17th September 2015

Dear Sir,

Barnsley Road, Flockton - Pre-Planning Sewerage Enquiry on P856083

Thank you for your recent enquiry. Our charge of £150.00 (plus VAT) will be added to your account with us, reference ARP013. You will receive an invoice for your account in due course.

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.

Existing Infrastructure

(Please note:- due to the change in legislation on 01/10/2011 there may be public sewers within the site boundary which is not recorded on the Statutory Sewer Map the presence of which should be taken into account in the design of the

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 should discharge to the 150 mm diameter public foul sewer recorded in Barnsley Road, at a point approximately 25 metres from the site.

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.

The public sewer network does not have any capacity available to accept any discharge of surface water from the proposal. If SuDS are not viable, the developer is advised to contact the Environment

Agency/local Land Drainage Authority with a view to establishing a suitable watercourse for discharge.

It is understood that a watercourse, Flockton Beck, is located 200 metres to the south of the site. This appears to be the obvious place for surface water disposal (if SuDS are not viable).

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, 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 obtain an application form from our website (www.yorkshirewater.com) or by telephoning 0345 120 84 82.

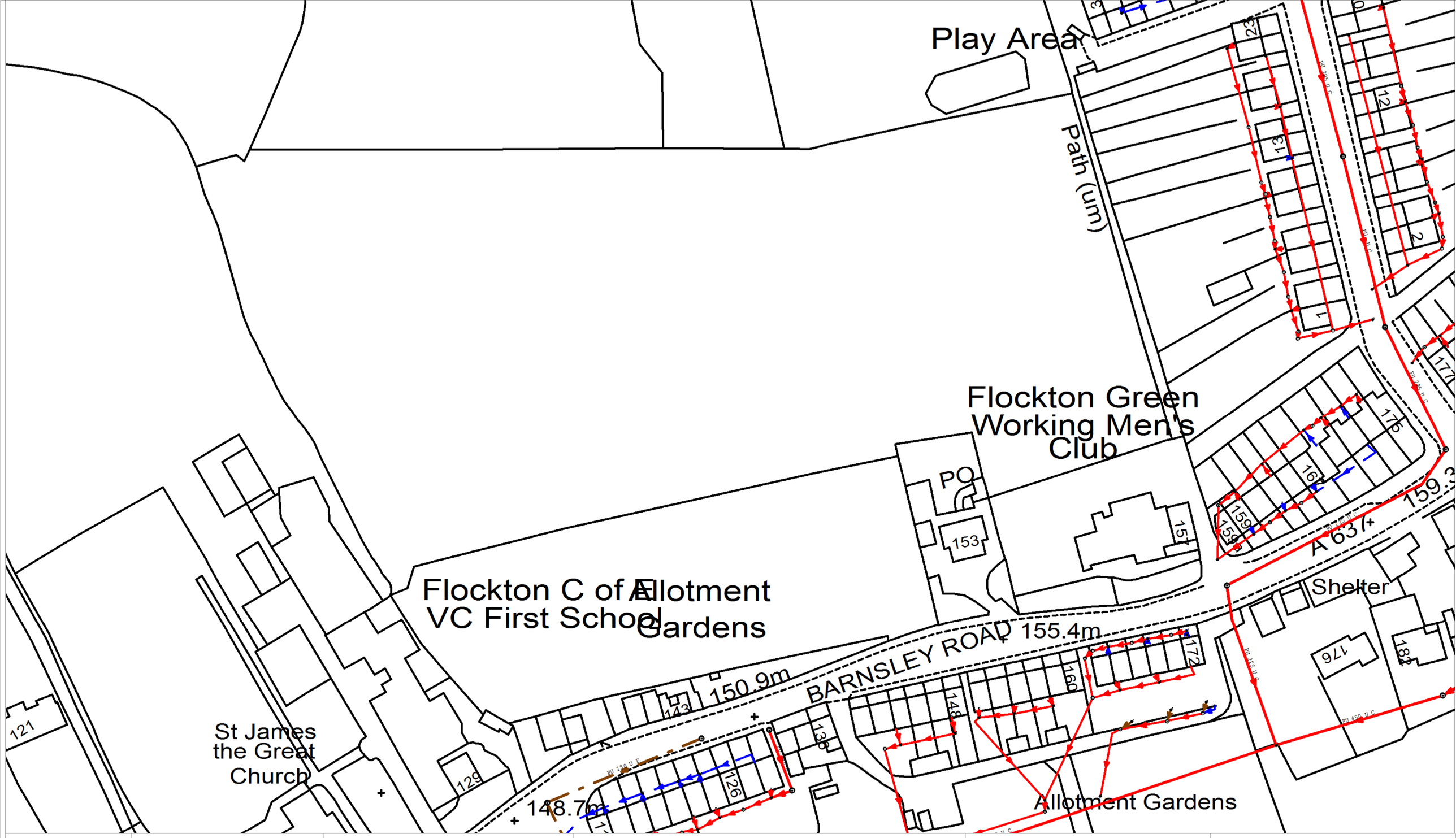
Prospectively adoptable sewers and pumping stations must be designed and constructed in accordance with the WRc publication "Sewers for Adoption - a design and construction guide for developers" 6th Edition as supplemented by Yorkshire Water's requirements, pursuant to an agreement under Section 104 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.

The public sewer network is for domestic sewage purposes. This generally means foul water for domestic purposes and, where a suitable surface water or combined sewer is available, surface water from the roofs of buildings together with surface water from paved areas of land appurtenant to those buildings. Land and highway drainage have no right of connection to the public sewer network. No land drainage to be connected/discharged to public sewer.

All the above comments are based upon the information and records available at the present time. 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. 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
Developer Services



	423912 : 414911	Map Name : SE2314NE	Title	Partial Key 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 : Bethany Scully Contact Tel :		Notes (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	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.
				Date Req : 20/10/2015, 15:56:39 Date Gen : 20/10/2015, 15:56:42 Source : Sewer Network Enquiry

UPN: Undefined Originator: Bethany Scully, Land and Planning,

A P P E N D I X E

LAND DRAINAGE AUTHORITY CONSULTATION

Wayne Walker

From: Paul Farndale <Paul.Farndale@kirklees.gov.uk>
Sent: Tuesday 20 October, 2015 4:48 pm
To: Wayne Walker
Subject: RE: 1048/77 - Barnsley Road, Flockton - Consultation - 1048/77

Hello Wayne,

Main River Flood Zone 1 – Low Risk.

Surface Water 3rd Generation Flood Map- Shows a linear flooding pattern at the western boundary with Flockton Cof E First School. This route should be kept clear. Such linear routing as opposed to ponding usually indicated the presence of an above ground or culverted watercourse. We do not have any on our records but would strongly advise further investigation. There are no known flood incidents in the immediate vicinity of the site.

SUDS needs to be considered in line with Leeds City Region advice on submissions. A quick scan at BGS data indicates a mixed bag for infiltration potential however testing is expected. We advise a plan A and B if an outline application is forthcoming. SUDS can still be used for water quality improvements if a connection to watercourse as opposed to treatment works (via sewer) is available.

A highway drain is shown immediately outside the site. However this is a private pipe for highway purposes and we would only consider a connection to it if no other suitable system is available, it's condition is considered fit for purpose, and it is deemed to have capacity. It should be noted that a recent survey to the west of 'The Sun' public house along Barnsley Road, revealed that lengthy sections needed urgent attention. It is not clear whether this connects to watercourse or combined sewer at this stage.

A foul only sewers is shown outside the site although it could be found that properties have combined connections to it. It is depicted as combined adjacent to Pinfold Court. Connections to either of these systems could be restricted to much less than greenfield run off rates, e.g. 3-5 l/s.

Flow routing for surface water from the north, e.g. saturated field run off has to be considered as does exceedance events and blockage scenarios for onsite drainage. This should mimic current run off directions but the increases in volume could affect routes through 3rd party land negatively and needs careful consideration.

Kind regards,

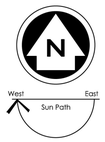
Paul Farndale
Principal Engineer
Flood Management & Drainage
Investment & Regeneration Service
Kirklees Council
01484 221000

From: Wayne Walker [mailto:WayneWalker@arpassociates.co.uk]
Sent: 16 October 2015 16:33
To: Paul Farndale
Subject: 1048/77 - Barnsley Road, Flockton - Consultation - 1048/77

Paul,

A P P E N D I X F

PROPOSED DEVELOPMENT LAYOUT





house type schedule

type			Sq. Ft	No.	
SH27	Darwin	2 Bed semi/terrace	750	11	**8250**
SH39	Selwood	3 Bed semi/terrace	926	8	**7408**
P315	Oakfield	3 bed semi/terrace	950	6	**5700**
P382	Archford	3 bed semi	837	6	**5022**
T322	Greenwood	4 bed semi/terrace	1188	12	**14256**
T447	Milwood	4 bed semi/terrace	1241	4	**4964**
H346	Kelston	3 Bed detached	938	5	**4690**
H316	Bradwell	3 Bed detached	995	7	**6965**
P341	Hadley	3 Bed detached	1001	8	**8008**
H404	Irving	4 Bed detached	1167	1	**1167**
H452	Mitchell	4 Bed detached	1240	5	**6200**
H451	Hurst	4 Bed detached	1354	3	**4062**
H433	Cornell	4 Bed detached	1374	5	**6870**
H408	Drummond	4 bed detached	1444	4	**5776**
H469	Holden	4 bed detached	1536	5	**7680**
H436	Layton	4 bed detached	1591	2	**3182**
		TOTAL		**92**	**100200**

Site Figures

Gross Site Area	6.3 Acres
Open Space	0 Acres
	0 Acres
Nett Site Area	6.3 Acres
Footage	15905 sq.ft./acre
Units/acre	14.60

site area 6.3 acres

proposed residential dwelling

primary access road

shared surface

private drives

indicative landscaping

existing residential dwelling

existing post office

land retained for new working mens club (0.2 Ha)

new site access position

Space to live.

David Wilson Homes

scale bar 20m
1-500 at paper

Barnsley Road
Flockton
Sketch Layout

scale 1-500 @ a1 April 2015 dwg. no. KSL -01

A P P E N D I X G

INDICATIVE GREENFIELD SURFACE WATER RUN-OFF CALCULATIONS

IH 124 Mean Annual Flood

Input

Return Period (years)	1	Soil	0.300
Area (ha)	1.340	Urban	0.000
SAAR (mm)	765	Region Number	Region 3

Results l/s

QBAR Rural	4.0
QBAR Urban	4.0
Q1 year	3.5
Q1 year	3.5
Q2 years	3.8
Q5 years	5.0
Q10 years	5.8
Q20 years	6.6
Q25 years	6.9
Q30 years	7.1
Q50 years	7.6
Q100 years	8.4
Q200 years	9.5
Q250 years	9.9
Q1000 years	12.3

Warning: It is unusual to use the IH124 method with an area < 50ha. The Interim Code of Practice recommends that the IH124 method is applied with 50ha and the resulting discharge is linearly interpolated for the required area. The ICP SUDS tab will do this automatically.

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N O T E S

K E Y

Denotes direction of overland run-off

Denotes area that drains into watercourse

Rev	By	Date	Revision	Chk
/	WMW	21.10.15	Issued for approval	WMW

ARP ASSOCIATES
CHARTERED CONSULTING ENGINEERS

Northwest House • 5/6 Northwest Business Park • Servia Hill • Leeds LS6 2QH
Telephone: 0113 2458498 • Fax: 0113 2443864 • E-Mail: leeds@arpassociates.co.uk

ARP Associates is a trading division of ARP Geotechnical Ltd, a company registered in England and Wales with company number 3771811, whose registered office is at 5/6 Northwest Business Park, Servia Hill, Leeds LS6 2QH

TITLE

GREENFIELD RUNOFF ASSESSMENT

PROJECT

BARNSLEY ROAD, FLOCKTON

CLIENT

BDW YORKSHIRE WEST

Scale	Date	Drawn	Chk.
1:500 @ A1	OCT 15	WMW	WMW

Drg. No.	Rev
1048/77/SK01	/

A P P E N D I X H

INDICATIVE SURFACE WATER DRAINAGE CALCULATIONS

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	100.385	0.385	3.5	159.0	O K
30 min Summer	100.509	0.509	3.5	210.1	O K
60 min Summer	100.642	0.642	3.5	264.8	O K
120 min Summer	100.779	0.779	3.5	321.5	O K
180 min Summer	100.856	0.856	3.5	353.2	O K
240 min Summer	100.906	0.906	3.5	373.7	O K
360 min Summer	100.968	0.968	3.5	399.4	O K
480 min Summer	101.005	1.005	3.5	414.4	O K
600 min Summer	101.025	1.025	3.5	423.0	O K
720 min Summer	101.036	1.036	3.5	427.5	O K
960 min Summer	101.039	1.039	3.5	428.6	O K
1440 min Summer	101.021	1.021	3.5	421.2	O K
2160 min Summer	100.983	0.983	3.5	405.6	O K
2880 min Summer	100.942	0.942	3.5	388.4	O K
4320 min Summer	100.854	0.854	3.5	352.5	O K
5760 min Summer	100.762	0.762	3.5	314.2	O K
7200 min Summer	100.653	0.653	3.5	269.2	O K
8640 min Summer	100.562	0.562	3.5	231.7	O K
10080 min Summer	100.484	0.484	3.5	199.7	O K
15 min Winter	100.432	0.432	3.5	178.3	O K
30 min Winter	100.572	0.572	3.5	235.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	68.903	0.0	155.1	19
30 min Summer	45.851	0.0	205.8	34
60 min Summer	29.238	0.0	270.9	64
120 min Summer	18.103	0.0	335.4	124
180 min Summer	13.524	0.0	375.4	182
240 min Summer	10.942	0.0	404.4	242
360 min Summer	8.096	0.0	447.3	362
480 min Summer	6.535	0.0	478.9	482
600 min Summer	5.531	0.0	502.4	602
720 min Summer	4.824	0.0	517.9	720
960 min Summer	3.885	0.0	523.0	954
1440 min Summer	2.860	0.0	503.1	1184
2160 min Summer	2.103	0.0	706.8	1560
2880 min Summer	1.689	0.0	756.1	1988
4320 min Summer	1.239	0.0	826.7	2812
5760 min Summer	0.993	0.0	892.9	3680
7200 min Summer	0.836	0.0	939.9	4392
8640 min Summer	0.727	0.0	980.2	5104
10080 min Summer	0.646	0.0	1014.9	5848
15 min Winter	68.903	0.0	173.7	19
30 min Winter	45.851	0.0	229.2	33

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Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	100.722	0.722	3.5	297.6	O K
120 min Winter	100.877	0.877	3.5	361.9	O K
180 min Winter	100.965	0.965	3.5	398.2	O K
240 min Winter	101.023	1.023	3.5	421.8	O K
360 min Winter	101.097	1.097	3.5	452.3	O K
480 min Winter	101.142	1.142	3.5	471.0	O K
600 min Winter	101.170	1.170	3.5	482.6	O K
720 min Winter	101.187	1.187	3.5	489.6	O K
960 min Winter	101.200	1.200	3.5	494.9	O K
1440 min Winter	101.180	1.180	3.5	486.9	O K
2160 min Winter	101.131	1.131	3.5	466.4	O K
2880 min Winter	101.072	1.072	3.5	442.1	O K
4320 min Winter	100.941	0.941	3.5	388.3	O K
5760 min Winter	100.802	0.802	3.5	330.7	O K
7200 min Winter	100.628	0.628	3.5	259.1	O K
8640 min Winter	100.492	0.492	3.5	203.1	O K
10080 min Winter	100.386	0.386	3.5	159.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	29.238	0.0	303.5	64
120 min Winter	18.103	0.0	375.3	122
180 min Winter	13.524	0.0	419.7	180
240 min Winter	10.942	0.0	451.5	240
360 min Winter	8.096	0.0	497.2	356
480 min Winter	6.535	0.0	526.4	472
600 min Winter	5.531	0.0	538.1	586
720 min Winter	4.824	0.0	538.4	700
960 min Winter	3.885	0.0	531.8	922
1440 min Winter	2.860	0.0	513.0	1338
2160 min Winter	2.103	0.0	791.3	1664
2880 min Winter	1.689	0.0	846.1	2132
4320 min Winter	1.239	0.0	915.7	3068
5760 min Winter	0.993	0.0	1000.1	3976
7200 min Winter	0.836	0.0	1052.8	4688
8640 min Winter	0.727	0.0	1098.1	5368
10080 min Winter	0.646	0.0	1137.3	6048

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.351	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+0

Time Area Diagram

Total Area (ha) 1.250

Time (mins) From:	To:	Area (ha)
0	4	1.250

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Model Details

Storage is Online Cover Level (m) 103.000

Tank or Pond Structure

Invert Level (m) 100.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	412.5	0.700	412.5	1.400	412.5	2.100	412.5
0.100	412.5	0.800	412.5	1.500	412.5	2.200	412.5
0.200	412.5	0.900	412.5	1.600	412.5	2.300	412.5
0.300	412.5	1.000	412.5	1.700	412.5	2.400	412.5
0.400	412.5	1.100	412.5	1.800	412.5	2.500	412.5
0.500	412.5	1.200	412.5	1.900	412.5		
0.600	412.5	1.300	412.5	2.000	412.5		

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0086-3500-1200-3500
Design Head (m)	1.200
Design Flow (l/s)	3.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	86
Invert Level (m)	100.000
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	3.5
Flush-Flo™	0.364	3.5
Kick-Flo®	0.741	2.8
Mean Flow over Head Range	-	3.1

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.6	1.200	3.5	3.000	5.3	7.000	7.9
0.200	3.3	1.400	3.7	3.500	5.7	7.500	8.2
0.300	3.5	1.600	4.0	4.000	6.1	8.000	8.5
0.400	3.5	1.800	4.2	4.500	6.4	8.500	8.7
0.500	3.4	2.000	4.4	5.000	6.8	9.000	9.0
0.600	3.3	2.200	4.6	5.500	7.1	9.500	9.2
0.800	2.9	2.400	4.8	6.000	7.4		
1.000	3.2	2.600	5.0	6.500	7.7		

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	100.341	0.341	3.5	269.1	O K
30 min Summer	100.456	0.456	3.5	360.2	O K
60 min Summer	100.581	0.581	3.5	458.9	O K
120 min Summer	100.712	0.712	3.5	561.9	O K
180 min Summer	100.787	0.787	3.5	621.3	O K
240 min Summer	100.836	0.836	3.5	660.2	O K
360 min Summer	100.903	0.903	3.5	712.6	O K
480 min Summer	100.947	0.947	3.5	748.0	O K
600 min Summer	100.979	0.979	3.5	772.8	O K
720 min Summer	101.001	1.001	3.5	790.6	O K
960 min Summer	101.029	1.029	3.5	812.8	O K
1440 min Summer	101.047	1.047	3.5	826.3	O K
2160 min Summer	101.028	1.028	3.5	811.9	O K
2880 min Summer	101.002	1.002	3.5	791.4	O K
4320 min Summer	100.947	0.947	3.5	747.5	O K
5760 min Summer	100.891	0.891	3.5	703.6	O K
7200 min Summer	100.836	0.836	3.5	659.8	O K
8640 min Summer	100.781	0.781	3.5	616.5	O K
10080 min Summer	100.719	0.719	3.5	568.0	O K
15 min Winter	100.382	0.382	3.5	301.5	O K
30 min Winter	100.511	0.511	3.5	403.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	115.846	0.0	236.2	19
30 min Summer	77.844	0.0	284.2	34
60 min Summer	49.937	0.0	448.0	64
120 min Summer	30.941	0.0	536.3	124
180 min Summer	23.042	0.0	552.5	184
240 min Summer	18.561	0.0	548.3	244
360 min Summer	13.641	0.0	536.8	362
480 min Summer	10.960	0.0	526.9	482
600 min Summer	9.241	0.0	519.1	602
720 min Summer	8.034	0.0	512.7	722
960 min Summer	6.437	0.0	502.9	962
1440 min Summer	4.700	0.0	491.9	1440
2160 min Summer	3.425	0.0	1038.1	1968
2880 min Summer	2.733	0.0	1006.7	2308
4320 min Summer	1.984	0.0	922.2	3108
5760 min Summer	1.579	0.0	1414.8	3920
7200 min Summer	1.322	0.0	1478.6	4760
8640 min Summer	1.144	0.0	1532.6	5616
10080 min Summer	1.012	0.0	1577.4	6360
15 min Winter	115.846	0.0	258.6	19
30 min Winter	77.844	0.0	291.0	34

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	100.652	0.652	3.5	514.9	O K
120 min Winter	100.800	0.800	3.5	631.7	O K
180 min Winter	100.885	0.885	3.5	698.5	O K
240 min Winter	100.941	0.941	3.5	742.7	O K
360 min Winter	101.017	1.017	3.5	802.9	O K
480 min Winter	101.069	1.069	3.5	844.3	O K
600 min Winter	101.107	1.107	3.5	873.8	O K
720 min Winter	101.134	1.134	3.5	895.7	O K
960 min Winter	101.171	1.171	3.5	924.3	O K
1440 min Winter	101.200	1.200	3.5	947.3	O K
2160 min Winter	101.192	1.192	3.5	940.9	O K
2880 min Winter	101.157	1.157	3.5	913.4	O K
4320 min Winter	101.087	1.087	3.5	857.9	O K
5760 min Winter	101.010	1.010	3.5	797.1	O K
7200 min Winter	100.930	0.930	3.5	734.4	O K
8640 min Winter	100.851	0.851	3.5	671.7	O K
10080 min Winter	100.767	0.767	3.5	605.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	49.937	0.0	496.8	64
120 min Winter	30.941	0.0	554.2	122
180 min Winter	23.042	0.0	548.0	182
240 min Winter	18.561	0.0	540.6	240
360 min Winter	13.641	0.0	529.9	358
480 min Winter	10.960	0.0	523.2	476
600 min Winter	9.241	0.0	519.0	594
720 min Winter	8.034	0.0	516.7	708
960 min Winter	6.437	0.0	516.4	942
1440 min Winter	4.700	0.0	519.7	1398
2160 min Winter	3.425	0.0	1056.9	2052
2880 min Winter	2.733	0.0	1025.6	2628
4320 min Winter	1.984	0.0	961.3	3288
5760 min Winter	1.579	0.0	1583.9	4216
7200 min Winter	1.322	0.0	1654.2	5184
8640 min Winter	1.144	0.0	1710.8	6056
10080 min Winter	1.012	0.0	1748.1	6968

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.351	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 1.250

Time (mins) From:	To:	Area (ha)
0	4	1.250

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Model Details

Storage is Online Cover Level (m) 103.000

Tank or Pond Structure

Invert Level (m) 100.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	789.5	0.700	789.5	1.400	789.5	2.100	789.5
0.100	789.5	0.800	789.5	1.500	789.5	2.200	789.5
0.200	789.5	0.900	789.5	1.600	789.5	2.300	789.5
0.300	789.5	1.000	789.5	1.700	789.5	2.400	789.5
0.400	789.5	1.100	789.5	1.800	789.5	2.500	789.5
0.500	789.5	1.200	789.5	1.900	789.5		
0.600	789.5	1.300	789.5	2.000	789.5		

Hydro-Brake Optimum® Outflow Control

Unit Reference	MD-SHE-0086-3500-1200-3500
Design Head (m)	1.200
Design Flow (l/s)	3.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	86
Invert Level (m)	100.000
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	3.5
Flush-Flo™	0.364	3.5
Kick-Flo®	0.741	2.8
Mean Flow over Head Range	-	3.1

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Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.6	1.200	3.5	3.000	5.3	7.000	7.9
0.200	3.3	1.400	3.7	3.500	5.7	7.500	8.2
0.300	3.5	1.600	4.0	4.000	6.1	8.000	8.5
0.400	3.5	1.800	4.2	4.500	6.4	8.500	8.7
0.500	3.4	2.000	4.4	5.000	6.8	9.000	9.0
0.600	3.3	2.200	4.6	5.500	7.1	9.500	9.2
0.800	2.9	2.400	4.8	6.000	7.4		
1.000	3.2	2.600	5.0	6.500	7.7		

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