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WATER ENGINEERING

UK Coal Mining Limited
Little Houghton
South Yorkshire

Flood Risk Assessment

BWB Consulting Ltd
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Ref: DA/UKC040/FRA – Rev D

Date: November 2008

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The information presented and conclusions drawn are based on statistical data and are for guidance purposes only. The study provides no guarantee against flooding of the study site or elsewhere, nor of the absolute accuracy of water levels, flow rates and associated probabilities.

EXECUTIVE SUMMARY

This Flood Risk Assessment (FRA) is compliant with the requirements set out in Planning Policy Statement 25 – Development and Flood Risk (PPS25). It has been produced on behalf of UK Coal Mining Ltd in respect of a planning application for a residential and employment development at Little Houghton, South Yorkshire.

The proposed development site is located east of Barnsley and is situated on the site of a disused coal mine that has been compacted and backfilled. As such it is presently unused and comprises open grassland. Ground levels on the site range from approximately 32m – 42m AOD.

Indicative flood zone mapping for the area was extracted from the Environment Agency website. This mapping indicates that the site lies within Flood Zone 1, which comprises land assessed as having less than a 1 in 1000 annual probability of flooding (<0.1%). The highest vulnerability class of land use with the proposed development is the 'More Vulnerable' residential use. The development is therefore considered to be an appropriate use within this flood zone and is sequentially preferable in terms of flood risk.

The River Dearne is located to the west of the proposed development site, and it has been confirmed that the site is located outside the extent of the extreme flood zone of the river. Pluvial runoff and sewer flooding have also been identified as sources of flood risk, though the current ground levels are arranged in such a way as to direct surface water and sewer flooding away from the site.

For the purposes of hydrological analysis the site is considered greenfield. Surface water runoff from the development must be restricted to the existing QBAR rate of 7.0 l/s. It is understood that the proposed development will generate an impermeable area of approximately 2.79 hectares on a total site area of 4.46 hectares. The increased surface water discharge must be attenuated before being discharged to sewer outfalls and the attenuation volume has been designed to include a 30% allowance for the possible effects of climate change.

As the site is located within Flood Zone 1, finished floor levels will be set according to practical and operational requirements. Sustainable Urban Drainage Systems (SuDS) must be incorporated into the drainage design where possible as a measure to further reducing the volume and increasing the quality of surface water runoff. This will be dealt with during detailed drainage design.

In accordance with the requirements set out in Planning Policy Statement 25 – Development and Flood Risk, and subject to the mitigation measures recommended, the development is not considered to be at significant risk of flooding and will not increase flood risk elsewhere in the wider catchment.

1.0 SUMMARY INFORMATION

Introduction

1.1 This Flood Risk Assessment (FRA) is compliant with the requirements set out in Planning Policy Statement 25 – Development and Flood Risk (PPS25). The FRA has been produced on behalf of UK Coal Mining Limited in respect of a planning application for the proposed residential and employment development at Little Houghton.

Site Name	Little Houghton
Address	Little Houghton, Barnsley, South Yorkshire
NGR	442099, 405817
Site Area (Ha)	4.46 ha (approx.)
Development Type	Residential and Industrial
EA Development Control Area	Ridings Area Office
Local Planning Authority	Barnsley Metropolitan Borough Council

Table 1.1 – Site Summary

1.2 The report is based on the following information:

(i) Topographical Survey Drawing by UK Coal Mining Ltd, Drawing No. 48/D34.
(ii) Site Boundary Plan by Pod, Drawing no. 025-UKC-02-01
(iii) OS Explorer Series Mapping
(iv) Environment Agency consultation.

Existing Site

1.3 The proposed development site is located towards the northern edge of the settlement of Little Houghton. In a wider context, this is approximately 11km east of Barnsley town centre and 1km north of the town of Darfield. A site location plan is included as **Figure 1**.

1.4 The site is bordered to the west by the A6195 Coalfields Link Road and to the south by Middlecliffe Lane with residential buildings beyond. To the east is an electricity sub-station and to the north the land comprises grazed grassland. The northwest of the site is bordered by an unoccupied warehouse building.

1.5 The mine on the site became disused approximately 15 years ago and has been compacted and backfilled. As such, the site presently remains undeveloped, and is largely given over as open grassland. Therefore the site is considered permeable in nature. The site covers a total area of approximately 4.46 hectares.

1.6 Existing ground levels on the site range from approximately 32m – 42m AOD. A topographical survey is included as **Appendix A**.

Proposed Development

1.7 The development proposal includes the construction of a mixed residential and employment development. At the time of writing this report, a master plan was currently unavailable, but a site boundary plan has been included as **Appendix B**.

Flood Zone Classification

1.8 Indicative flood zone mapping for the area was extracted from the Environment Agency (EA) website. This mapping indicates areas that may be at risk of flooding without taking into account existing flood defences. Printed extracts of the EA website are included as **Figure 2**.

1.9 The mapping indicates the site is located within Flood Zone 1. This is designated as land assessed as having less than a 1 in 1000 annual probability of flooding (<0.1%) in accordance with Planning Policy Statement 25 – Development and Flood Risk (PPS 25).

2.0 SOURCES OF FLOOD RISK

2.1 This section identifies the *potential* sources of flood risk to the site. The significance of these sources of flood risk is investigated further in **Section 4.0** of this report.

Flood Source	Presence	Description
Fluvial	✓	River Dearne
Tidal	X	The site is not located near to the coast.
Canals	X	No canals are found in the vicinity of the site.
Groundwater	X	The area has no history of groundwater flooding.
Sewers	✓	The development may alter discharge into nearby sewers.
Reservoirs	X	There are no reservoirs near to the site.
Pluvial runoff	✓	Nearby topography may direct pluvial runoff towards the site.
Development Drainage	✓	Could increase flood risk to wider catchment

Table 2.1 – Potential Flood Sources

2.2 The River Dearne is located approximately 250m to the western boundary of the site.

2.3 The site may be at risk from overland flows from pluvial runoff from the surrounding area. However, due to the existing ground levels on the site, pluvial flows and sewer flooding will generally be diverted away from the development site.

2.4 The development will generate an increase in impermeable area and so will increase the level of surface water discharge being shed from the site. This will require mitigation and the increase in discharge levels must be attenuated before being discharged to the sewer network.

3.0 SEQUENTIAL TEST

3.1 Table D2 of Planning Policy Statement 25 classifies land use according to its vulnerability to the effects of flooding. The residential development aspect of this proposal is classed as 'More Vulnerable' and the employment zone as 'Less Vulnerable'.

3.2 From the flood zone maps it can be seen that the site is designated as being within Flood Zone 1. This flood zone is described as being:

Zone 1 – Low Probability
This zone comprises land assessed as having a less than 1 in 1000 annual probability of river flooding in any year (<0.1%)

Appropriate Uses – All uses appropriate

3.3 Both development classes are considered a suitable use of land within Flood Zone 1. Therefore it can be concluded that the development is sequentially preferable in terms of flood risk.

4.0 FLOOD RISK ASSESSMENT

Risk of Flooding to Proposed Development

4.1 The Environment Agency was consulted and asked to provide historic flood records and modelled flood levels for the River Dearne in the vicinity of the site. The Environment Agency has confirmed that the site is located within Flood Zone 1. This correspondence is included as **Appendix C**.

4.2 The current levels on the site are arranged in such a way as to direct pluvial runoff away from the site towards the A6195 (Coalfields Link Road). Any sewer flooding will also be diverted in a similar manner.

4.3 Therefore, it can be concluded that the site is not considered to be at significant risk of flooding from fluvial, sewer or pluvial sources.

Effect of Development on Wider Catchment

4.4 As the proposed site is mainly permeable in nature, it is classed as a greenfield site for the purposes of hydrological analysis of the existing runoff. Any development will increase the impermeable footprint of the site. As such, an increase in surface water runoff will arise that will require mitigation.

5.0 FLOOD RISK MITIGATION

Finished Levels

5.1 The Environment Agency recommends that finished floor levels should be set at a minimum of 600mm above the modelled 100-year flood level. As the site lies outside of the extent of the extreme flood zone, finished floor levels should be set according to operational and practical considerations.

Drainage Arrangements

5.2 As the proposed development will increase the impermeable footprint of the site, surface water runoff rates will increase. As such, discharge from the proposed development will be restricted to the existing QBAR rate of 7.0 l/s. WinDes extracts have been included as **Appendix D**.

5.3 The Wallingford Procedure was used to calculate the runoff from the proposed development. It is understood that the proposed development will generate impermeable surfaces on approximately 2.79 hectares of the site. The proposed development runoff rates are summarised in **Table 5.1** below. Calculations are shown in **Appendix E.**

Return Period	Permeable Runoff (l/s)	Impermeable Runoff (l/s)	Total runoff (l/s)
1-year	2.3	223.69	225.99
30-year	4.7	547.98	552.68
100-year	5.5	709.30	714.80

Table 5.1 – Proposed Development Runoff Rates

5.4 An attenuation volume will be provided to store the excess surface water flows before being discharged to existing outfalls. A 30% increase in rainfall to allow for the possible effects of climate change has been incorporated into the calculation. A summary of the attenuation volumes is shown in **Table 5.2** below. WinDes calculations are included as **Appendix F.**

Return Period	Critical Storm Duration (min) and Season	Storage Volume Required (m^3)
1-year	960 Winter	429
30-year	1440 Winter	1151
100-year	1440 Winter	1563
100-year + 30%	2160 Winter	2176

Table 5.2 – Proposed Storage Requirements

5.5 Sustainable Drainage Systems (SuDS) should be incorporated into the detailed drainage design where possible as a measure to reduce the volume and increase the quality of surface water resulting from the development. This design will also include an allowance for climate change.

5.6 Attenuation could be provided in the form of above-ground storage basins, permeable paving systems, swales etc and will be investigated further at the detailed drainage design stage.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 The development may proceed without being subject to significant risk from flooding.

6.2 As the site lies outside the extent of the extreme flood zone, finished floor level will be set according to operational and practical requirements.

6.3 Flood risk through the wider catchment will not increase as a result of the development's contribution to flood flows from proposed drainage subject to the following recommendations:

- Surface water runoff rates are restricted to the existing QBAR rate of 7.0 l/s.
- An attenuation volume is provided for additional surface water discharge before it is discharged to existing outfalls.
- Appropriate Sustainable Urban Drainage Systems (SuDS) are to be integrated into the detailed drainage design where possible.

6.4 In accordance with the requirements set out in Planning Policy Statement 25 – Development and Flood Risk, and subject to the mitigation measures recommended, the development is not considered to be at risk from flooding and will not have an adverse impact on flood risk elsewhere.

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Figure 1

Site Location Plan

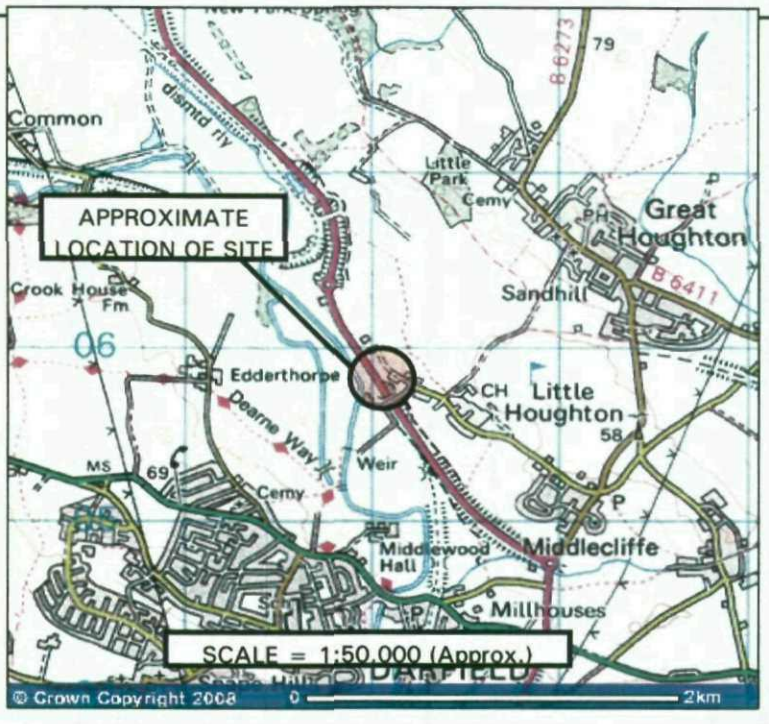
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Drawing Title	SITE LOCATION PLAN
Drawing Status	FOR REPORT PURPOSES ONLY
Date	DEC 2008
Drawing No.	UKC/040/FIGURE 1
Scale	AS SHOWN

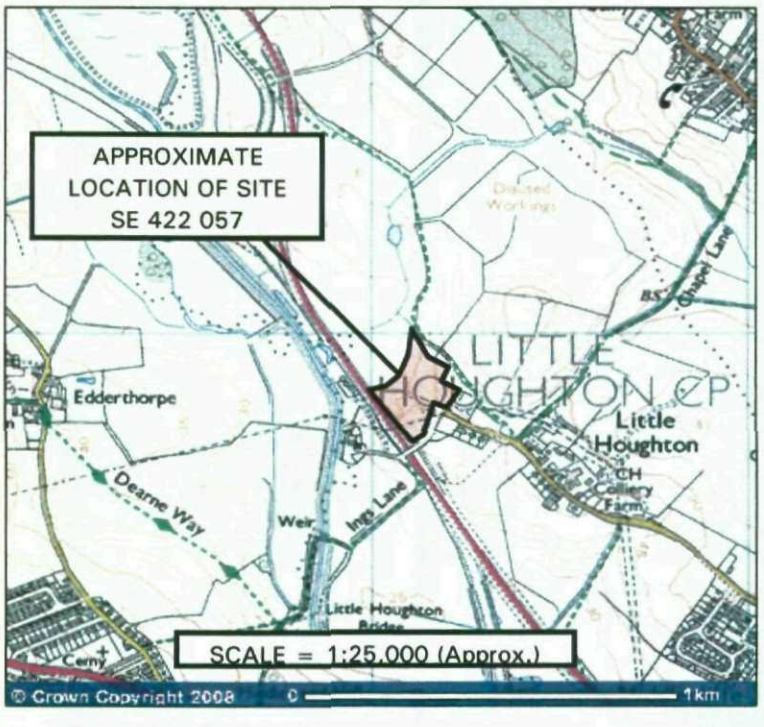
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environmental | water | transportation | civil | structural | highways | infrastructure





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Figure 2

Indicative Floodplain Maps

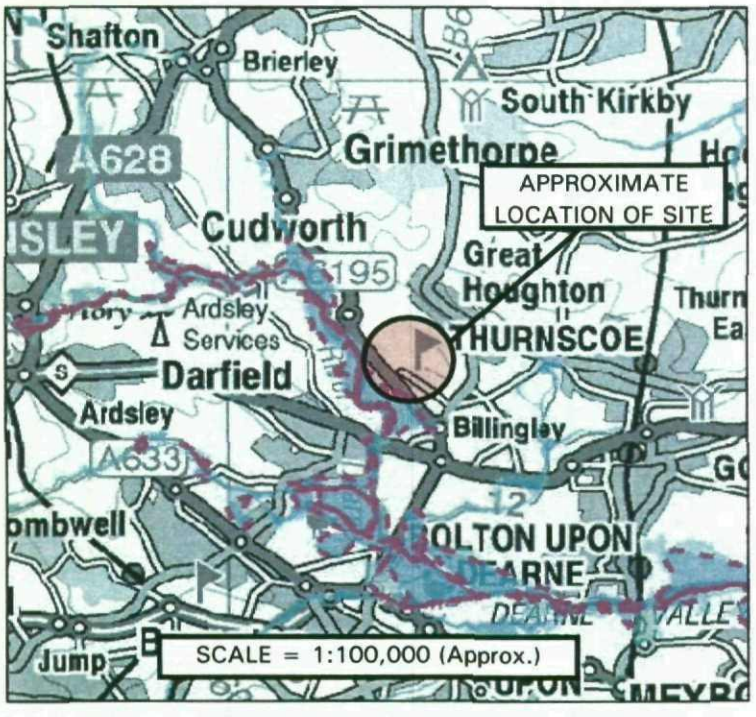
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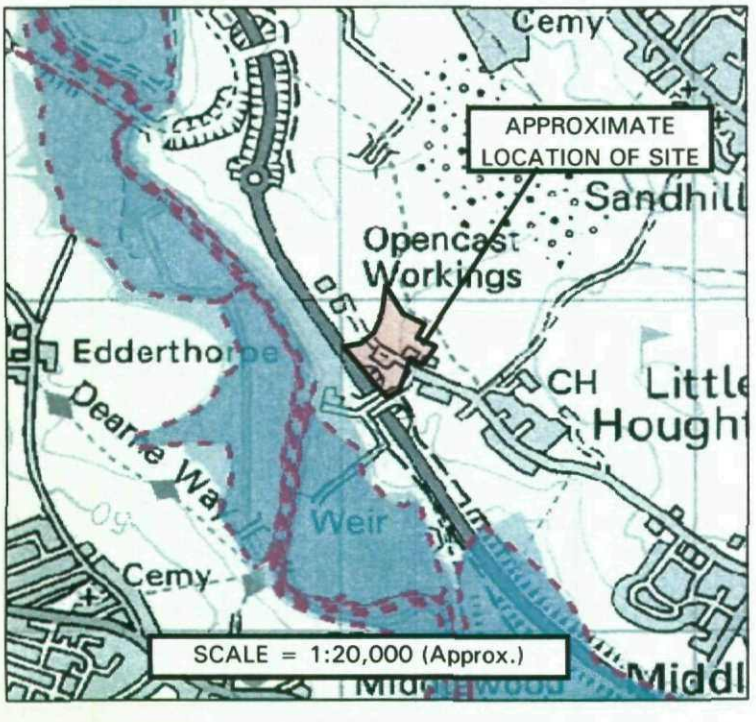
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Key:

- Flooding from rivers or sea without defences
- Extent of extreme flood
- Flood defences
- Areas benefiting from flood defences

Extracted From Environment Agency Website, March 2008

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Appendix A

Topographical Survey

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Appendix B

Site Plan

Land at Little Houghton, Barnsley

Site Location Plan

For: UK Coal Mining Limited
Scale: 1:1250 @ A1 / approx 1:2500 @A3
Date: 28 July 2008
Dwg No: 025-UKC-02-01

Plan 1:1250

All measurements subject to confirmation on site
Drawings should not be scaled. Ask.
O.S. license number AL 100044466

Junction layouts indicative only. Refer to Highways Engineer Design. On site vegetation not surveyed. Any strategy for retention and / or felling and rationalisation subject to full arboricultural input.

pod \ 99 gaigate\ barnard castle\ county durham\ DL12 8ES
tel:0845 003 7755 \ fax:0845 003 7756 \ e: info@pod.gb.com

pod \ 10 summerhill terrace\ newcastle-upon-tyne\ NE4 6EB
tel:0845 003 7755 \ fax:0845 003 7757 \ e: info@pod.gb.com

equivalent to scale

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Appendix C

Environment Agency Correspondence

creating a better place

Environment Agency

Darren Harvey
BWB Consulting
3-4 Kayes Walk
The Lace Market
Nottingham
NG1 1PY

BWB CONSULTING LTD
RECD 31 MAR 2008
TO SEE | SEE
OIH
KA | 31.03.08
DA

Our Ref : RFI/2008/3983
Your Ref :

Date : 28 March 2008

Dear Darren

RE: Flood Risk Assessment Little Houghton, Near Barnsley

Thank you for your enquiry which was received on 2008 and payment taken.

Development Control

We have no record of this site having suffered flooding
Our indicative "Flood Zone Maps" show this site to be in PPS25 zone 1.
For sites in PPS25 zone 1 in excess of 1 ha a Flood Risk Assessment is required, the details for this are shown on www.pipernetworking.com , see Browse the EA Flood Risk Standing Advice... , Flood Risk Assessment Notes 1 to 3, see note 1.

Flood Risk Mapping & Data

The Flood Map
We provide the Flood Map (see enclosed extract).

What is the Flood Map?

The Flood Map is a new multi-layered map which provides information on flooding from rivers and the sea for England and Wales. The Flood Map also has information on flood defences and the areas benefiting from those flood defences.

The Flood Map consists of the following layers of information:

1. Flooding from rivers or sea without defences - the natural flood plain area that could be affected in the event of flooding from rivers and the sea - Flood Zone 3 on the enclosed map.
- For flooding from rivers the map indicates the extent of a flood with a 1% (1 in 100) chance of happening each year
- For flooding from the sea the map shows the extent of a flood with a 0.5% (1 in 200) chance of happening each year

2. Extent of extreme flood - the extent of a flood with a 0.1% (1 in 1000) chance of happening each year - Flood Zone 2 on the enclosed map.

Phoenix House, Global Avenue, Leeds, LS11 8PG
Customer services line: 08708 506 506
Email: enquiries@environment-agency.gov.uk
www.environment-agency.gov.uk

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3. Flood defences built in the last five years to protect against river floods with a 1% (1 in 100) chance of happening each year, together with some, but not all, older defences and defences which protect against smaller floods.

4. Areas benefiting from flood defences - areas that benefit from the flood defences shown, in the event of a river flood with a 1% (1 in 100) chance of happening each year, or a flood from the sea with a 0.5% (1 in 200) chance of happening each year. If the defences were not there, these areas would flood.

Flood History
To the best of our knowledge there is no known flood history for this site. However, in close proximity to this location we do have some flood history available (see enclosed map).

June/July 2007 Floods
This flood history does not take into account the June 2007 flood event. We are currently processing this information. Extents and levels may be available for this area later this year.

Asset Drawings
Please find enclosed asset drawing(s) showing location of all (Agency and non Agency maintained) flood defences and channels.

Flood Modelling - River Don
The River Don Catchment Flood Model was completed by Jeremy Benn Associates in May 2004. See enclosed the ISIS Hydraulic Model Summary Sheets showing modelled water levels and flows for 5 different return periods.

This information is provided subject to the enclosed notice which you should read.

Yours sincerely,

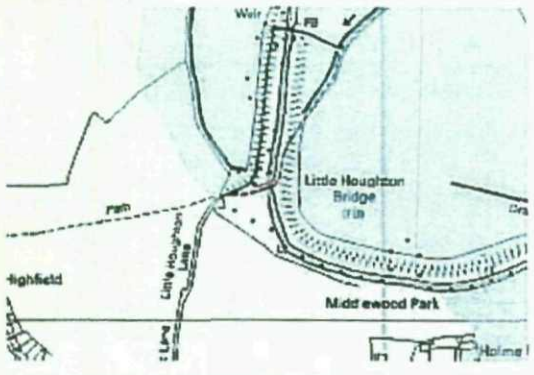
Lesley Slaney
External Relations Officer

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Environment Agency - North East Region
Re-working of the River Don Model
ISIS Hydraulic Model Summary Sheet

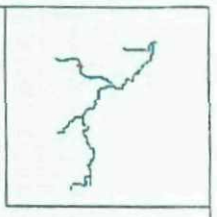
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Location Plan



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Cross Section References



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Chainage: 13441U

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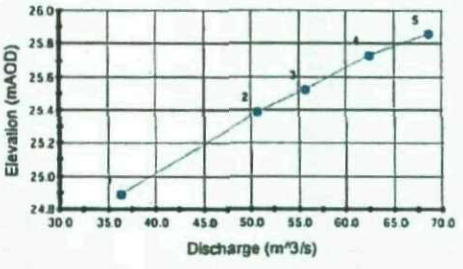
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Rating Curve



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Summary of Results

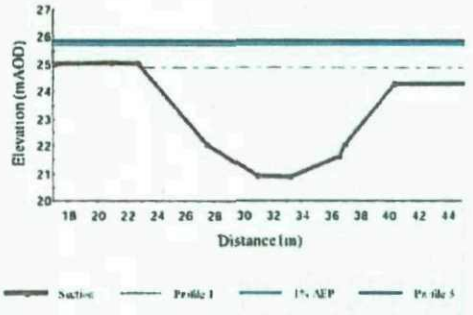
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2	2.00	50.7	25.392	0.86
3	1.33	55.7	25.526	0.86
4	1.00	62.4	25.731	0.86
5	0.67	68.5	25.861	0.86

Level of Left Bank 25.030 mAOD

Level of Right Bank 24.290 mAOD

AEP: Annual Exceedance Probability = 1/T, where T = Return Period (Years)

Cross Section Profile



DRN: 01: CROSS SECTION NUMBER 13441U

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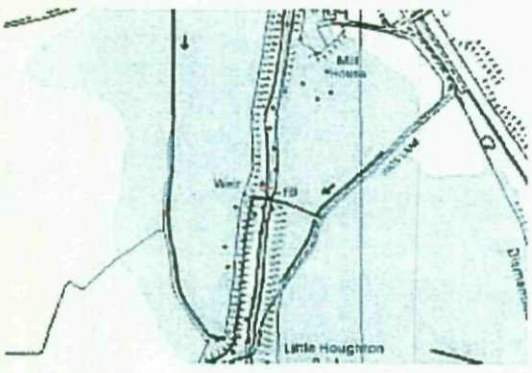
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Re-working of the River Don Model
ISIS Hydraulic Model Summary Sheet

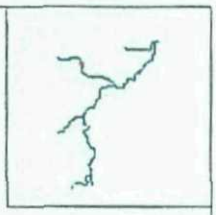
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Location Plan



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Cross Section References



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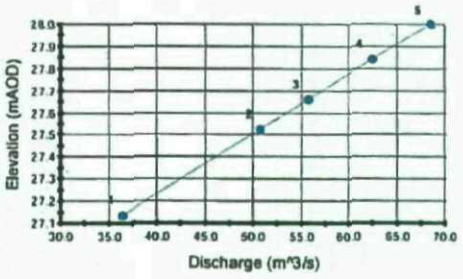
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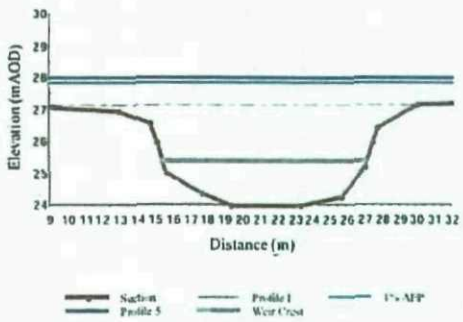
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2	2.00	50.7	27.528	1.07
3	1.33	55.7	27.663	1.09
4	1.00	62.4	27.844	1.10
5	0.67	68.5	28.000	1.11

Level of Left Bank 26.560 mAOD

Level of Right Bank 26.420 mAOD

AEP: Annual Exceedance Probability = 1/T, where T = Return Period (Years)

Weir Crest Profile
(Weir Type: Sharp Crested)



DRN: 01: CROSS SECTION NUMBER 13676U

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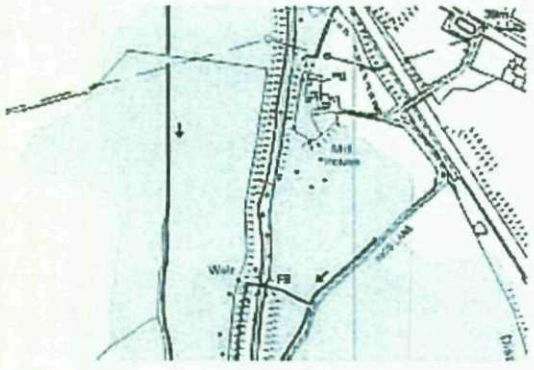
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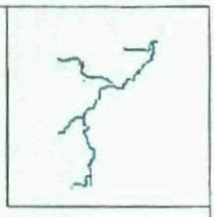
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Location Plan



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Cross Section References



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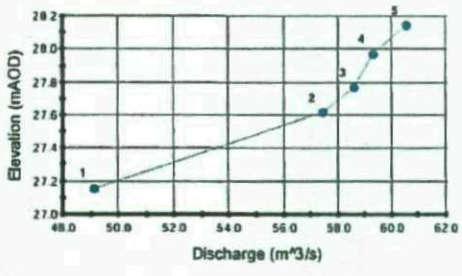
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Summary of Results

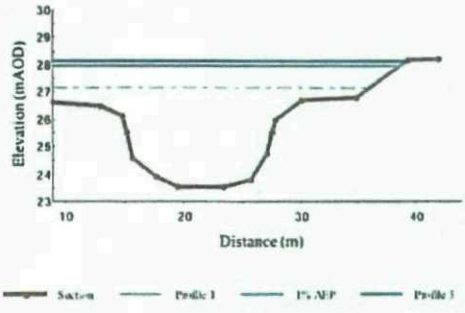
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2	2.00	57.5	27.621	1.14
3	1.33	58.6	27.770	1.15
4	1.00	59.3	27.972	1.17
5	0.67	60.5	28.145	1.18

Level of Left Bank 26.130 mAOD

Level of Right Bank 28.190 mAOD

AEP: Annual Exceedance Probability = 1/T, where T = Return Period (Years)

Cross Section Profile



DRN: 01: CROSS SECTION NUMBER 13805

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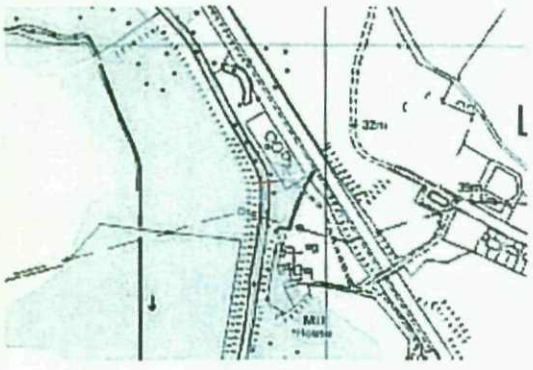
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Environment Agency - North East Region
Re-working of the River Don Model
ISIS Hydraulic Model Summary Sheet

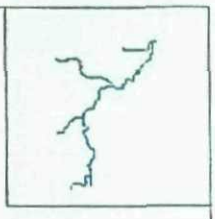
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Location Plan



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Cross Section References



River: DRN

Reach: 01

Chainage: 14055

Section Type: SECTION

OS NGR: SE 41911 05804

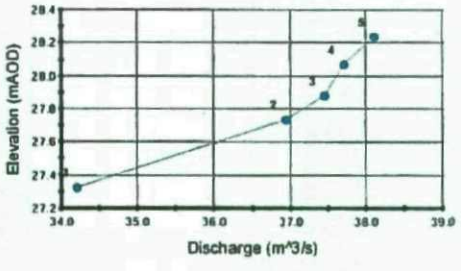
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Photograph Ref: DEAR_14055.JPG

Next
Section D/s: 13805
Section U/s: 14304



Rating Curve



Number represents model profile number

Summary of Results

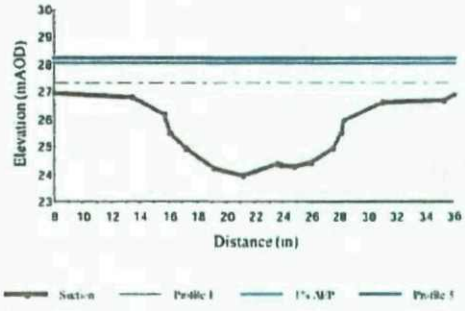
Profile No	AEP (%)	Flow (m^3/s)	Water Level (mAOD)	Velocity (m/s)
1	4.00	34.2	27.329	0.74
2	2.00	36.9	27.736	0.75
3	1.33	37.4	27.882	0.76
4	1.00	37.7	28.070	0.76
5	0.67	38.1	28.236	0.76

Level of Left Bank 26.810 mAOD

Level of Right Bank 26.630 mAOD

AEP: Annual Exceedance Probability = 1/T, where T = Return Period (Years)

Cross Section Profile



DRN: 01: CROSS SECTION NUMBER 14055

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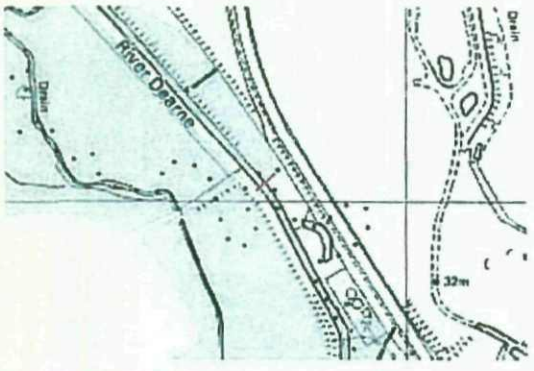
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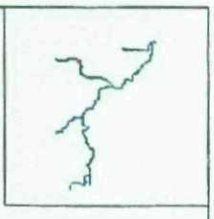
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Cross Section References



River: DRN

Reach: 01

Chainage: 14304

Section Type: SECTION

OS NGR: SE 41794 06026

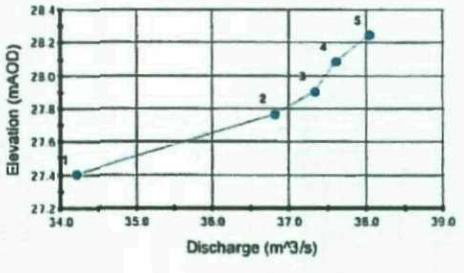
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Photograph Ref: DEAR_14304.JPG

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Section D/s: 14055
Section U/s: 14554



Rating Curve



Number represents model profile number

Summary of Results

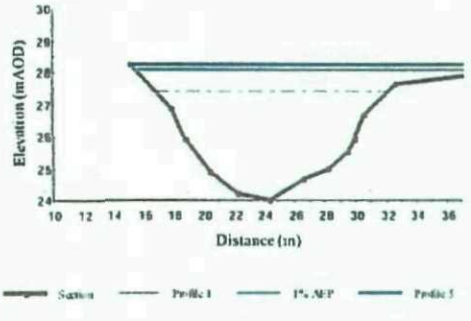
Profile No	AEP (%)	Flow (m^3/s)	Water Level (mAOD)	Velocity (m/s)
1	4.00	34.2	27.408	1.06
2	2.00	36.8	27.769	1.09
3	1.33	37.3	27.905	1.09
4	1.00	37.6	28.087	1.10
5	0.67	38.0	28.248	1.11

Level of Left Bank 28.240 mAOD

Level of Right Bank 27.630 mAOD

AEP: Annual Exceedance Probability = 1/T, where T = Return Period (Years)

Cross Section Profile



DRN: 01: CROSS SECTION NUMBER 14304

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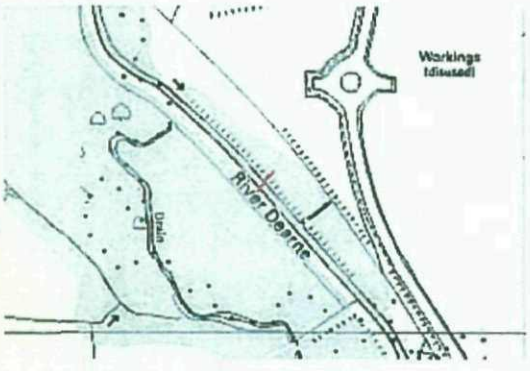
Print Date: 21/05/2004

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ISIS Hydraulic Model Summary Sheet

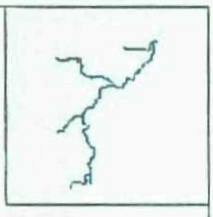
jba

Location Plan



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Cross Section References



River: DRN

Reach: 01

Chainage: 14554

Section Type: SECTION

OS NGR: SE 41627 06213

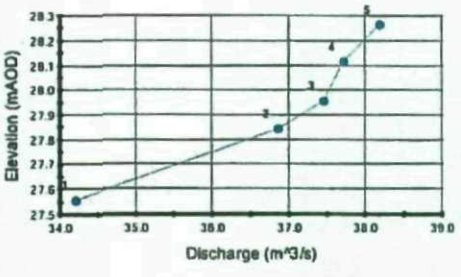
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Photograph Ref: DEAR_14554.JPG

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Section U/s: 14806



Rating Curve



Number represents model profile number

Summary of Results

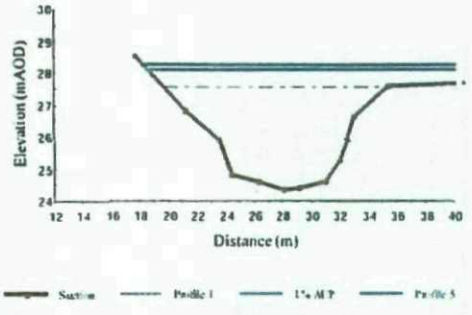
Profile No	AEP (%)	Flow (m^3/s)	Water Level (mAOD)	Velocity (m/s)
1	4.00	34.2	27.560	1.13
2	2.00	36.9	27.846	1.15
3	1.33	37.5	27.959	1.16
4	1.00	37.7	28.115	1.16
5	0.67	38.2	28.264	1.17

Level of Left Bank 28.530 mAOD

Level of Right Bank 27.600 mAOD

AEP: Annual Exceedance Probability = 1/T, where T = Return Period (Years)

Cross Section Profile



DRN: 01: CROSS SECTION NUMBER 14554

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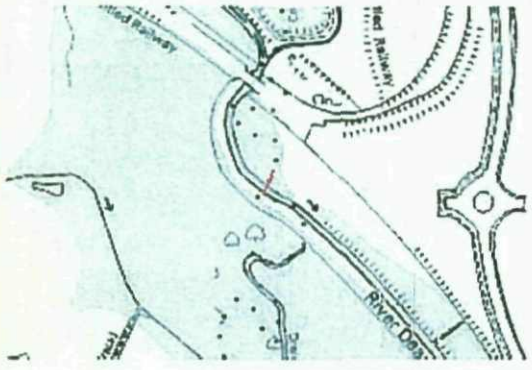
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ISIS Hydraulic Model Summary Sheet

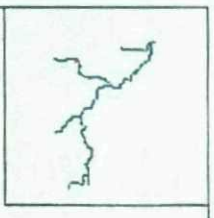
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Location Plan



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Cross Section References



River: DRN

Reach: 01

Chainage: 14806

Section Type: SECTION

OS NGR: SE 41440 06383

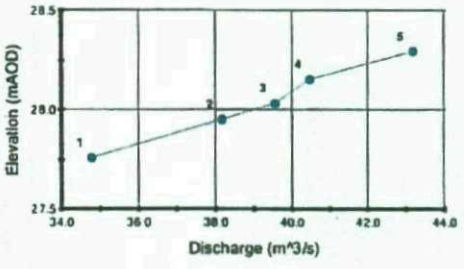
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Photograph Ref: DEAR_14806.JPG

Next
Section D/s: 14554
Section U/s: 14998D



Rating Curve



Number represents model profile number

Summary of Results

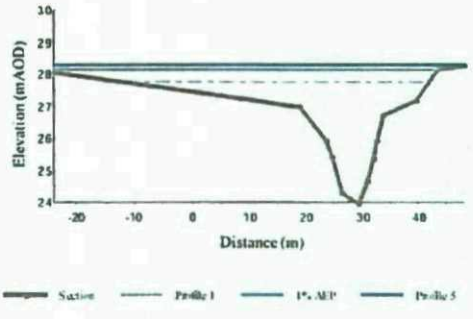
Profile No	AEP (%)	Flow (m^3/s)	Water Level (mAOD)	Velocity (m/s)
1	4.00	34.8	27.762	0.79
2	2.00	38.2	27.953	0.80
3	1.33	39.6	28.034	0.80
4	1.00	40.5	28.154	0.80
5	0.67	43.2	28.296	0.80

Level of Left Bank 28.060 mAOD

Level of Right Bank 27.850 mAOD

AEP: Annual Exceedance Probability = 1/T, where T = Return Period (Years)

Cross Section Profile



DRN: 01: CROSS SECTION NUMBER 14806

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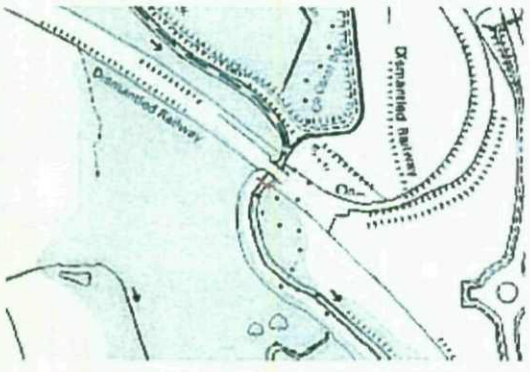
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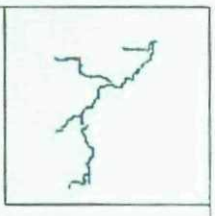
jba

Location Plan



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Cross Section References



River: DRN

Reach: 01

Chainage: 14998D

Section Type: SECTION

OS NGR: SE 41402 06509

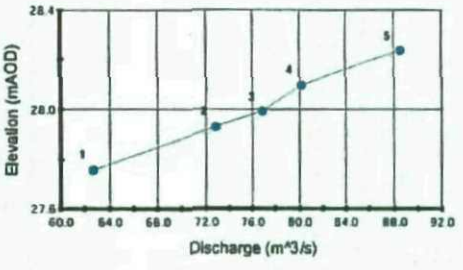
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Section D/s: 14806
Section U/s: 14998U



Rating Curve



Number represents model profile number

Summary of Results

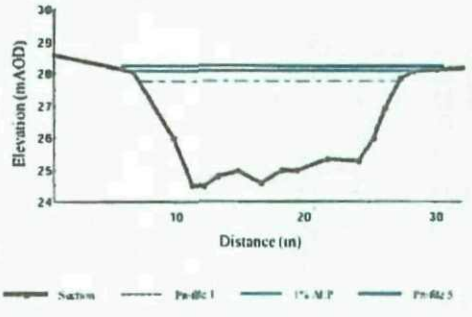
Profile No	AEP (%)	Flow (m^3/s)	Water Level (mAOD)	Velocity (m/s)
1	4.00	62.7	27.759	1.37
2	2.00	72.8	27.932	1.53
3	1.33	76.8	27.997	1.61
4	1.00	80.1	28.099	1.65
5	0.67	88.5	28.240	1.74

Level of Left Bank 28.060 mAOD

Level of Right Bank 27.850 mAOD

AEP: Annual Exceedance Probability = 1/T, where T = Return Period (Years)

Cross Section Profile



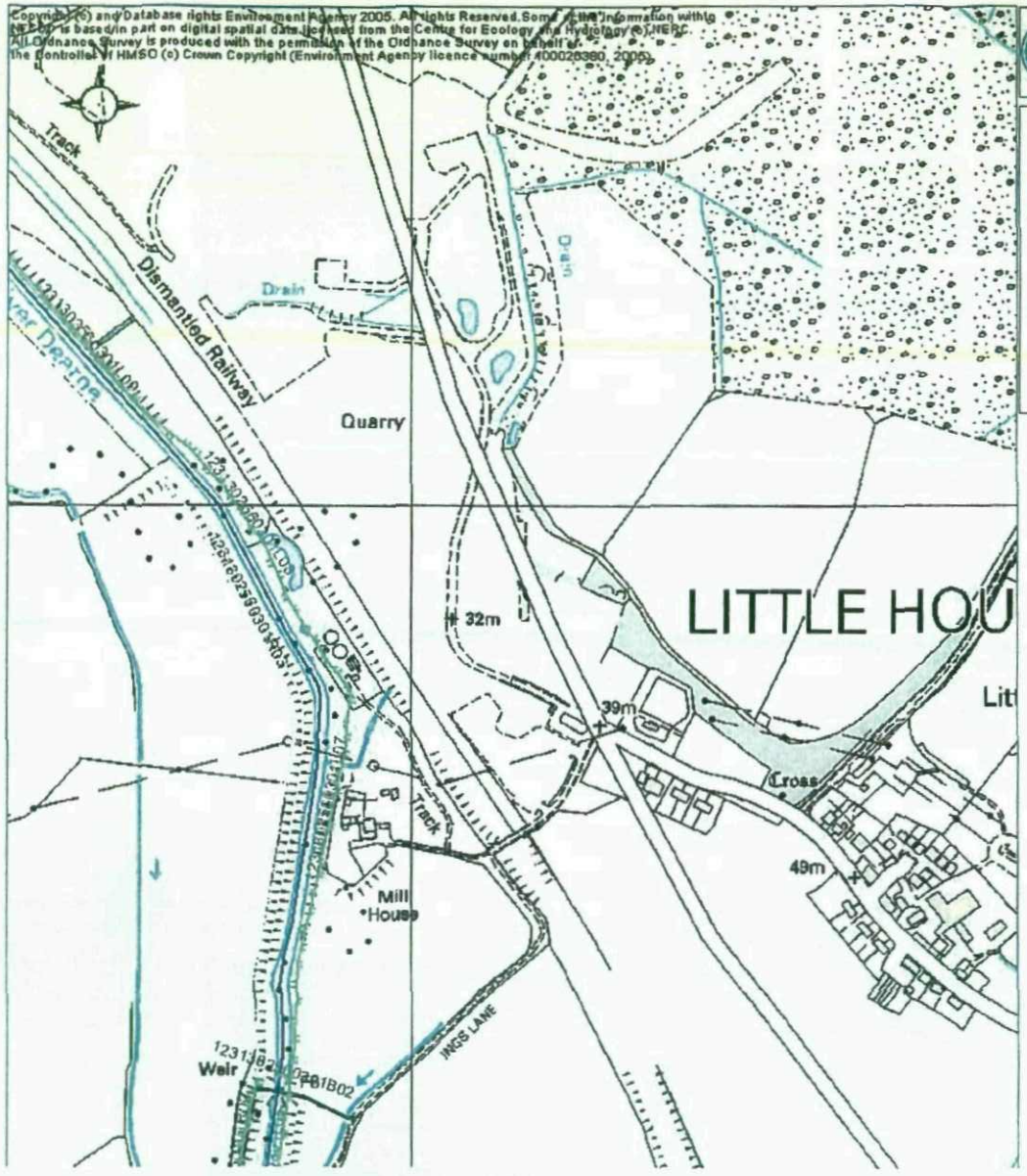
DRN: 01: CROSS SECTION NUMBER 14998D

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ENVIRONMENT AGENCY

- Defence
- Overall Condition: .. 0
- Overall Condition: .. 1
- Overall Condition: .. 2
- Overall Condition: .. 3
- Overall Condition: .. 4
- Overall Condition: .. 5
- Overall Condition: .. 9
- Watercourse

☑ print Compass
☑ print Logo
☑ print Legend

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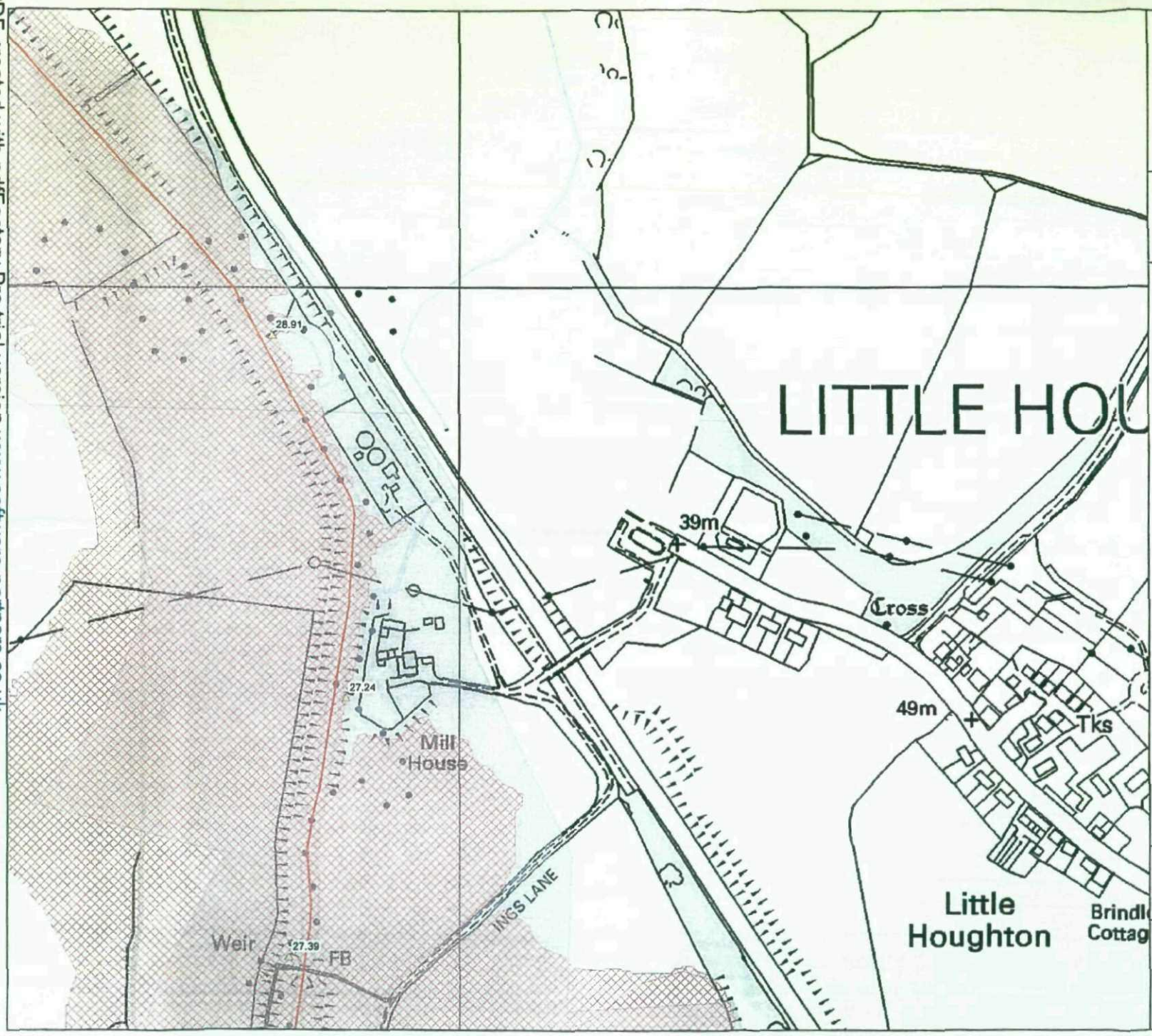
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Layer: **Defence**

Asset Ref.	Asset Type	Description	Location	Bank	Maintainer	Design Standard	Asset Prot. Type
1231302560301L05	raised defence (man-made)	GRASS EMBANKMENT	LITTLE HOUGHTON BRIDGE	left	Environment Agency	30	fluvial
1231302560301R03	raised defence (man-made)	GRASS EMBANKMENT	U/S OF WEIR	right	Environment Agency	30	fluvial
1231302560301L06	raised defence (man-made)	GRASS EMBANKMENT (ACTS AS SPILLWAY)	U/S OF WEIR	left	Environment Agency	30	fluvial
1231302560301L07	raised defence (man-made)	GRASS EMBANKMENT	U/S OF WEIR	left	Environment Agency	30	fluvial
1231302560301L08	maintained channel	NATURAL GROUND	LITTLE HOUGHTON	left	private	30	fluvial
1231302560301L09	raised defence (man-made)	GRASS EMBANKMENT	U/S OF WEIR	left	Environment Agency	30	fluvial

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Environment Agency

www.environment-agency.gov.uk

General Enquiries: 08708 506 506
General Enquiries (Minicom): 08702 422 549

Flood Extent and Flood Levels - Information

The extent of flooding is only shown for those watercourses surveyed after the flood event. Other flooding may have occured which is not shown. This is the best information currently available.

Flooding History: Flood Levels & Flood Extents

Legend

- Main River
- Autumn 2000 Flood Event Flood Level (m)
- River Don 1947 Flood Event Flood Extent
- Autumn 2000 Flood Event Flood Extent

14/03/2008

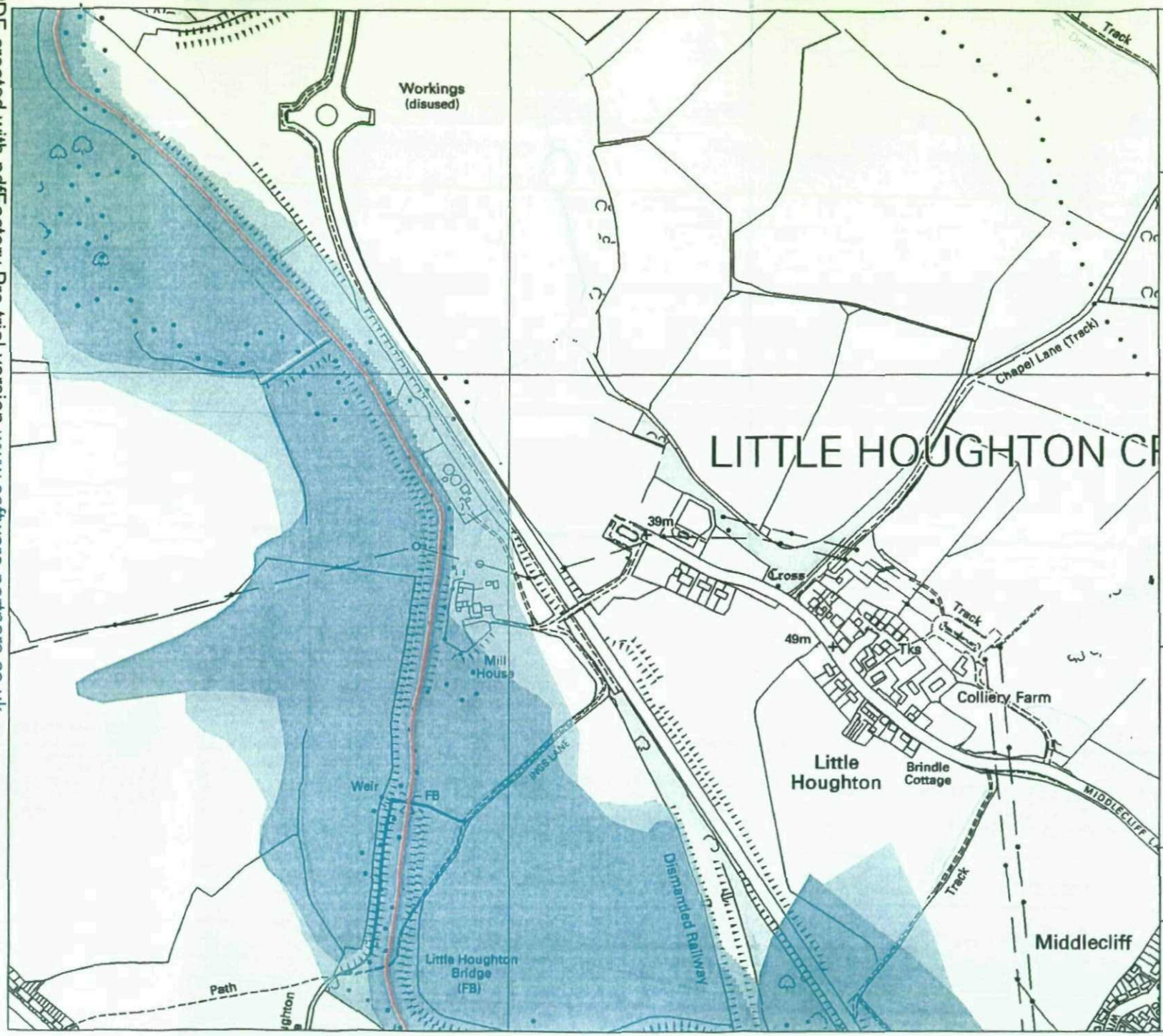
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FLOOD ZONE DATA FOR ENGLAND

Information - User Note

The Flood Zones have been produced in accordance with the requirements of government planning Policy on Development and Flood Risk (Planning Policy Guidance PPG25 in England dated July 2001 and the Draft Technical Advice Note TAN15 in Wales dated July 03). The Flood Zones are for planning consultations.

The Flood Zones are based on information available at that 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, maybe at risk of flooding. When in doubt the Environment Agency should be consulted.

These maps may also be used by Local Authority Emergency Planners when producing Major Incident Flood Response Plans. The extents of any Flood Warning Service provided by the Environment Agency is contained within 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 or (0.1%) chance of flooding each year from rivers and the sea without the presence of defences.

Flood Zone Data For England

main river
flood zone 2
flood zone 3

14/03/2008

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Appendix D

Existing Runoff Calculations

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.300
Area (Ha)	4.460	Urban	0.000
SAAR (mm)	618.000	Region Number	3

Results l/s

QBAR Rural	7.0
QBAR Urban	7.0
Q 100 years	14.6
Q 1 year	6.0
Q 30 years	12.3
Q 100 years	14.6

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Appendix E

Wallingford Procedure Calculations

Integrated Engineering and Environmental Consultants

BWB CONSULTING

Job No. UKC040	Calc. No./Sketch No.	Rev. A
Project: Little Houghton, South Yorkshire	Date prepared 28.11.2008	Prepared by DA
Title: Proposed Development Runoff Rates		Authorised by TG

Wallingford Procedure $Q = 2.78 * A_{imp} * i$

Where: A_{imp} = Impermeable Area (ha)
i = Rainfall Intensity

1 Year Runoff Rate

Q	=	2.78 * 2.79 * 28.84	
	=	223.69 l/s	Impermeable runoff
	+	2.3 l/s	Permeable runoff
	=	**225.99 l/s**	**Total runoff**

30 Year Runoff Rate

Q	=	2.78 * 2.79 * 70.65	
	=	547.98 l/s	Impermeable runoff
	+	4.7 l/s	Permeable runoff
	=	**552.68 l/s**	**Total runoff**

100 Year Runoff Rate

Q	=	2.78 * 2.79 * 91.45	
	=	709.3 l/s	Impermeable runoff
	+	5.5 l/s	Permeable runoff
	=	**714.8 l/s**	**Total runoff**

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Appendix F

Attenuation Volume Calculations

3-4 Kayes Walk
Lace Market
Nottingham NG1 1PY

Date 28 November 2008 14:17 | Designed By daniel.allum
File UKC040 1YR TO QBAR.SRC | Checked By
Elstree Computing Ltd | Source Control W.11.2 net

Micro Drainage

Summary of Results for 1 year Return Period

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m^3)	Maximum Volume (m^3)	Status
15 Summer	4.3	0.0	4.3	100.3452	0.3452	0.0	148.0	O K
30 Summer	4.8	0.0	4.8	100.4482	0.4482	0.0	192.0	O K
60 Summer	5.3	0.0	5.3	100.5618	0.5617	0.0	240.6	O K
120 Summer	5.8	0.0	5.8	100.6788	0.6788	0.0	290.9	O K
180 Summer	6.1	0.0	6.1	100.7453	0.7453	0.0	319.3	O K
240 Summer	6.3	0.0	6.3	100.7878	0.7878	0.0	337.5	O K
360 Summer	6.5	0.0	6.5	100.8338	0.8338	0.0	357.2	FLOOD RISK
480 Summer	6.5	0.0	6.5	100.8533	0.8533	0.0	365.6	FLOOD RISK
600 Summer	6.6	0.0	6.6	100.8668	0.8668	0.0	371.4	FLOOD RISK
720 Summer	6.6	0.0	6.6	100.8763	0.8763	0.0	375.4	FLOOD RISK
960 Summer	6.6	0.0	6.6	100.8853	0.8853	0.0	379.4	FLOOD RISK
1440 Summer	6.6	0.0	6.6	100.8818	0.8818	0.0	377.7	FLOOD RISK
2160 Summer	6.5	0.0	6.5	100.8518	0.8518	0.0	365.0	FLOOD RISK
2880 Summer	6.4	0.0	6.4	100.8103	0.8103	0.0	347.3	FLOOD RISK
4320 Summer	6.0	0.0	6.0	100.7283	0.7283	0.0	312.1	O K
5760 Summer	5.7	0.0	5.7	100.6553	0.6553	0.0	280.7	O K
7200 Summer	5.5	0.0	5.5	100.5913	0.5913	0.0	253.4	O K
8640 Summer	5.2	0.0	5.2	100.5368	0.5367	0.0	230.0	O K
10080 Summer	5.0	0.0	5.0	100.4892	0.4892	0.0	209.7	O K
15 Winter	4.5	0.0	4.5	100.3872	0.3872	0.0	165.9	O K
30 Winter	5.1	0.0	5.1	100.5032	0.5032	0.0	215.5	O K
60 Winter	5.6	0.0	5.6	100.6312	0.6313	0.0	270.5	O K
120 Winter	6.2	0.0	6.2	100.7648	0.7648	0.0	327.8	O K
180 Winter	6.5	0.0	6.5	100.8418	0.8418	0.0	360.6	FLOOD RISK
240 Winter	6.7	0.0	6.7	100.8923	0.8923	0.0	382.4	FLOOD RISK
360 Winter	6.9	0.0	6.9	100.9503	0.9503	0.0	407.2	FLOOD RISK
480 Winter	7.0	0.0	7.0	100.9748	0.9748	0.0	417.7	FLOOD RISK
600 Winter	7.0	0.0	7.0	100.9848	0.9848	0.0	421.9	FLOOD RISK

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	28.81	19
30 Summer	18.90	33
60 Summer	12.08	64
120 Summer	7.58	122
180 Summer	5.74	182
240 Summer	4.71	242
360 Summer	3.55	360
480 Summer	2.89	418
600 Summer	2.47	480
720 Summer	2.17	542
960 Summer	1.76	676
1440 Summer	1.32	954
2160 Summer	0.99	1364
2880 Summer	0.81	1784
4320 Summer	0.60	2556
5760 Summer	0.49	3344
7200 Summer	0.42	4104
8640 Summer	0.37	4840
10080 Summer	0.33	5552
15 Winter	28.81	19
30 Winter	18.90	33
60 Winter	12.08	62
120 Winter	7.58	120
180 Winter	5.74	178
240 Winter	4.71	236
360 Winter	3.55	348
480 Winter	2.89	454
600 Winter	2.47	546

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Summary of Results for 1 year Return Period

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m^3)	Maximum Volume (m^3)	Status
720 Winter	7.0	0.0	7.0	100.9928	0.9928	0.0	425.5	FLOOD RISK
960 Winter	7.1	0.0	7.1	100.9988	0.9988	0.0	428.1	FLOOD RISK
1440 Winter	7.0	0.0	7.0	100.9808	0.9808	0.0	420.2	FLOOD RISK
2160 Winter	6.8	0.0	6.8	100.9238	0.9238	0.0	395.8	FLOOD RISK
2880 Winter	6.5	0.0	6.5	100.8563	0.8563	0.0	366.8	FLOOD RISK
4320 Winter	6.0	0.0	6.0	100.7293	0.7293	0.0	312.6	O K
5760 Winter	5.6	0.0	5.6	100.6228	0.6228	0.0	266.9	O K
7200 Winter	5.2	0.0	5.2	100.5352	0.5352	0.0	229.4	O K
8640 Winter	4.9	0.0	4.9	100.4637	0.4637	0.0	198.7	O K
10080 Winter	4.6	0.0	4.6	100.4042	0.4042	0.0	173.1	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
720 Winter	2.17	570
960 Winter	1.76	724
1440 Winter	1.32	1036
2160 Winter	0.99	1472
2880 Winter	0.81	1904
4320 Winter	0.60	2724
5760 Winter	0.49	3512
7200 Winter	0.42	4256
8640 Winter	0.37	5016
10080 Winter	0.33	5744

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Summary of Results for 30 year Return Period

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m³)	Maximum Volume (m³)	Status
15 Summer	4.1	0.0	4.1	100.3172	0.3172	0.0	366.6	O K
30 Summer	4.6	0.0	4.6	100.4157	0.4157	0.0	480.3	O K
60 Summer	5.1	0.0	5.1	100.5192	0.5192	0.0	600.2	O K
120 Summer	5.6	0.0	5.6	100.6258	0.6258	0.0	723.4	O K
180 Summer	5.9	0.0	5.9	100.6868	0.6868	0.0	794.1	O K
240 Summer	6.0	0.0	6.0	100.7283	0.7283	0.0	841.5	O K
360 Summer	6.3	0.0	6.3	100.7813	0.7813	0.0	902.9	O K
480 Summer	6.4	0.0	6.4	100.8153	0.8153	0.0	942.3	FLOOD RISK
600 Summer	6.5	0.0	6.5	100.8378	0.8378	0.0	968.2	FLOOD RISK
720 Summer	6.5	0.0	6.5	100.8523	0.8523	0.0	985.2	FLOOD RISK
960 Summer	6.6	0.0	6.6	100.8668	0.8668	0.0	1002.1	FLOOD RISK
1440 Summer	6.6	0.0	6.6	100.8728	0.8728	0.0	1008.7	FLOOD RISK
2160 Summer	6.6	0.0	6.6	100.8693	0.8693	0.0	1004.5	FLOOD RISK
2880 Summer	6.5	0.0	6.5	100.8568	0.8568	0.0	990.3	FLOOD RISK
4320 Summer	6.4	0.0	6.4	100.8188	0.8188	0.0	946.4	FLOOD RISK
5760 Summer	6.2	0.0	6.2	100.7753	0.7753	0.0	896.3	O K
7200 Summer	6.0	0.0	6.0	100.7318	0.7318	0.0	846.0	O K
8640 Summer	5.9	0.0	5.9	100.6908	0.6908	0.0	798.2	O K
10080 Summer	5.7	0.0	5.7	100.6523	0.6523	0.0	753.7	O K
15 Winter	4.3	0.0	4.3	100.3552	0.3552	0.0	410.8	O K
30 Winter	4.9	0.0	4.9	100.4657	0.4657	0.0	538.2	O K
60 Winter	5.4	0.0	5.4	100.5823	0.5822	0.0	672.8	O K
120 Winter	5.9	0.0	5.9	100.7023	0.7023	0.0	811.9	O K
180 Winter	6.2	0.0	6.2	100.7718	0.7718	0.0	892.1	O K
240 Winter	6.4	0.0	6.4	100.8188	0.8188	0.0	946.2	FLOOD RISK
360 Winter	6.6	0.0	6.6	100.8798	0.8798	0.0	1017.0	FLOOD RISK
480 Winter	6.8	0.0	6.8	100.9203	0.9203	0.0	1063.5	FLOOD RISK
600 Winter	6.9	0.0	6.9	100.9473	0.9473	0.0	1095.1	FLOOD RISK

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	70.59	19
30 Summer	46.43	34
60 Summer	29.24	64
120 Summer	17.88	124
180 Summer	13.27	184
240 Summer	10.70	242
360 Summer	7.86	362
480 Summer	6.31	482
600 Summer	5.32	602
720 Summer	4.63	720
960 Summer	3.71	960
1440 Summer	2.72	1210
2160 Summer	1.98	1580
2880 Summer	1.59	1988
4320 Summer	1.16	2808
5760 Summer	0.92	3632
7200 Summer	0.78	4464
8640 Summer	0.67	5272
10080 Summer	0.60	6048
15 Winter	70.59	19
30 Winter	46.43	34
60 Winter	29.24	64
120 Winter	17.88	122
180 Winter	13.27	180
240 Winter	10.70	240
360 Winter	7.86	356
480 Winter	6.31	472
600 Winter	5.32	588

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Summary of Results for 30 year Return Period

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m^3)	Maximum Volume (m^3)	Status
720 Winter	6.9	0.0	6.9	100.9663	0.9663	0.0	1116.9	FLOOD RISK
960 Winter	7.0	0.0	7.0	100.9878	0.9878	0.0	1141.7	FLOOD RISK
1440 Winter	7.1	0.0	7.1	100.9953	0.9953	0.0	1150.2	FLOOD RISK
2160 Winter	7.0	0.0	7.0	100.9838	0.9838	0.0	1137.2	FLOOD RISK
2880 Winter	6.9	0.0	6.9	100.9633	0.9633	0.0	1113.5	FLOOD RISK
4320 Winter	6.7	0.0	6.7	100.9038	0.9038	0.0	1044.6	FLOOD RISK
5760 Winter	6.5	0.0	6.5	100.8378	0.8378	0.0	968.3	FLOOD RISK
7200 Winter	6.2	0.0	6.2	100.7738	0.7738	0.0	894.4	O K
8640 Winter	6.0	0.0	6.0	100.7143	0.7143	0.0	825.3	O K
10080 Winter	5.7	0.0	5.7	100.6588	0.6588	0.0	761.7	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
720 Winter	4.63	700
960 Winter	3.71	924
1440 Winter	2.72	1342
2160 Winter	1.98	1668
2880 Winter	1.59	2132
4320 Winter	1.16	3028
5760 Winter	0.92	3920
7200 Winter	0.78	4760
8640 Winter	0.67	5616
10080 Winter	0.60	6448

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Summary of Results for 100 year Return Period

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m³)	Maximum Volume (m³)	Status
15 Summer	4.0	0.0	4.0	100.3027	0.3027	0.0	475.4	O K
30 Summer	4.6	0.0	4.6	100.4007	0.4007	0.0	629.2	O K
60 Summer	5.1	0.0	5.1	100.5047	0.5047	0.0	792.3	O K
120 Summer	5.6	0.0	5.6	100.6113	0.6113	0.0	959.4	O K
180 Summer	5.8	0.0	5.8	100.6718	0.6718	0.0	1054.3	O K
240 Summer	6.0	0.0	6.0	100.7118	0.7118	0.0	1117.0	O K
360 Summer	6.2	0.0	6.2	100.7633	0.7633	0.0	1198.5	O K
480 Summer	6.3	0.0	6.3	100.7988	0.7988	0.0	1253.7	O K
600 Summer	6.4	0.0	6.4	100.8228	0.8228	0.0	1292.0	FLOOD RISK
720 Summer	6.5	0.0	6.5	100.8403	0.8403	0.0	1319.1	FLOOD RISK
960 Summer	6.6	0.0	6.6	100.8613	0.8613	0.0	1351.8	FLOOD RISK
1440 Summer	6.6	0.0	6.6	100.8718	0.8718	0.0	1368.2	FLOOD RISK
2160 Summer	6.6	0.0	6.6	100.8668	0.8668	0.0	1360.9	FLOOD RISK
2880 Summer	6.5	0.0	6.5	100.8573	0.8573	0.0	1345.5	FLOOD RISK
4320 Summer	6.4	0.0	6.4	100.8278	0.8278	0.0	1299.7	FLOOD RISK
5760 Summer	6.3	0.0	6.3	100.7928	0.7928	0.0	1244.1	O K
7200 Summer	6.1	0.0	6.1	100.7558	0.7558	0.0	1186.5	O K
8640 Summer	6.0	0.0	6.0	100.7198	0.7198	0.0	1129.9	O K
10080 Summer	5.9	0.0	5.9	100.6853	0.6853	0.0	1075.7	O K
15 Winter	4.2	0.0	4.2	100.3392	0.3392	0.0	532.6	O K
30 Winter	4.8	0.0	4.8	100.4492	0.4492	0.0	705.0	O K
60 Winter	5.4	0.0	5.4	100.5658	0.5657	0.0	888.0	O K
120 Winter	5.9	0.0	5.9	100.6858	0.6858	0.0	1076.2	O K
180 Winter	6.1	0.0	6.1	100.7538	0.7538	0.0	1183.3	O K
240 Winter	6.3	0.0	6.3	100.7993	0.7993	0.0	1254.7	O K
360 Winter	6.5	0.0	6.5	100.8588	0.8588	0.0	1347.9	FLOOD RISK
480 Winter	6.7	0.0	6.7	100.8993	0.8993	0.0	1411.8	FLOOD RISK
600 Winter	6.8	0.0	6.8	100.9283	0.9283	0.0	1457.0	FLOOD RISK

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	91.37	19
30 Summer	60.65	34
60 Summer	38.41	64
120 Summer	23.52	124
180 Summer	17.41	184
240 Summer	13.98	244
360 Summer	10.20	362
480 Summer	8.16	482
600 Summer	6.86	602
720 Summer	5.95	722
960 Summer	4.75	962
1440 Summer	3.45	1426
2160 Summer	2.50	1732
2880 Summer	1.99	2104
4320 Summer	1.44	2936
5760 Summer	1.14	3744
7200 Summer	0.95	4544
8640 Summer	0.82	5368
10080 Summer	0.72	6160
15 Winter	91.37	19
30 Winter	60.65	34
60 Winter	38.41	64
120 Winter	23.52	122
180 Winter	17.41	182
240 Winter	13.98	240
360 Winter	10.20	358
480 Winter	8.16	474
600 Winter	6.86	590

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Summary of Results for 100 year Return Period

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m^3)	Maximum Volume (m^3)	Status
720 Winter	6.9	0.0	6.9	100.9493	0.9493	0.0	1489.9	FLOOD RISK
960 Winter	7.0	0.0	7.0	100.9758	0.9758	0.0	1531.8	FLOOD RISK
1440 Winter	7.1	0.0	7.1	100.9953	0.9953	0.0	1562.2	FLOOD RISK
2160 Winter	7.0	0.0	7.0	100.9853	0.9853	0.0	1546.6	FLOOD RISK
2880 Winter	7.0	0.0	7.0	100.9703	0.9703	0.0	1523.4	FLOOD RISK
4320 Winter	6.8	0.0	6.8	100.9273	0.9273	0.0	1455.5	FLOOD RISK
5760 Winter	6.6	0.0	6.6	100.8748	0.8748	0.0	1372.9	FLOOD RISK
7200 Winter	6.4	0.0	6.4	100.8208	0.8208	0.0	1288.1	FLOOD RISK
8640 Winter	6.2	0.0	6.2	100.7688	0.7688	0.0	1206.6	O K
10080 Winter	6.0	0.0	6.0	100.7193	0.7193	0.0	1129.3	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
720 Winter	5.95	708
960 Winter	4.75	934
1440 Winter	3.45	1382
2160 Winter	2.50	1972
2880 Winter	1.99	2224
4320 Winter	1.44	3156
5760 Winter	1.14	4040
7200 Winter	0.95	4904
8640 Winter	0.82	5792
10080 Winter	0.72	6656

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

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m^3)	Maximum Volume (m^3)	Status
15 Summer	4.0	0.0	4.0	100.2897	0.2897	0.0	571.1	O K
30 Summer	4.5	0.0	4.5	100.3837	0.3837	0.0	756.3	O K
60 Summer	5.0	0.0	5.0	100.4842	0.4842	0.0	953.4	O K
120 Summer	5.4	0.0	5.4	100.5872	0.5873	0.0	1156.8	O K
180 Summer	5.7	0.0	5.7	100.6468	0.6468	0.0	1273.7	O K
240 Summer	5.9	0.0	5.9	100.6863	0.6863	0.0	1352.1	O K
360 Summer	6.1	0.0	6.1	100.7393	0.7393	0.0	1456.2	O K
480 Summer	6.2	0.0	6.2	100.7763	0.7763	0.0	1529.0	O K
600 Summer	6.3	0.0	6.3	100.8028	0.8028	0.0	1581.5	FLOOD RISK
720 Summer	6.4	0.0	6.4	100.8228	0.8228	0.0	1620.6	FLOOD RISK
960 Summer	6.5	0.0	6.5	100.8493	0.8493	0.0	1672.8	FLOOD RISK
1440 Summer	6.6	0.0	6.6	100.8718	0.8718	0.0	1717.4	FLOOD RISK
2160 Summer	6.6	0.0	6.6	100.8723	0.8723	0.0	1718.1	FLOOD RISK
2880 Summer	6.6	0.0	6.6	100.8668	0.8668	0.0	1707.3	FLOOD RISK
4320 Summer	6.5	0.0	6.5	100.8473	0.8473	0.0	1669.0	FLOOD RISK
5760 Summer	6.4	0.0	6.4	100.8213	0.8213	0.0	1617.5	FLOOD RISK
7200 Summer	6.3	0.0	6.3	100.7923	0.7923	0.0	1560.4	O K
8640 Summer	6.2	0.0	6.2	100.7628	0.7628	0.0	1502.1	O K
10080 Summer	6.1	0.0	6.1	100.7333	0.7333	0.0	1444.4	O K
15 Winter	4.2	0.0	4.2	100.3247	0.3247	0.0	639.7	O K
30 Winter	4.7	0.0	4.7	100.4302	0.4302	0.0	847.3	O K
60 Winter	5.2	0.0	5.2	100.5422	0.5422	0.0	1068.3	O K
120 Winter	5.7	0.0	5.7	100.6588	0.6588	0.0	1297.2	O K
180 Winter	6.0	0.0	6.0	100.7258	0.7258	0.0	1429.0	O K
240 Winter	6.2	0.0	6.2	100.7708	0.7708	0.0	1517.8	O K
360 Winter	6.4	0.0	6.4	100.8308	0.8308	0.0	1636.3	FLOOD RISK
480 Winter	6.6	0.0	6.6	100.8733	0.8733	0.0	1719.8	FLOOD RISK
600 Winter	6.7	0.0	6.7	100.9043	0.9043	0.0	1780.8	FLOOD RISK

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
15 Summer	109.64	19
30 Summer	72.79	34
60 Summer	46.10	64
120 Summer	28.22	124
180 Summer	20.89	184
240 Summer	16.78	244
360 Summer	12.24	362
480 Summer	9.80	482
600 Summer	8.23	602
720 Summer	7.14	722
960 Summer	5.70	962
1440 Summer	4.14	1440
2160 Summer	3.00	1920
2880 Summer	2.39	2276
4320 Summer	1.72	3028
5760 Summer	1.37	3864
7200 Summer	1.14	4688
8640 Summer	0.99	5528
10080 Summer	0.87	6352
15 Winter	109.64	19
30 Winter	72.79	34
60 Winter	46.10	64
120 Winter	28.22	122
180 Winter	20.89	182
240 Winter	16.78	240
360 Winter	12.24	358
480 Winter	9.80	476
600 Winter	8.23	594

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

Storm Duration (mins)	Maximum Control (l/s)	Maximum Overflow (l/s)	Maximum Outflow (l/s)	Maximum Water Level (m OD)	Maximum Depth (m)	Overflow Volume (m^3)	Maximum Volume (m^3)	Status
720 Winter	6.8	0.0	6.8	100.9278	0.9278	0.0	1826.9	FLOOD RISK
960 Winter	6.9	0.0	6.9	100.9598	0.9598	0.0	1890.4	FLOOD RISK
1440 Winter	7.0	0.0	7.0	100.9908	0.9908	0.0	1951.5	FLOOD RISK
2160 Winter	7.1	0.0	7.1	100.9973	0.9973	0.0	1964.0	FLOOD RISK
2880 Winter	7.0	0.0	7.0	100.9833	0.9833	0.0	1936.8	FLOOD RISK
4320 Winter	6.9	0.0	6.9	100.9558	0.9558	0.0	1882.8	FLOOD RISK
5760 Winter	6.8	0.0	6.8	100.9173	0.9173	0.0	1806.6	FLOOD RISK
7200 Winter	6.6	0.0	6.6	100.8743	0.8743	0.0	1722.2	FLOOD RISK
8640 Winter	6.4	0.0	6.4	100.8308	0.8308	0.0	1636.6	FLOOD RISK
10080 Winter	6.3	0.0	6.3	100.7883	0.7883	0.0	1552.8	O K

Storm Duration (mins)	Rain (mm/hr)	Time-Peak (mins)
720 Winter	7.14	708
960 Winter	5.70	942
1440 Winter	4.14	1398
2160 Winter	3.00	2052
2880 Winter	2.39	2388
4320 Winter	1.72	3244
5760 Winter	1.37	4160
7200 Winter	1.14	5048
8640 Winter	0.99	5960
10080 Winter	0.87	6848

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