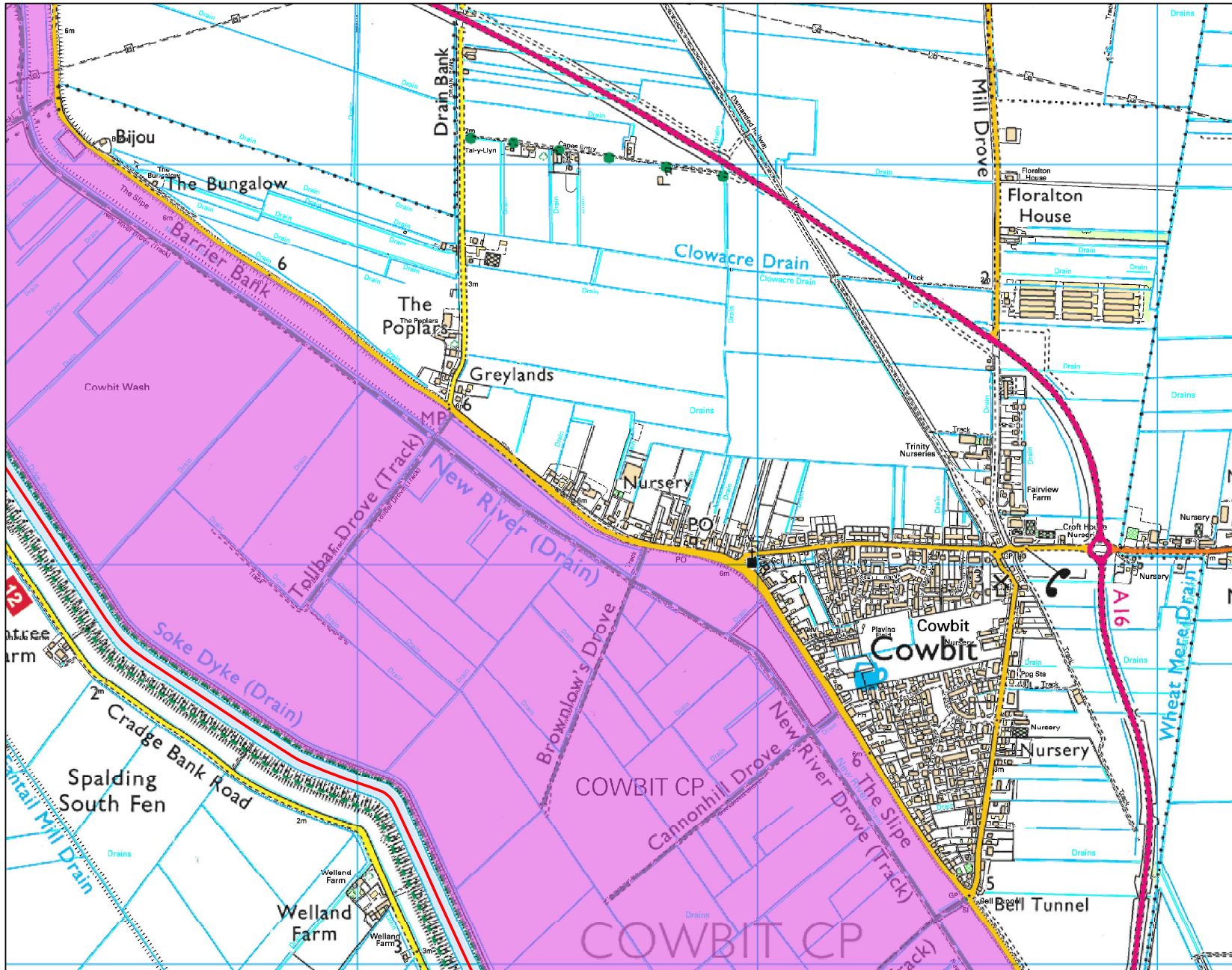


Historic Flood Extent Map

Map centred on TF 25664 18191- created August 2018 [Ref: CCN-2018-96794]



Scale 1:10,000



- Main River
- March 1947 on the River Welland near Cowbit

Created by the Partnership & Strategic Overview Team,
Kettering

Datasheet [Ref: CCN-2018-96794]

Data Model – Welland - Dated 2016

Fluvial Flood Levels (mODN)

The fluvial flood levels for the model nodes shown on the attached map are set out in the table below. They are measured in metres above Ordnance Datum Newlyn (mODN).

Node Label	Easting	Northing	Annual Exceedance Probability - Maximum Water Levels (mODN)										
			50% (1 in 2)	20% (1 in 5)	10% (1 in 10)	5% (1 in 20)	2% (1 in 50)	1.33% (1 in 75)	1% (1 in 100)	1% (1 in 100) inc 20% Climate Change	0.5% (1 in 200)	0.1% (1 in 1000)	0.1% (1 in 1000) inc 20% Climate Change
WELLAND 1824	524196	318022	3.21	4.01	4.22	4.46	4.55	4.56	4.56	4.65	4.56	4.52	4.65
WELLAND 19224	524514	312698	3.22	4.01	4.23	4.42	4.55	4.56	4.56	4.65	4.52	4.52	4.65
WELLAND 1924	524948	312453	3.22	4.02	4.24	4.48	4.56	4.52	4.58	4.66	4.58	4.58	4.66
WELLAND 20224	525241	312081	3.23	4.03	4.24	4.49	4.58	4.59	4.59	4.62	4.60	4.60	4.62

Fluvial Flood Flows (m³/s)

The fluvial flood flows for the model nodes shown on the attached map are set out in the table below. They are measured in metres cubed per second (m³/s).

Node Label	Easting	Northing	Annual Exceedance Probability - Maximum Flows (m³/s)										
			50% (1 in 2)	20% (1 in 5)	10% (1 in 10)	5% (1 in 20)	2% (1 in 50)	1.33% (1 in 75)	1% (1 in 100)	1% (1 in 100) inc 20% Climate Change	0.5% (1 in 200)	0.1% (1 in 1000)	0.1% (1 in 1000) inc 20% Climate Change
WELLAND 1844	524052	318200	50.32	31.6	83.08	90.40	111.64	112.88	114.64	114.41	115.80	113.68	113.64
WELLAND 1944	524028	310568	56.15	22.11	82.65	96.59	112.95	114.04	116.40	116.26	110.33	115.09	115.80
WELLAND 20224	525241	310080	55.32	11.30	81.80	95.81	113.09	114.99	110.36	116.64	110.92	116.20	116.23

Risk of flooding from Surface Water CCN-2018-96794



Scale 1: 10,000



Likelihood of flooding from Surface Water

- High ($\geq 3.3\%$)
- Medium ($3.3\% - 1\%$)
- Low ($1\% - 0.1\%$)
- Very Low

Likelihood of flooding from Surface Water

- High: Greater than or equal to 3.3% (1 in 30) chance in any given year
- Medium: Less than 3.3% (1 in 30) but greater than or equal to 1% (1 in 100) chance in any given year
- Low: Less than 1% (1 in 100) but greater than or equal to 0.1% (1 in 1,000) chance in any given year
- Very Low: Less than 0.1% (1 in 1,000) chance in any given year

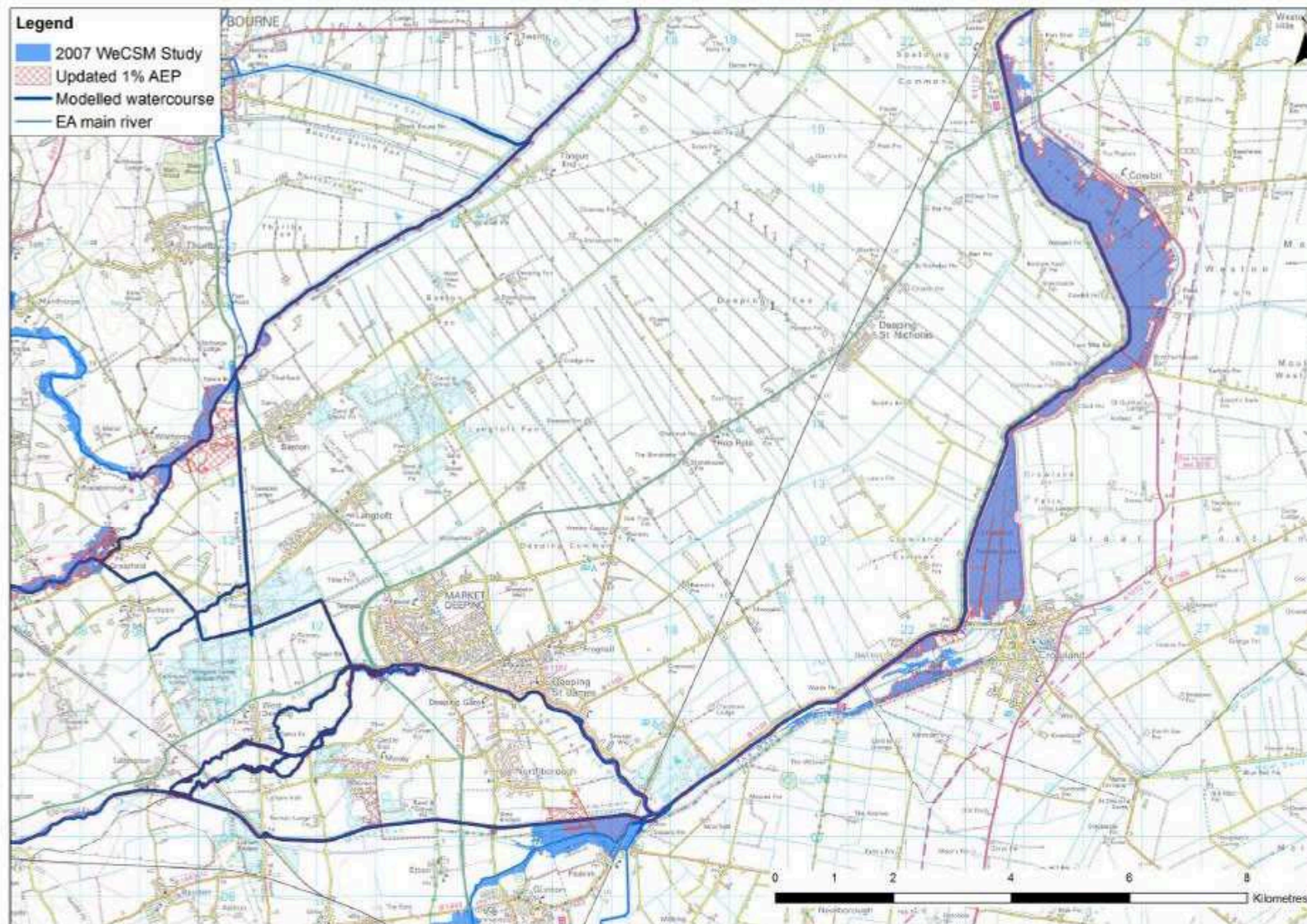
This information is shown on the Risk of Flooding from Surface Water map on our website.



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Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). E-mail: enquires@environment-agency.gov.uk

Figure G.14: Modelled flood extents compared to previous study extents – 3 of 3



Source: Mott MacDonald. Contains Ordnance Survey data Crown copyright and database right © 2016 All rights reserved. Environment Agency 100026380 2016.

Figure G.7: Modelled flood extents for the defended scenario - 7 of 8

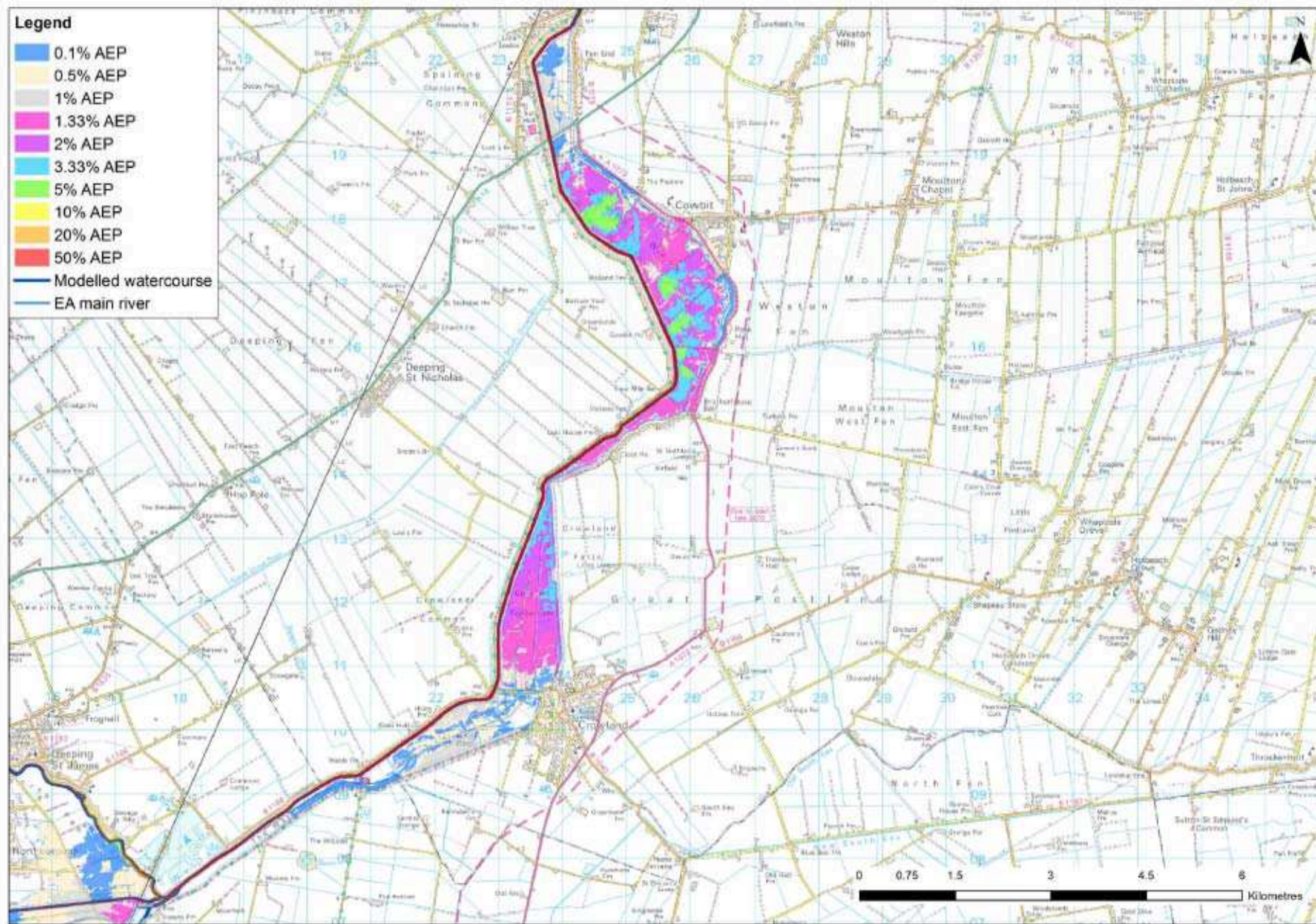
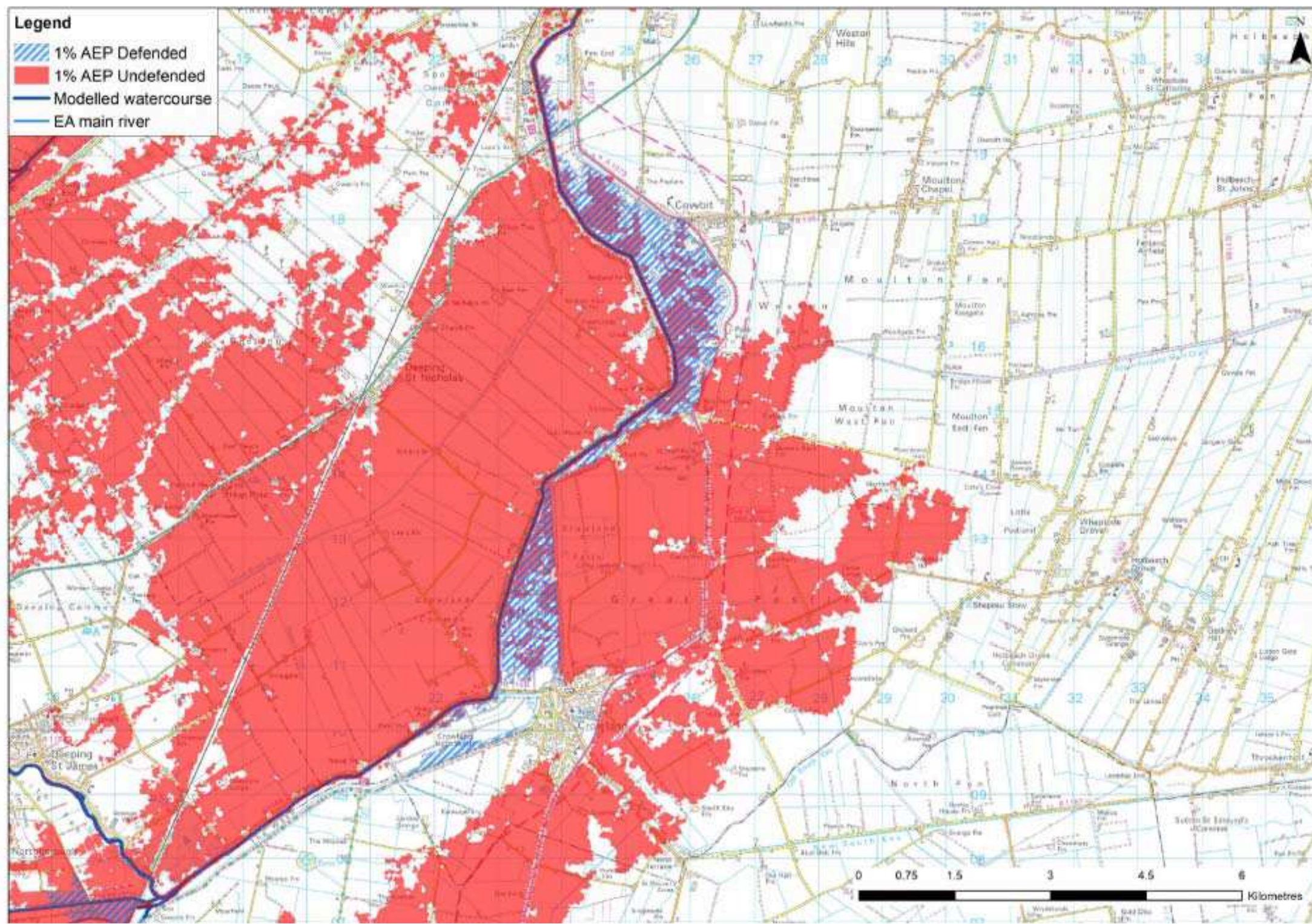


Figure G.21: Modelled flood extents for the undefended scenario - 7 of 8





Flood risk from rivers
or the sea



Extent of flooding



Flood risk from surface
water



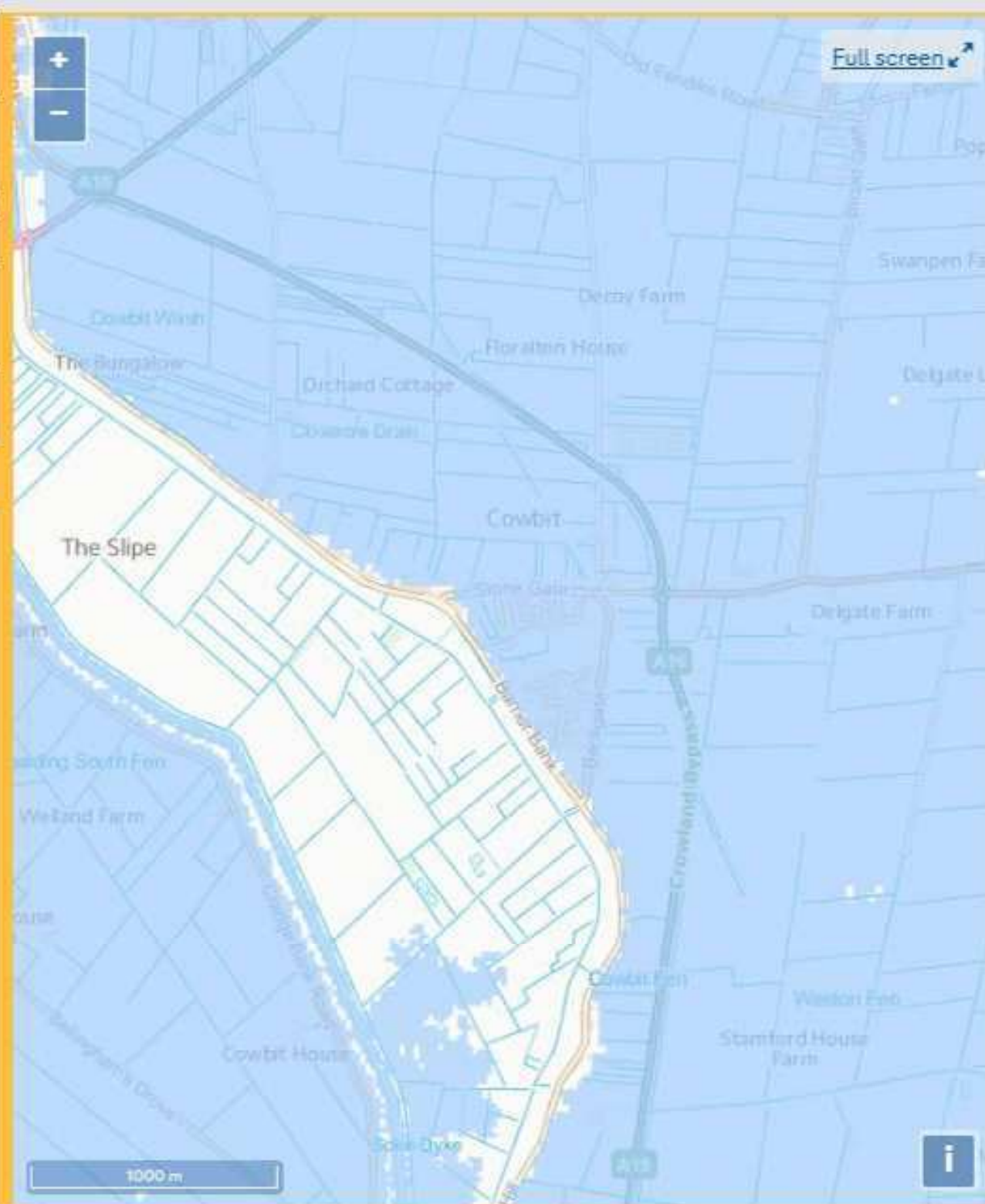
Extent of flooding



Flood risk from
reservoirs



Extent of flooding



Flood risk



Maximum
extent of
flooding



Location you
selected

APPENDIX E

WATER AUTHORITY CONSULTATION

Pre-Planning Assessment Report

MOULTON ROAD, COWBIT

972/903899111/1/0000579

Section 1: Proposed development

Thank you for submitting a pre-planning enquiry. This has been produced for ARP Associates. Your reference number is **972/903899111/1/0000579**. If you have any questions upon receipt of this report, please contact the Pre-Development team on 0345 60 66 087 or email planningliaison@anglianwater.co.uk.

The response within this report has been based on the following information which was submitted as part of your application:

List of planned developments	
Type of development	No. Of units
Dwellings	32

The anticipated residential build rate is:

Year	Y1	Y2	Y3	Y4	Y5	Y6	Y7	Y8	Y9	Y10	Y11	Y12
Build rate	32	0	0	0	0	0	0	0	0	0	0	0

Site grid reference no.

TF2673918005

Development type

Greenfield

Planning application status

Unknown

The comments contained within this report relate to the public water mains and sewers indicated on our records. Your attention is drawn to the disclaimer in the useful information section of this report.

Section 2: Assets affected

Our records indicate that we have the following types of assets within or overlapping the boundary of your development site as listed in the table below.

Additionally, it is highly recommended that you carry out a thorough investigation of your proposed working area to establish whether any unmapped public or private sewers and lateral drains are in existence. We are unable to permit development either over or within the easement strip without our prior consent. The extent of the easement is provided in the table below. Please be aware that the existing water mains/public sewers should be located in highway or open space and not in private gardens. This is to ensure available access for any future maintenance and repair and this should be taken into consideration when planning your site layout.

Water and Used water easement information		
Asset type	Pipe size (mm)	Total easement required (m)
Water mains	6	4.50 m either side of the centre line
Water mains	6	4.50 m either side of the centre line
Water mains	158	6.00 m either side of the centre line
Water mains	6	4.50 m either side of the centre line
Water mains	6	4.50 m either side of the centre line
Sewer mains	100	3.00 m either side of the centre line
Sewer mains	150	3.00 m either side of the centre line
Sewer mains	125	3.00 m either side of the centre line
Sewer mains	125	3.00 m either side of the centre line
Sewer mains	150	3.00 m either side of the centre line
Sewer mains	125	3.00 m either side of the centre line

If it is not possible to avoid our assets then these may need to be diverted in accordance with Section 185 of the Water Industry Act (1991). You will need to make a formal application if you would like a diversion to be considered.

Due to the private sewer transfer in October 2011 many newly adopted public used water assets and their history are not indicated on our records. You also need to be aware that your development site may contain private water mains, drains or other assets not shown on our records. These are private assets and not the responsibility of Anglian Water but that of the landowner.

Section 3: Water recycling services

In examining the used water system we assess the ability for your site to connect to the public sewerage network without causing a detriment to the operation of the system. We also assess the receiving water recycling centre and determine whether the water recycling centre can cope with the increased flow and influent quality arising from your development.

Water recycling centre

The foul drainage from this development is in the catchment of Cowbit Water Recycling Centre, which currently does not have capacity to treat the flows from your development site. Anglian Water are obligated to accept the foul flows from your development with the benefit of planning consent and would therefore take the necessary steps to ensure that there is sufficient treatment capacity should the planning authority grant planning permission.

Used water network

Our assessment has been based on development flows connecting to the nearest foul water sewer of the same size or greater pipe diameter to that required to drain the site. The infrastructure to convey foul water flows to the receiving sewerage network is assumed to be the responsibility of the developer. Conveyance to the connection point is considered as Onsite Work and includes all work carried out upstream from the point of connection, including making the connection to our existing network. This connection point has been determined in reference to the calculated design flow using criteria from Sewers for Adoption (6th edition). On this basis, a 150mm internal diameter pipe is required to drain the development site. Anglian water has assessed the impact of gravity flows from the planned development to the public foul sewerage network. We can confirm that this is acceptable as the foul sewerage system, at present, has available capacity for your site. The connection point will be to the nearest 150mm diameter sewer at manhole 7002, at National Grid Reference TF2677018040, located in Stonegate.

It is assumed that the developer will provide the necessary infrastructure to convey flows from the site to the network. Consequently, this report does not include any costs for the conveyance of flows.

Surface water disposal

There are no public surface water sewers within the vicinity of the proposed development. Therefore Anglian Water will be unable to provide the site with a feasible solution of surface water disposal within the current assets. Alternative methods of surface water disposal will need to be investigated such as infiltration techniques or a discharge to a watercourse in accordance with the surface water management hierarchy as outlined in Building Regulations Part H. The alternative is that a new surface water sewer is constructed which is used to convey your surface water to a watercourse or as part of a SuDs scheme, where appropriate. Subject to the sewer being designed in accordance with the current version of Sewers For Adoption, the sewer can be put forward for adoption by Anglian Water under Section 104 of the Water Industry Act 1991. If the outfall is to a watercourse, the applicant will be required to obtain consent to discharge via the appropriate body. If your site has no means of drainage due to third party land then you may be able to requisition Anglian Water, under Section 98, to provide a connection to the public sewer for domestic drainage purposes. As part of this option, you may wish to enter into a works agreement in accordance with Section 30 of the Anglian Water Authority Act 1977. This will allow you to design and construct the public sewer using Anglian Waters' statutory powers in accordance with Section 159/168 of the Water Industry Act 1991.

As you may be aware, Anglian Water will consider the adoption of SuDs provided that they meet the criteria outline in our SuDs adoption manual. This can be found on our website at <http://www.anglianwater.co.uk/developers/suds.aspx>. We will adopt features located in public open space that are designed and constructed, in conjunction with the Local Authority and Lead Local Flood Authority (LLFA), to the criteria within our SuDs adoption manual. Specifically, developers must be able to demonstrate:

1. Effective upstream source control,
2. Effective exceedance design, and
3. Effective maintenance schedule demonstrating that the assets can be maintained both now and in the future with adequate access.

If you wish to look at the adoption of any SuDs then an expression of interest form can be found on our website at: <http://www.anglianwater.co.uk/developers/suds.aspx>

The proposed method of surface water disposal is not relevant to Anglian Water; we suggest that you contact the relevant Local Authority, Lead Local Flood Authority, the Environment Agency or the Internal Drainage Board, as appropriate.

Trade Effluent

We note that you do not have any trade effluent requirements. Should this be required in the future you will need our written formal consent. This is in accordance with Section 118 of the Water Industry Act (1991).

Used Water Budget Costs

As a result of the recent charging rules published by Ofwat, our charging regime has changed. Your development site will be required to pay a Zonal charge for each new property connecting to the public sewer that benefits from Full planning permission.

Payment of the Zonal charge must be made before premises are connected to the public sewer. More information on the Zonal charge can be found at <http://www.anglianwater.co.uk/developers/charges>

The Zonal charge consists of two elements. The first is called the 'Fixed Element' which is the same in nature to the Infrastructure charge applied prior to April 2018. The second is called the 'Variable Element' which may vary each financial year.

The elements are combined together to create the 2018/19 Zonal charge for Sewerage:

Fixed Element	£ 370
Variable Element	£ 101

In most circumstances zonal charges are raised on a standard basis of one charge per new connection (one for water and one for sewerage). However, if the new connection is to non-household premises, the fixed element is calculated according to the number and type of water fittings in the premises. This is called the "relevant multiplier" method of calculating the charge. Details of the relevant multiplier for each fitting can be found at our web-page: <http://www.anglianwater.co.uk/developers/charges/>

The total Zonal charge payable for your site for Sewerage is:

Zonal charge per new connection - Sewerage	No. Of Units	Total amount payable
£ 471	32	£ 15,072.00

It has been assumed that the onsite used water network will be provided under a section 104 Water Industry Act application.

It is recommended that you also budget for connection costs. Please note that we offer alternative types of connections depending on your needs and these costs are available at our website.

Section 4: Map of Proposed Connection Points

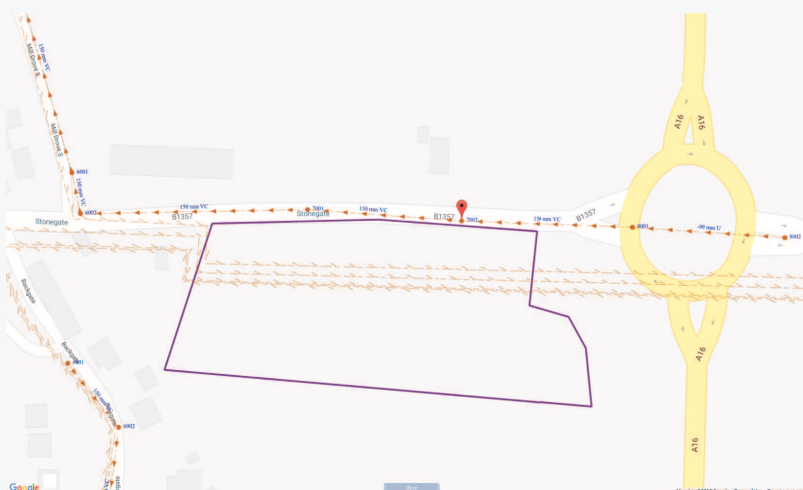


Figure 1: Showing your used water point of connection

Section 5: Useful Information

Used water

Water Industry Act – Key Used Water Sections:

Section 98:

This provides you with the right to requisition a new public sewer. The new public sewer can be constructed by Anglian Water on your behalf. Alternatively, you can construct the sewer yourself under section 30 of the Anglian Water Authority Act 1977.

Section 102:

This provides you with the right to have an existing sewerage asset vested by us. It is your responsibility to bring the infrastructure to an adoptable condition ahead of the asset being vested.

Section 104:

This provides you with the right to have a design technically vetted and an agreement reached that will see us adopt your assets following their satisfactory construction and connection to the public sewer.

Section 106:

This provides you with the right to have your constructed sewer connected to the public sewer.

Section 185:

This provides you with the right to have a public sewerage asset diverted.

Details on how to make a formal application for a new sewer, new connection or diversion are available on our website at <http://www.anglianwater.co.uk/developers> or via our Developer Services team on 0345 60 66 087.

Sustainable drainage systems:

Many existing urban drainage systems can cause problems of flooding, pollution or damage to the environment and are not resilient to climate change in the long term. Therefore our preferred method of surface water disposal is through the use of Sustainable Drainage Systems (SuDS). SuDS are a range of techniques that aim to mimic the way surface water drains in natural systems within urban areas. For more information on SuDS, please visit our website at <http://www.anglianwater.co.uk/developers/suds.aspx>. We also recommend that you contact the Local Authority and Lead Local Flood Authority (LLFA) for the area to discuss your application.

Private sewer transfers:

Sewers and lateral drains connected to the public sewer on the 1 July 2011 transferred into Water Company ownership on the 1 October 2011. This follows the implementation of the Floods and Water Management Act (FWMA). This included sewers and lateral drains that were subject to an existing Section 104 Adoption Agreement and those that were not. There were exemptions and the main non-transferable assets were as follows:

- Surface water sewers and lateral drains that did not discharge to the public sewer, e.g. those that discharged to a watercourse.
- Foul sewers and lateral drains that discharged to a privately owned sewage treatment/collection facility.
- Pumping stations and rising mains will transfer between 1 October 2011 and 1 October 2016.

The implementation of Section 42 of the FWMA will ensure that future private sewers will not be created. It is anticipated that all new sewer applications will need to have an approved section 104 application ahead of a section 106 connection.

Encroachment:

Anglian Water operates a risk based approach to development encroaching close to our used water infrastructure. We assess the issue of encroachment if you are planning to build within 400 metres of a water recycling centre or, within 15 metres to 100 metres of a pumping station. We have more information available on our website at <http://anglianwater.co.uk/developers/encroachment.aspx>

Locating our assets:

Maps detailing the location of our water and used water infrastructure including both underground assets and above ground assets such as pumping stations and recycling centres are available from . All requests from members of the public or non-statutory bodies for maps showing the location of our assets will be subject to an appropriate administrative charge. We have more information on our website at: <http://www.anglianwater.co.uk/developers/our-assets/>

Summary of charges:

A summary of this year's water and used water connection and infrastructure charges can be found at <http://www.anglianwater.co.uk/developers/charges>

Disclaimer:

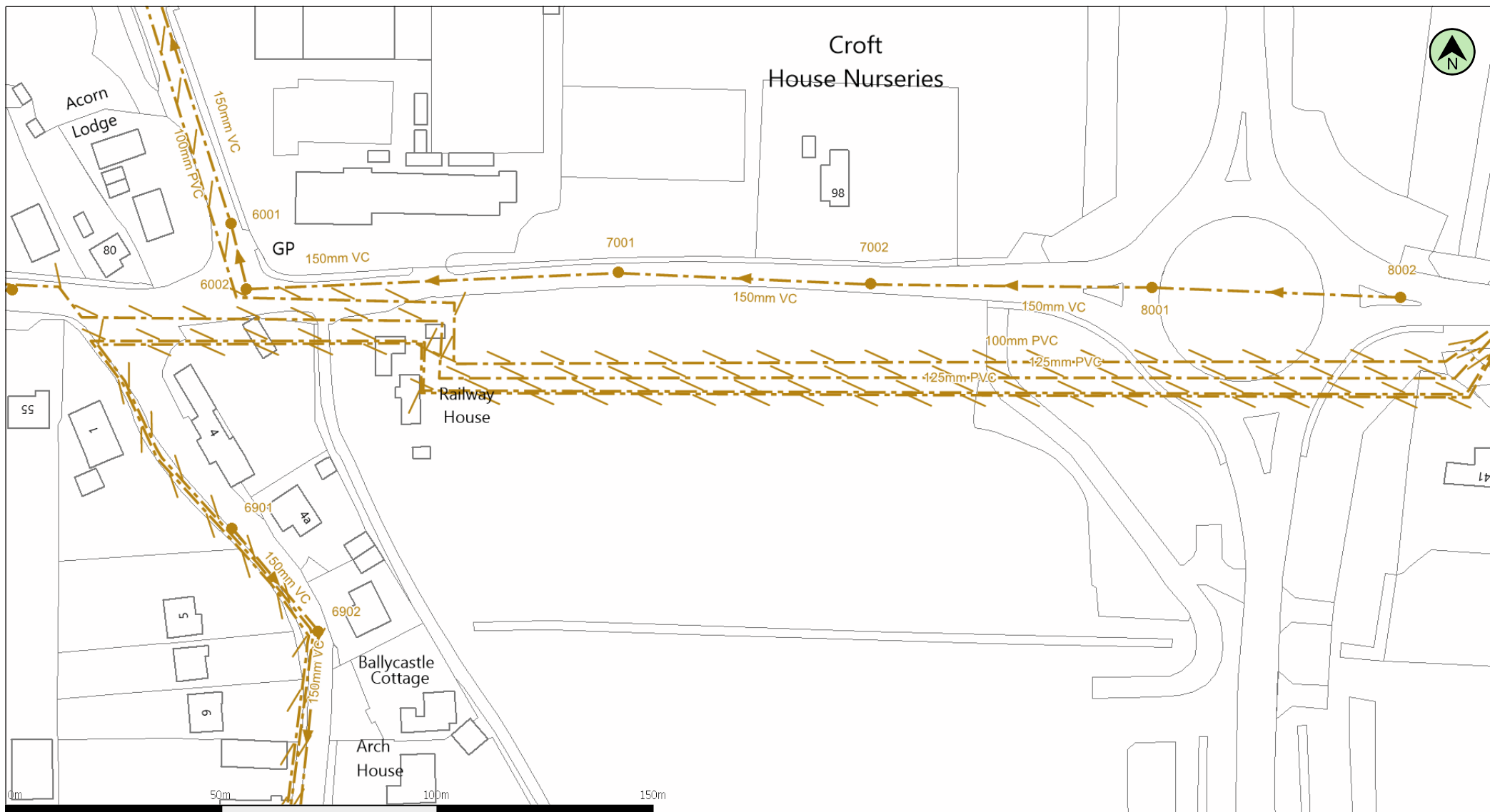
The information provided in this report is based on data currently held by Anglian Water Services Limited ('Anglian Water') or provided by a third party. Accordingly, the information in this report is provided with no guarantee of accuracy, timeliness, completeness and is without indemnity or warranty of any kind (express or implied).

This report should not be considered in isolation and does not nullify the need for the enquirer to make additional appropriate searches, inspections and enquiries. Anglian Water supports the plan led approach to sustainable development that is set out in the National Planning Policy Framework ('NPPF') and any infrastructure needs identified in this report must be considered in the context of current, adopted and/or emerging local plans. Where local plans are absent, silent or have expired these needs should be considered against the definition of sustainability holistically as set out in the NPPF.

Whilst the information in this report is based on the presumption that proposed development obtains planning permission, nothing in this report confirms that planning permission will be granted or that Anglian Water will be bound to carry out the works/proposals contained within this report.

No liability whatsoever, including liability for negligence is accepted by Anglian Water, or its partners, employees or agents, for any error or omission, or for the results obtained from the use of this report and/or its content. Furthermore in no event will any of those parties be liable to the applicant or any third party for any decision made or action taken as a result of reliance on this report.

This report is valid for the date printed and the enquirer is advised to resubmit their request for an up to date report should there be a delay in submitting any subsequent application for water supply/sewer connection(s).



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Date: 01/05/18

Scale: 1:1250

Map Centre: 526743,318011

Data updated: 13/03/18

Our Ref: 262726 - 2

Wastewater Plan A4

This plan is provided by Anglian Water pursuant to its obligations under the Water Industry Act 1991 sections 198 or 199. It must be used in conjunction with any search results attached. The information on this plan is based on data currently recorded but position must be regarded as approximate. Service pipes, private sewers and drains are generally not shown. Users of this map are strongly advised to commission their own survey of the area shown on the plan before carrying out any works. The actual position of all apparatus MUST be established by trial holes. No liability whatsoever, including liability for negligence, is accepted by Anglian Water for any error or inaccuracy or omission, including the failure to accurately record, or record at all, the location of any water main, discharge pipe, sewer or disposal main or any item of apparatus. This information is valid for the date printed. This plan is produced by Anglian Water Services Limited (c) Crown copyright and database rights 2018 Ordnance Survey 100022432. This map is to be used for the purposes of viewing the location of Anglian Water plant only. Any other uses of the map data or further copies is not permitted. This notice is not intended to exclude or restrict liability for death or personal injury resulting from negligence.

Foul Sewer	Orange dashed line	Outfall*
Surface Sewer	Blue dashed line	
Combined Sewer	Red dashed line	
Final Effluent	Purple dashed line	Inlet*
Rising Main*	Black dashed line with triangles	
Private Sewer*	Black dashed line	
Decommissioned Sewer*	Black dashed line with triangles	Manhole*

Sewage Treatment Works

Public Pumping Station

Decommissioned Pumping Station

*(Colour denotes effluent type)

utility.reports@technicsgroup.com

GRS04859

love every drop
anglianwater

APPENDIX F

LEAD LOCAL FLOOD AUTHORITY CONSULTATION

From: [FloodRisk](#)
To: [Anna-Lisa Morse](#)
Subject: FW: 1834/02 Moulton Road, Cowbit
Date: Wednesday 15 August, 2018 9:10:42am
Attachments: [Site Location Plan.pdf](#)

Good morning

Thank you for your email. I have made some comments in red in response to each point below from a Lead Local Flood Authority point of view:

We have been appointed to prepare a Flood Risk Assessment and Drainage Strategy for the site. We would appreciate your consultation on any known flooding. **We do not hold records for field flooding. The Environment Agency should be able to advise on the extent of any historical flooding.** the location of any culverted or open watercourses that would be a suitable outfall **We do not hold this information, suitability of a watercourse for accepting discharge will need to be determined as part of the drainage strategy.** and any comments relating to discharge of surface water to sewer or watercourse that would be beneficial at this stage. **I advise contacting South Holland Internal Drainage Board to enquire about any information they may hold, or if it is a sewer I advise contacting Anglian Water to enquire about any information they may hold.**

Do you have any information available for any drainage / sewerage assets within the Site boundary? Also, do you have any specific discharge conditions? **We do not hold this information. With regard to any discharge conditions, the discharge rate is assumed to be the greenfield run off rate.**

I am sorry that I cannot be of more help on this occasion.

Kind regards

Sam Abrams
Assistant Flood Risk Officer
Lincolnshire County Council
Lancaster House
36 Orchard Street
Lincoln
LN1 1XX
Tel - 01522 782070
Email - FloodRisk@lincolnshire.gov.uk

From: Anna-Lisa Morse [<mailto:Anna-LisaMorse@arpassociates.co.uk>]
Sent: 08 August 2018 15:02
To: DEV_PlanningEnquiries
Cc: Paul Carter
Subject: 1834/02 Moulton Road, Cowbit

Good Afternoon,

Our Client is proposing a residential development at a plot of land off Moulton Road, Cowbit,

A P P E N D I X G

I N T E R N A L D R A I N A G E B O A R D C O N S U L T A T I O N

Paul Carter

Subject: FW: 1834/02 Moulton Road, Cowbit IDB Consultation
Attachments: 605 with pipes.png

From: Graham Brown [mailto:Graham.Brown@wlma.org.uk]
Sent: Thursday 13 September, 2018 11:29am
To: Anna-Lisa Morse
Subject: RE: 1834/02 Moulton Road, Cowbit IDB Consultation

Hi Anna-Lisa,

Apologies for the delay in responding.

I would agree that infiltration across most of our drainage district is difficult to achieve given the nature of the soils and the shallow depth of groundwater.

Please find attached a screenshot from our mapping that highlights the Board's adopted watercourses in blue (with the culverted lengths in maroon).

With regards to the Boards requirements please see the bullet points below;

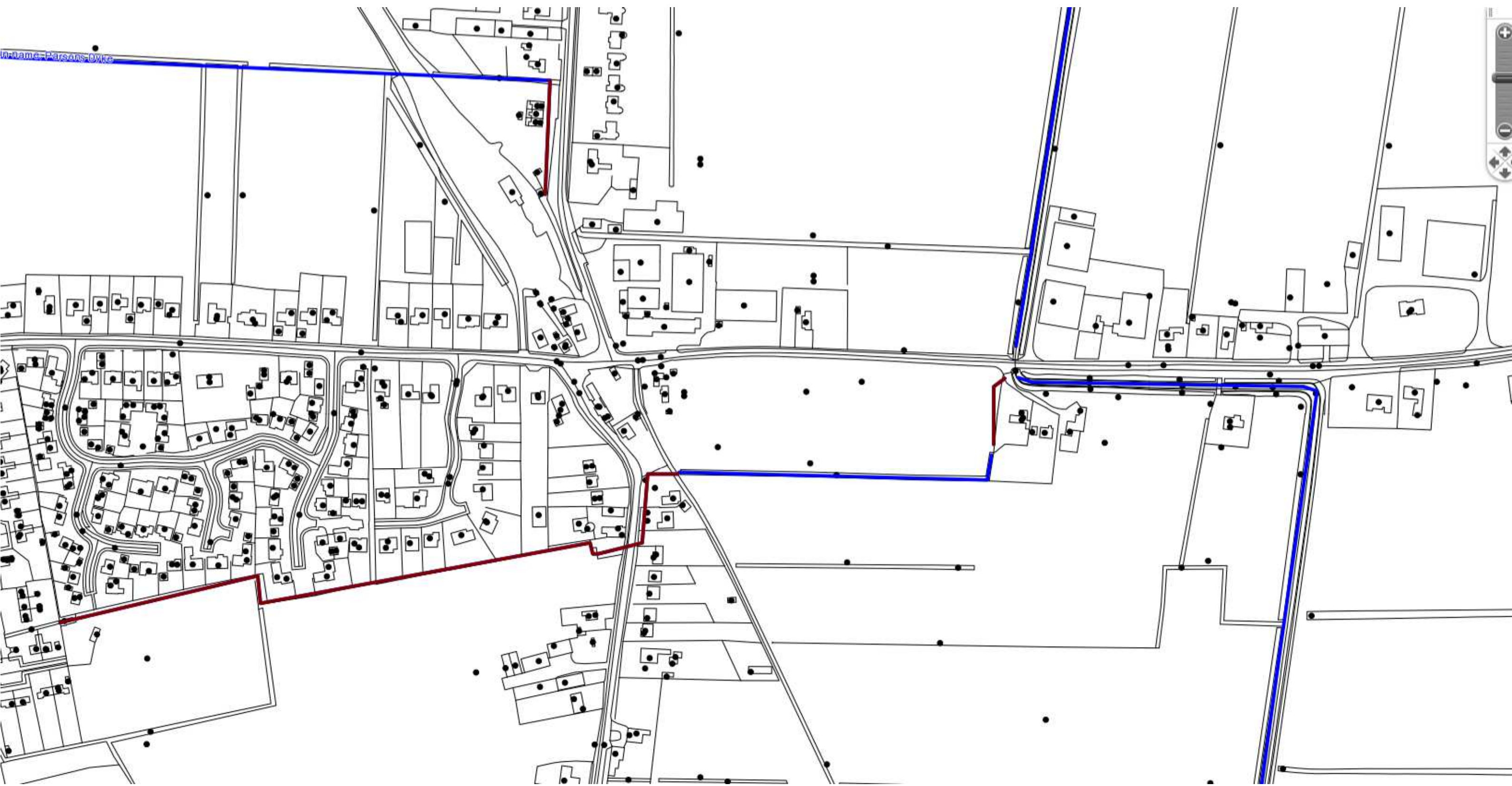
- As you are within the Board's Internal Drainage Board's Internal Drainage District (IDD), the Board's byelaws apply. These Byelaws are available on our website (https://www.wlma.org.uk/uploads/SHIDB_Byelaws.pdf).
- Please see our website (https://www.wlma.org.uk/uploads/210-SHIDB_Index.pdf) for detailed mapping of the Board's Drainage District, including which drains are designated as adopted watercourses. Your proposal is located in catchment B - CMT193P - Wisemans (South)
- Proposals to undertake works to alter any watercourse within the Board's IDD whether it be an adopted watercourse or a privately maintained watercourse, (including culverting for access) require consent under Section 23 of the Land Drainage Act.
- If a surface water (or treated foul water) discharge is proposed to a watercourse (either directly or indirectly), then land drainage consent is required. Consents granted may be conditional, pending the payment of a surface water development contribution fee, calculated in line with the Board's charging policy (https://www.wlma.org.uk/uploads/WMA_Table_of_Charges_and_Fees.pdf).
- If works are proposed within 9m of a Board adopted watercourse, consent is required under byelaw 10. Please use the link to mapping above to check if you are near a Board adopted watercourse. Please note there is a Board's watercourse B21 - Mill Dyke located on the southern boundary of your proposed site. This may have implication for your site layout given the need to retain a 9m maintenance strip adjacent to this watercourse.

Please note that whilst the consenting process as set out under the Land Drainage Act 1991 and the Board's Byelaws are separate from planning, the ability to implement a planning permission may be dependent on the granting of these consents. As such we strongly recommend that where works are associated with a planning permission that any required consents are sought prior to the determination of the planning application.

Kind regards,

Graham

Graham Brown
Flood and Water Manager
Water Management Alliance
t: 07733 105048 | e: Graham.Brown@wlma.org.uk





Map Index	
Sheet Number	Sheet Title
A - CMT192P	Clay Lake
B - CMT193P	Wisemans (N)
B - CMT193P	Wisemans (S)
C - CMT194P	Peartree Hill
D - CMT195P	Donningtons
E - CMT196P	Fleet Fen (N)
E - CMT196P	Fleet Fen (S)
F - CMT197P	Little Holland (N)
F - CMT197P	Little Holland (S)
F - CMT197P	Little Holland (W)
G - CMT198P	Sutton St James
H - CMT199G	Free Discharge (E)
H - CMT199G	Free Discharge (W)
H - CMT199G	Free Discharge (C)
I - CMT200P	Westmere
K - CMT201G	Lutton Leam (E)
K - CMT201G	Lutton Leam (W)
L - CMT202P	Dawsmere
M - CMT203P	Fleet Haven
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T - CMT210P	Roses
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LEGEND

- Boards Boundary
- Hydrological Catchment

KEY MAP

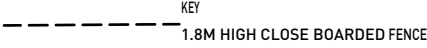


SCALE	SHEET NUMBER
Best Fit	© Crown Copyright and database rights [2012]. All rights reserved OS licence number 100029527.
PLOT DATE	Index
23/07/2015	
FILE NAME	
SHIDB_webmap2013.dwg	

A P P E N D I X H

PROPOSED DEVELOPMENT MASTERPLAN LAYOUT

A diagram of a brick building with a 90.50 degree angle.



Symbol	Beds	Storey Height	Area (SQFT)	Number	Total SQFT
3 BED	3	2	883	8	7064
2 BED	2	2	732	14	10248
BUNGALOW	2	1	614	4	2456
1 BED MAS	1	2	490	6	2940
GRAND TOTAL:				Number 32	Total SQFT 22708

Symbol	Beds	Storey Height	Area (SQFT)	Number	Total SQFT
3 BED	3	2	883	8	7064
2 BED	2	2	732	14	10248
BUNGALOW	2	1	614	4	2456
1 BED MAS	1	2	490	6	2940
GRAND TOTAL:				Number 32	Total SQFT 22708

LAND OFF CHAPEL ROAD, COWBIT
PROPOSED PLANNING LAYOUT SHOWING
INDICATIVE LANDSCAPE
SCALE 1:500 @A3
DATE - SEPT 18
REF-CWB-2018-001



0

50

100

APPENDIX J

INDICATIVE GREENFIELD RUN-OFF CALCULATIONS

ARP Associates		Page 1
Northwest House Servia Hill Leeds LS6 2QH		
Date 07/09/2018 4:54pm	Designed by PaulCarter	
File 1834-02 - 100YR PLUS 20...	Checked by	
Elstree Computing Ltd	Source Control 2018.1	

IH 124 Mean Annual Flood

Input

Return Period (years)	1	Soil	0.300
Area (ha)	50.000	Urban	0.000
SAAR (mm)	555	Region Number	Region 5

Results 1/s

QBAR Rural	69.5
QBAR Urban	69.5

Q1 year	60.4
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Q1 year	60.4
Q2 years	62.1
Q5 years	89.6
Q10 years	114.9
Q20 years	145.2
Q25 years	157.1
Q30 years	166.9
Q50 years	197.4
Q100 years	247.2
Q200 years	291.0
Q250 years	304.9
Q1000 years	400.0

It is unusual for the IH124 method to be used with an area < 50 ha. 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. Therefore,

$$\begin{aligned}
 60.4 \div 50 &= 1.208 \text{ L/s/ha} \\
 1.208 \times 0.88 &= 1.063 \text{ L/s}
 \end{aligned}$$

A P P E N D I X K

INDICATIVE SURFACE WATER DRAINAGE CALCULATIONS

ARP Associates		Page 1
Northwest House Servia Hill Leeds LS6 2QH	Moulton Chapel Road Cowbit	
Date 11/09/2018 10:33am File 1834-02 -30YR.SRCX	Designed by PSC Checked by SAB	
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Source Control 2018.1		

Source Control 2018.1

Summary of Results for 30 year Return Period

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	99.627	0.427	5.0	56.0	O K
30 min Summer	99.743	0.543	5.0	71.1	Flood Risk
60 min Summer	99.840	0.640	5.0	83.8	Flood Risk
120 min Summer	99.893	0.693	5.0	90.8	Flood Risk
180 min Summer	99.892	0.692	5.0	90.7	Flood Risk
240 min Summer	99.881	0.681	5.0	89.2	Flood Risk
360 min Summer	99.849	0.649	5.0	85.0	Flood Risk
480 min Summer	99.814	0.614	5.0	80.5	Flood Risk
600 min Summer	99.778	0.578	5.0	75.7	Flood Risk
720 min Summer	99.739	0.539	5.0	70.6	Flood Risk
960 min Summer	99.657	0.457	5.0	59.8	O K
1440 min Summer	99.527	0.327	5.0	42.8	O K
2160 min Summer	99.402	0.202	5.0	26.4	O K
2880 min Summer	99.339	0.139	4.8	18.2	O K
4320 min Summer	99.302	0.102	3.8	13.4	O K
5760 min Summer	99.286	0.086	3.1	11.2	O K
7200 min Summer	99.276	0.076	2.6	10.0	O K
8640 min Summer	99.270	0.070	2.3	9.1	O K
10080 min Summer	99.265	0.065	2.0	8.5	O K
15 min Winter	99.682	0.482	5.0	63.1	O K
30 min Winter	99.813	0.613	5.0	80.3	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	72.136	0.0	59.1	18
30 min Summer	46.950	0.0	77.1	33
60 min Summer	29.238	0.0	96.3	62
120 min Summer	17.689	0.0	116.6	120
180 min Summer	13.053	0.0	129.0	158
240 min Summer	10.478	0.0	138.1	190
360 min Summer	7.650	0.0	151.3	256
480 min Summer	6.120	0.0	161.4	326
600 min Summer	5.144	0.0	169.6	394
720 min Summer	4.462	0.0	176.5	464
960 min Summer	3.563	0.0	187.9	588
1440 min Summer	2.592	0.0	205.0	834
2160 min Summer	1.884	0.0	223.7	1168
2880 min Summer	1.501	0.0	237.6	1500
4320 min Summer	1.089	0.0	258.4	2204
5760 min Summer	0.866	0.0	274.4	2936
7200 min Summer	0.725	0.0	287.2	3672
8640 min Summer	0.627	0.0	298.0	4368
10080 min Summer	0.555	0.0	307.3	5088
15 min Winter	72.136	0.0	66.3	18
30 min Winter	46.950	0.0	86.4	32

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Source Control 2018.1

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	99.924	0.724	5.0	94.8	Flood Risk
120 min Winter	99.993	0.793	5.0	103.8	Flood Risk
180 min Winter	99.997	0.797	5.0	104.4	Flood Risk
240 min Winter	99.979	0.779	5.0	102.1	Flood Risk
360 min Winter	99.938	0.738	5.0	96.6	Flood Risk
480 min Winter	99.888	0.688	5.0	90.1	Flood Risk
600 min Winter	99.834	0.634	5.0	83.1	Flood Risk
720 min Winter	99.778	0.578	5.0	75.8	Flood Risk
960 min Winter	99.649	0.449	5.0	58.8	O K
1440 min Winter	99.459	0.259	5.0	33.9	O K
2160 min Winter	99.329	0.129	4.7	16.9	O K
2880 min Winter	99.303	0.103	3.8	13.5	O K
4320 min Winter	99.281	0.081	2.8	10.5	O K
5760 min Winter	99.270	0.070	2.3	9.1	O K
7200 min Winter	99.263	0.063	1.9	8.2	O K
8640 min Winter	99.257	0.057	1.6	7.5	O K
10080 min Winter	99.254	0.054	1.5	7.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	29.238	0.0	107.9	60
120 min Winter	17.689	0.0	130.6	118
180 min Winter	13.053	0.0	144.5	172
240 min Winter	10.478	0.0	154.7	198
360 min Winter	7.650	0.0	169.4	274
480 min Winter	6.120	0.0	180.7	352
600 min Winter	5.144	0.0	189.9	428
720 min Winter	4.462	0.0	197.7	504
960 min Winter	3.563	0.0	210.5	634
1440 min Winter	2.592	0.0	229.7	864
2160 min Winter	1.884	0.0	250.5	1144
2880 min Winter	1.501	0.0	266.1	1496
4320 min Winter	1.089	0.0	289.4	2200
5760 min Winter	0.866	0.0	307.3	2936
7200 min Winter	0.725	0.0	321.7	3672
8640 min Winter	0.627	0.0	333.8	4408
10080 min Winter	0.555	0.0	344.2	5088

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Model Details

Storage is Online Cover Level (m) 100.000

Tank or Pond Structure

Invert Level (m) 99.200

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	131.0	0.700	131.0	1.400	131.0	2.100	131.0
0.100	131.0	0.800	131.0	1.500	131.0	2.200	131.0
0.200	131.0	0.900	131.0	1.600	131.0	2.300	131.0
0.300	131.0	1.000	131.0	1.700	131.0	2.400	131.0
0.400	131.0	1.100	131.0	1.800	131.0	2.500	131.0
0.500	131.0	1.200	131.0	1.900	131.0		
0.600	131.0	1.300	131.0	2.000	131.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0109-5000-0800-5000
Design Head (m)	0.800
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	109
Invert Level (m)	99.200
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	5.0
Flush-Flo™	0.241	5.0
Kick-Flo®	0.537	4.2
Mean Flow over Head Range	-	4.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.7	1.200	6.0	3.000	9.3	7.000	13.9
0.200	5.0	1.400	6.5	3.500	10.0	7.500	14.4
0.300	5.0	1.600	6.9	4.000	10.6	8.000	14.8
0.400	4.8	1.800	7.3	4.500	11.3	8.500	15.2
0.500	4.5	2.000	7.7	5.000	11.8	9.000	15.7
0.600	4.4	2.200	8.0	5.500	12.4	9.500	16.1
0.800	5.0	2.400	8.4	6.000	12.9		
1.000	5.5	2.600	8.7	6.500	13.4		

ARP Associates

Northwest House
Servia Hill
Leeds LS6 2QH

Moulton Chapel Road
Cowbit

Date 11/09/2018 8:55am
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Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	99.575	0.375	5.0	89.0	O K
30 min Summer	99.685	0.485	5.0	115.0	O K
60 min Summer	99.789	0.589	5.0	139.7	Flood Risk
120 min Summer	99.869	0.669	5.0	158.7	Flood Risk
180 min Summer	99.894	0.694	5.0	164.6	Flood Risk
240 min Summer	99.896	0.696	5.0	165.1	Flood Risk
360 min Summer	99.878	0.678	5.0	160.9	Flood Risk
480 min Summer	99.859	0.659	5.0	156.3	Flood Risk
600 min Summer	99.838	0.638	5.0	151.4	Flood Risk
720 min Summer	99.816	0.616	5.0	146.3	Flood Risk
960 min Summer	99.771	0.571	5.0	135.6	Flood Risk
1440 min Summer	99.673	0.473	5.0	112.2	O K
2160 min Summer	99.551	0.351	5.0	83.3	O K
2880 min Summer	99.460	0.260	5.0	61.6	O K
4320 min Summer	99.355	0.155	4.8	36.8	O K
5760 min Summer	99.317	0.117	4.4	27.8	O K
7200 min Summer	99.301	0.101	3.8	23.9	O K
8640 min Summer	99.290	0.090	3.3	21.3	O K
10080 min Summer	99.282	0.082	2.9	19.5	O K
15 min Winter	99.621	0.421	5.0	100.0	O K
30 min Winter	99.746	0.546	5.0	129.6	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	112.136	0.0	91.2	18
30 min Summer	73.631	0.0	120.1	33
60 min Summer	46.096	0.0	151.5	62
120 min Summer	27.915	0.0	183.6	122
180 min Summer	20.556	0.0	202.8	180
240 min Summer	16.453	0.0	216.5	240
360 min Summer	11.937	0.0	235.6	302
480 min Summer	9.514	0.0	250.4	364
600 min Summer	7.973	0.0	262.3	430
720 min Summer	6.898	0.0	272.3	498
960 min Summer	5.484	0.0	288.6	638
1440 min Summer	3.964	0.0	312.9	896
2160 min Summer	2.860	0.0	339.4	1272
2880 min Summer	2.267	0.0	358.6	1616
4320 min Summer	1.632	0.0	386.7	2288
5760 min Summer	1.291	0.0	408.6	2944
7200 min Summer	1.075	0.0	425.6	3672
8640 min Summer	0.926	0.0	439.7	4408
10080 min Summer	0.816	0.0	451.6	5136
15 min Winter	112.136	0.0	102.3	18
30 min Winter	73.631	0.0	134.6	33

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Source Control 2018.1

Summary of Results for 100 year Return Period (+20%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	99.864	0.664	5.0	157.5	Flood Risk
120 min Winter	99.958	0.758	5.0	179.8	Flood Risk
180 min Winter	99.991	0.791	5.0	187.6	Flood Risk
240 min Winter	99.998	0.798	5.0	189.4	Flood Risk
360 min Winter	99.979	0.779	5.0	184.8	Flood Risk
480 min Winter	99.953	0.753	5.0	178.6	Flood Risk
600 min Winter	99.926	0.726	5.0	172.3	Flood Risk
720 min Winter	99.897	0.697	5.0	165.3	Flood Risk
960 min Winter	99.833	0.633	5.0	150.3	Flood Risk
1440 min Winter	99.688	0.488	5.0	115.7	O K
2160 min Winter	99.503	0.303	5.0	71.9	O K
2880 min Winter	99.387	0.187	4.9	44.3	O K
4320 min Winter	99.311	0.111	4.1	26.3	O K
5760 min Winter	99.291	0.091	3.3	21.5	O K
7200 min Winter	99.280	0.080	2.8	18.9	O K
8640 min Winter	99.273	0.073	2.4	17.2	O K
10080 min Winter	99.267	0.067	2.1	15.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	46.096	0.0	169.7	62
120 min Winter	27.915	0.0	205.6	120
180 min Winter	20.556	0.0	227.2	176
240 min Winter	16.453	0.0	242.5	232
360 min Winter	11.937	0.0	263.9	336
480 min Winter	9.514	0.0	280.5	382
600 min Winter	7.973	0.0	293.8	458
720 min Winter	6.898	0.0	305.0	536
960 min Winter	5.484	0.0	323.3	692
1440 min Winter	3.964	0.0	350.5	978
2160 min Winter	2.860	0.0	380.2	1324
2880 min Winter	2.267	0.0	401.7	1644
4320 min Winter	1.632	0.0	433.2	2248
5760 min Winter	1.291	0.0	457.7	2944
7200 min Winter	1.075	0.0	476.7	3672
8640 min Winter	0.926	0.0	492.5	4408
10080 min Winter	0.816	0.0	506.0	5112

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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	0.402	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+20

Time Area Diagram

Total Area (ha) 0.440

Time (mins)	Area
From:	To: (ha)

0	4 0.440
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Model Details

Storage is Online Cover Level (m) 100.000

Tank or Pond Structure

Invert Level (m) 99.200

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	237.3	0.700	237.3	1.400	237.3	2.100	237.3
0.100	237.3	0.800	237.3	1.500	237.3	2.200	237.3
0.200	237.3	0.900	237.3	1.600	237.3	2.300	237.3
0.300	237.3	1.000	237.3	1.700	237.3	2.400	237.3
0.400	237.3	1.100	237.3	1.800	237.3	2.500	237.3
0.500	237.3	1.200	237.3	1.900	237.3		
0.600	237.3	1.300	237.3	2.000	237.3		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0109-5000-0800-5000
Design Head (m)	0.800
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	109
Invert Level (m)	99.200
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.800	5.0
Flush-Flo™	0.241	5.0
Kick-Flo®	0.537	4.2
Mean Flow over Head Range	-	4.3

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.7	1.200	6.0	3.000	9.3	7.000	13.9
0.200	5.0	1.400	6.5	3.500	10.0	7.500	14.4
0.300	5.0	1.600	6.9	4.000	10.6	8.000	14.8
0.400	4.8	1.800	7.3	4.500	11.3	8.500	15.2
0.500	4.5	2.000	7.7	5.000	11.8	9.000	15.7
0.600	4.4	2.200	8.0	5.500	12.4	9.500	16.1
0.800	5.0	2.400	8.4	6.000	12.9		
1.000	5.5	2.600	8.7	6.500	13.4		

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