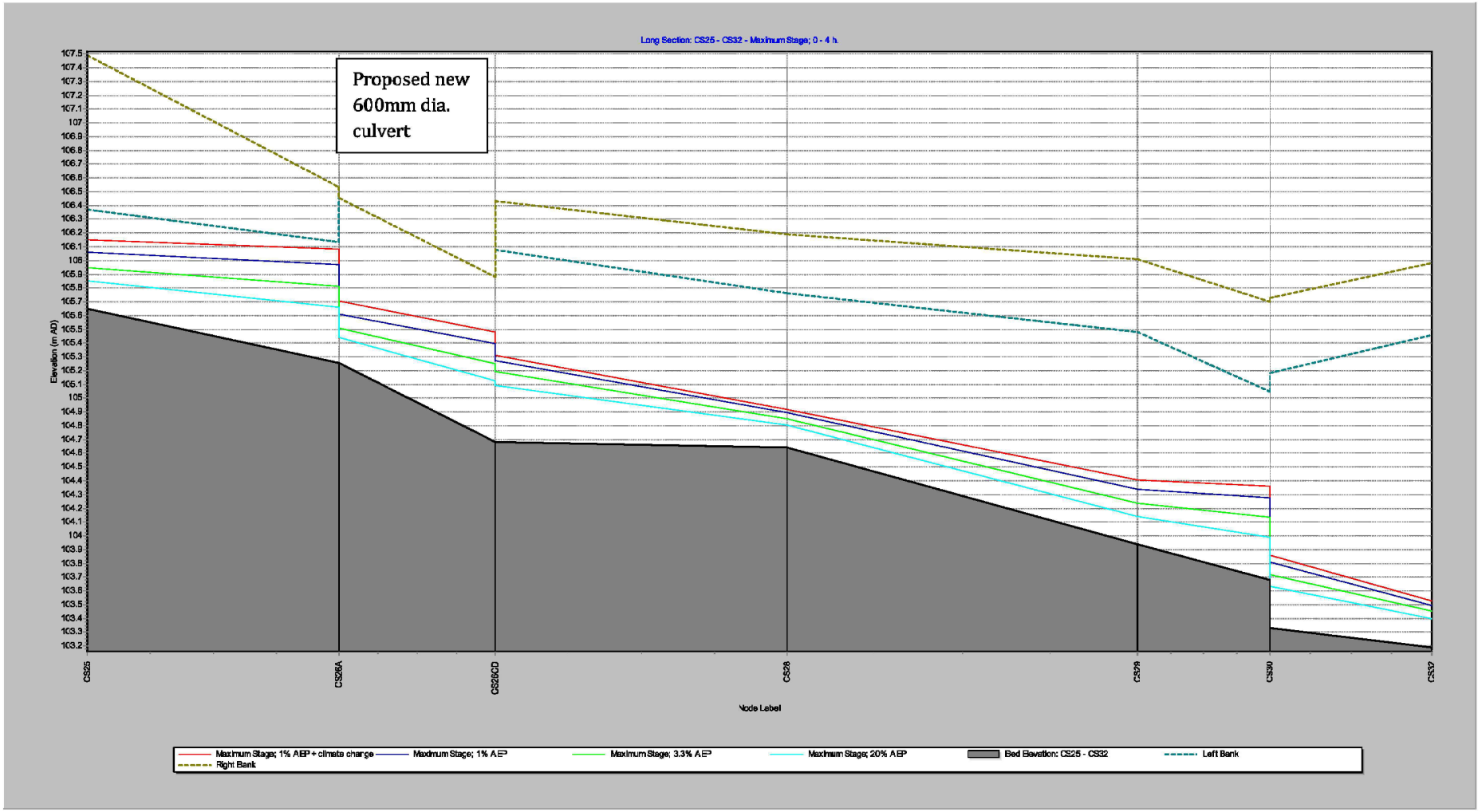

Figure F.32 Long section CS25 to CS32

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APPENDIX G: FLOOD MODELLER OUTPUTS: SENSITIVITY TESTING

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Cross section	1% AEP level (mAOD)	Manning's roughness n+20% (mAOD)	Difference (m)	Manning's roughness n-20% (mAOD)	Difference (m)	1% AEP Flow + 20% level (mAOD)	Difference (m)
CS01	116.064	116.095	0.031	116.033	-0.031	116.095	0.031
CS02	114.892	114.920	0.028	114.858	-0.034	114.920	0.028
CS03	113.506	113.530	0.024	113.471	-0.035	113.528	0.022
CS04	112.883	112.884	0.001	112.883	0.000	112.917	0.034
CS05	111.444	111.478	0.034	111.421	-0.023	111.474	0.030
CS06	109.972	109.996	0.024	109.942	-0.030	110.001	0.029
CS07	109.077	109.080	0.003	109.069	-0.008	109.400	0.323
CS08	107.949	107.980	0.031	107.919	-0.030	107.973	0.024
CS09	107.590	107.591	0.001	107.589	-0.001	107.621	0.031
CS10	106.966	106.989	0.023	106.935	-0.031	106.985	0.019
CS11	106.487	106.487	0.000	106.485	-0.002	106.509	0.022
CS14	106.154	106.158	0.004	106.152	-0.002	106.229	0.075
CS15	106.152	106.155	0.003	106.150	-0.002	106.228	0.076
CS16	105.222	105.249	0.027	105.195	-0.027	105.249	0.027
CS17	103.936	103.947	0.011	103.925	-0.011	103.947	0.011
CS18	103.496	103.524	0.028	103.467	-0.029	103.523	0.027
CS19	103.496	103.524	0.028	103.467	-0.029	103.523	0.027
CS20	102.933	102.974	0.041	102.893	-0.040	103.143	0.210
CS21	102.837	102.877	0.040	102.833	-0.004	103.137	0.300
CS22	102.827	102.866	0.039	102.829	0.002	103.136	0.309
CS23	101.440	101.468	0.028	101.405	-0.035	101.450	0.010
CS24	101.352	101.389	0.037	101.304	-0.048	101.361	0.009
CS25	106.028	106.052	0.024	106.000	-0.028	106.125	0.097
CS26	105.911	105.911	0.000	105.911	0.000	106.059	0.148
CS27	105.274	105.288	0.014	105.267	-0.007	105.309	0.035
CS28	104.893	104.929	0.036	104.852	-0.041	104.917	0.024
CS29	104.336	104.358	0.022	104.312	-0.024	104.399	0.063
CS30	104.274	104.275	0.001	104.274	0.000	104.352	0.078
CS31	103.806	103.849	0.043	103.749	-0.057	103.851	0.045
CS32	103.496	103.524	0.028	103.467	-0.029	103.523	0.027
Maximum			0.043		-0.057		0.323
Mean			0.022		-0.021		0.073

Table G.1 Sensitivity analysis on 1 in 100 year peak water level

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APPENDIX H: NOTES OF LIMITATIONS

The data essentially comprised a study of available documented information from various sources together with discussions with relevant authorities and other interested parties. There may also be circumstances at the site that are not documented. The information reviewed is not exhaustive and has been accepted in good faith as providing representative and true data pertaining to site conditions. If additional information becomes available which might impact our l conclusions, we request the opportunity to review the information, reassess the potential concerns and modify our opinion if warranted.

It should be noted that any risks identified in this report are perceived risks based on the available information.

This report was prepared by Betts Hydro Ltd for the sole and exclusive use of the titled client in response to particular instructions. Any other parties using the information contained in this report do so at their own risk and any duty of care to those parties is excluded.

This document has been prepared for the titled project only and should any third party wish to use or rely upon the contents of the report, written approval from Betts Associates Ltd must be sought.

Betts Associates Ltd accepts no responsibility or liability for the consequences of this document being used for the purpose other than that for which it was commissioned and for this document to any other party other than the person by whom it was commissioned.

APPENDIX I: PFRA/SFRA PLANNING EXTRACTS

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Lancashire PFRA
Locally Agreed Surface Water Information

Lancashire County Council

Map created : May 2011 Map scale : 1:339,347

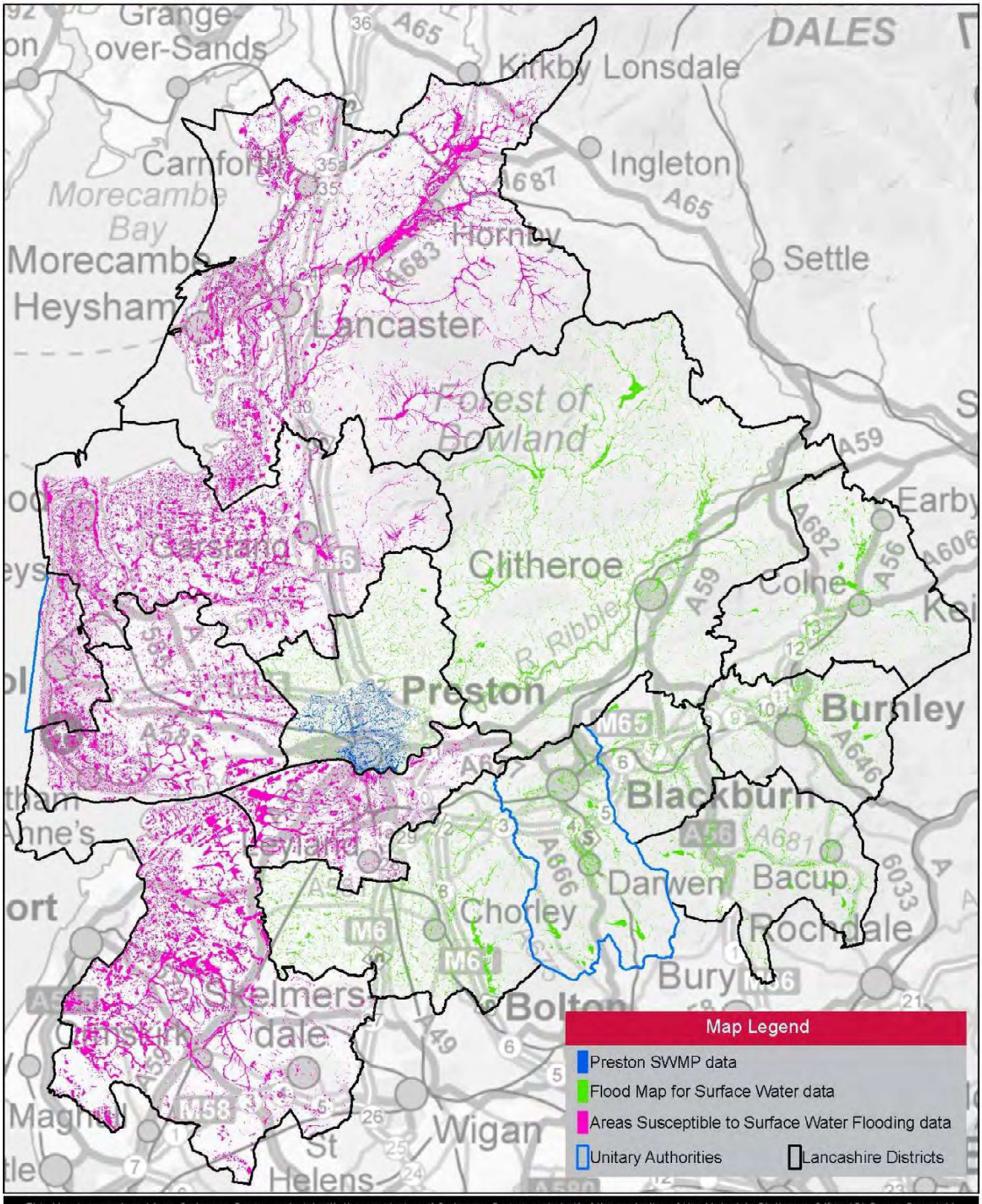
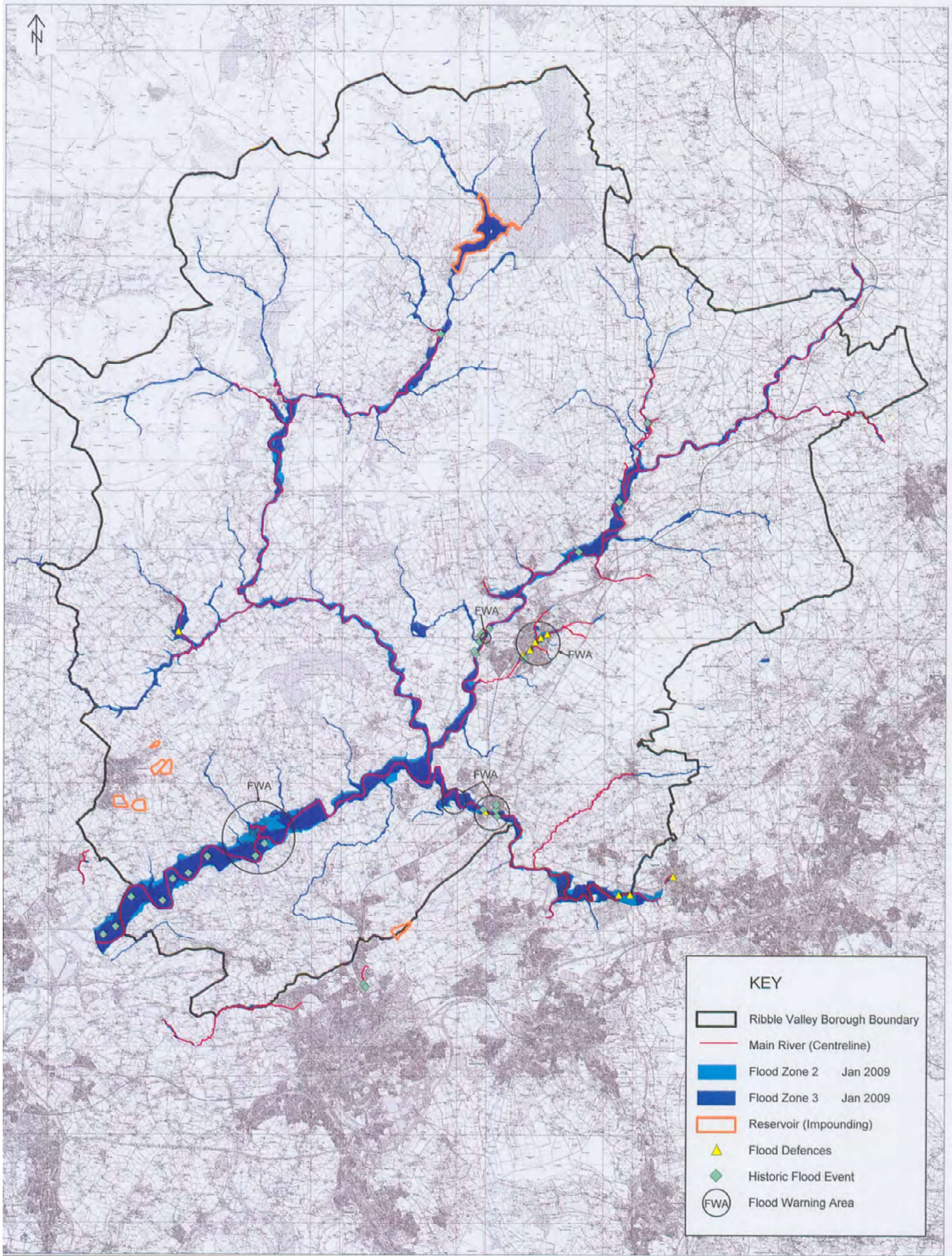


Figure 5.2 – Locally Agreed Surface Water Information



MAP 1 RIBBLE VALLEY STRATEGIC FLOOD RISK ASSESSMENT

Scale: 1:115000

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APPENDIX J: SURFACE WATER RUN-OFF CALCULATIONS

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HR Wallingford
Working with water

Greenfield runoff estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Megan Berry
Site name:	CHIPPINGS LANE
Site location:	LONGRIDGE

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the SuDS Manual, C753 (Ciria, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site coordinates

Latitude:	53.83699° N
Longitude:	2.60329° W

Reference:	6489164
Date:	2018-11-07T12:58:15

Methodology	FEH Statistical

Site characteristics

Total site area (ha)	6.236

Methodology

Qmed estimation method	Calculate from BFI and SAAR
BFI and SPR estimation method	Specify BFI manually
HOST class	14
BFI / BFIHOST	0.377
Qmed (l/s)	78.38
Qbar / Qmed Conversion Factor	1.08

Hydrological characteristics

	Default	Edited
SAAR (mm)	1211	1211
Hydrological region	10	10
Growth curve factor: 1 year	0.87	0.87
Growth curve factor: 30 year	1.7	1.7
Growth curve factor: 100 year	2.08	2.08

Notes:

(1) Is Q_{BAR} < 2.0 l/s/ha?

(2) Are flow rates < 5.0 l/s?

(3) Is SPR/SPRHOST ≤ 0.3?

Greenfield runoff rates

	Default	Edited
Qbar (l/s)	84.26	84.85
1 in 1 year (l/s)	73.31	73.82
1 in 30 years (l/s)	143.24	144.25
1 in 100 years (l/s)	175.26	176.49

SURFACE WATER RUN-OFF CALCULATION SHEET

Development	CHIPPINGS LANE, LONGRIDGE
Project No.	HYD371

Revision	1.0	**Completed by**	MB
Date	05/12/2018	**Checked by**	DK

BETTS HYDRO
CONSULTING ENGINEERS

Areas			**Catchment Charateristics**		
Total Site	10.659	ha	SAAR	1219	mm
Development Area (for SW Strategy)	6.236	ha	BFI	0.377	
Existing Impermeable	0.000	ha	i_1	19.3	mm/hr
Existing Impermeable (for SW Strategy)	0.000	ha	i_{30}	37.4	mm/hr
Existing Pervious	10.659	ha	i_{100}	48.2	mm/hr
Existing Pervious (for SW Strategy)	6.236	ha			
Proposed Impermeable (total)	2.806	ha			
Proposed Impermeable (domestic only)	2.806	ha			

Run-off Rates

Pre-development

Impermeable	1yr	0.0	l/s
	30yr	0.0	l/s
	100yr	0.0	l/s
	50mm/hr	0.0	l/s
Pervious	1yr	73.8	l/s
	30yr	144.3	l/s
	100yr	176.5	l/s
	QBar	84.9	l/s
Total	1yr	73.8	l/s
	30yr	144.3	l/s
	100yr	176.5	l/s

Post-development

Impermeable (total)	1yr	150.2	l/s
	30yr	291.3	l/s
	100yr+CC	488.5	l/s

Volumes

Pre-development

Impermeable	1yr	0.0	cu.m
	100yr	0.0	cu.m
Pervious	1yr	710.7	cu.m
	100yr	2178.7	cu.m
Total	1yr	710.7	cu.m
	100yr	2178.7	cu.m

Quick storage Estimates

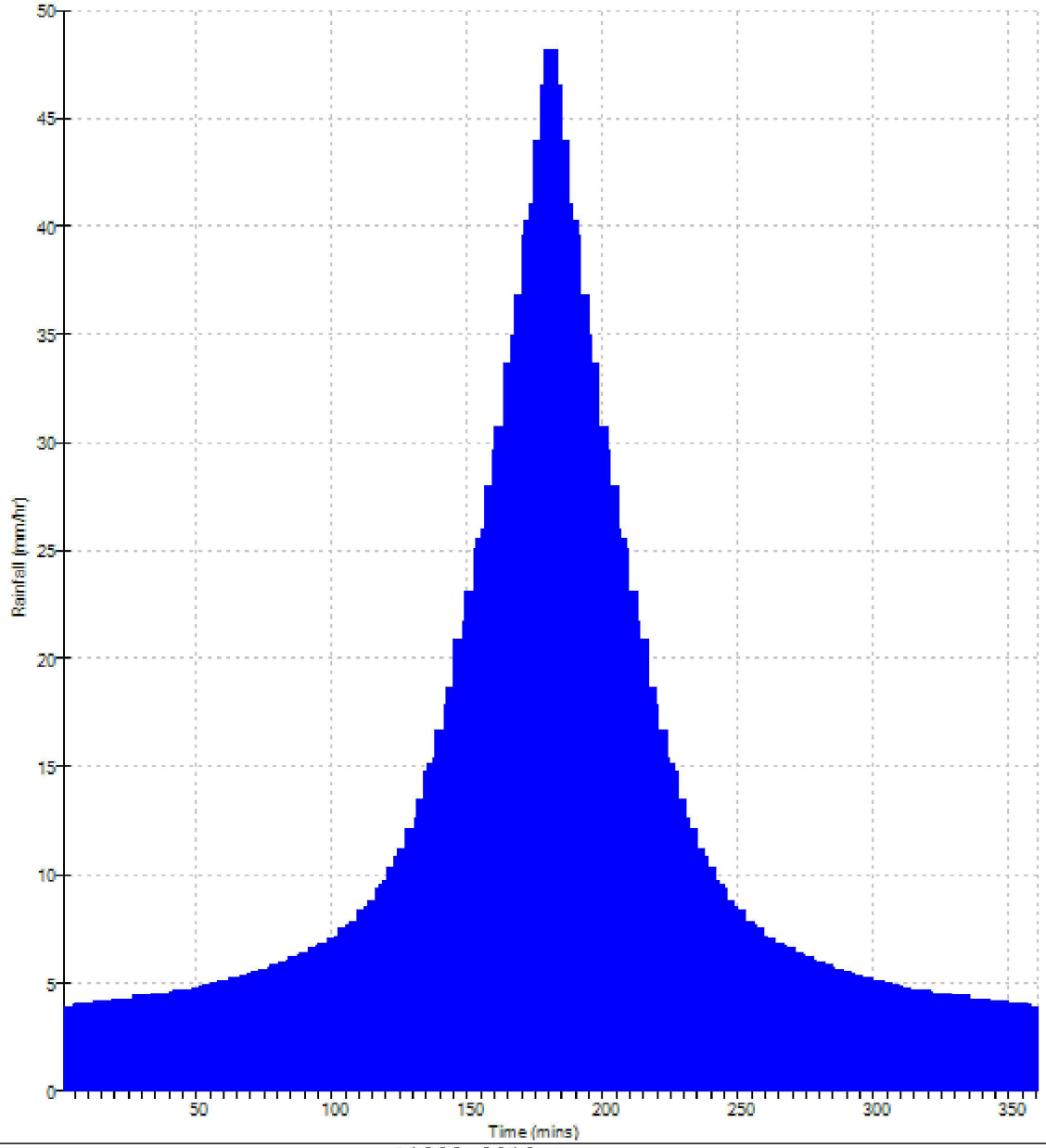
		low	high	mean	Imp. Area (ha)	Max. Discharge (l/s)	Rainfall	CC
Return Period	1yr	117	290	204	2.806	84.9	FEH	0
Return Period	30yr	515	853	684	2.806	84.9	FEH	0
Return Period	100yr+CC	989	1549	1269	2.806	84.9	FEH	20%
Return Period	100yr+CC	1113	1720	1417	2.806	84.9	FEH	30%
Return Period	100yr+CC	1240	1892	1566	2.806	84.9	FEH	40%

Rainfall profile

Storm duration (mins) 360

FEH Data

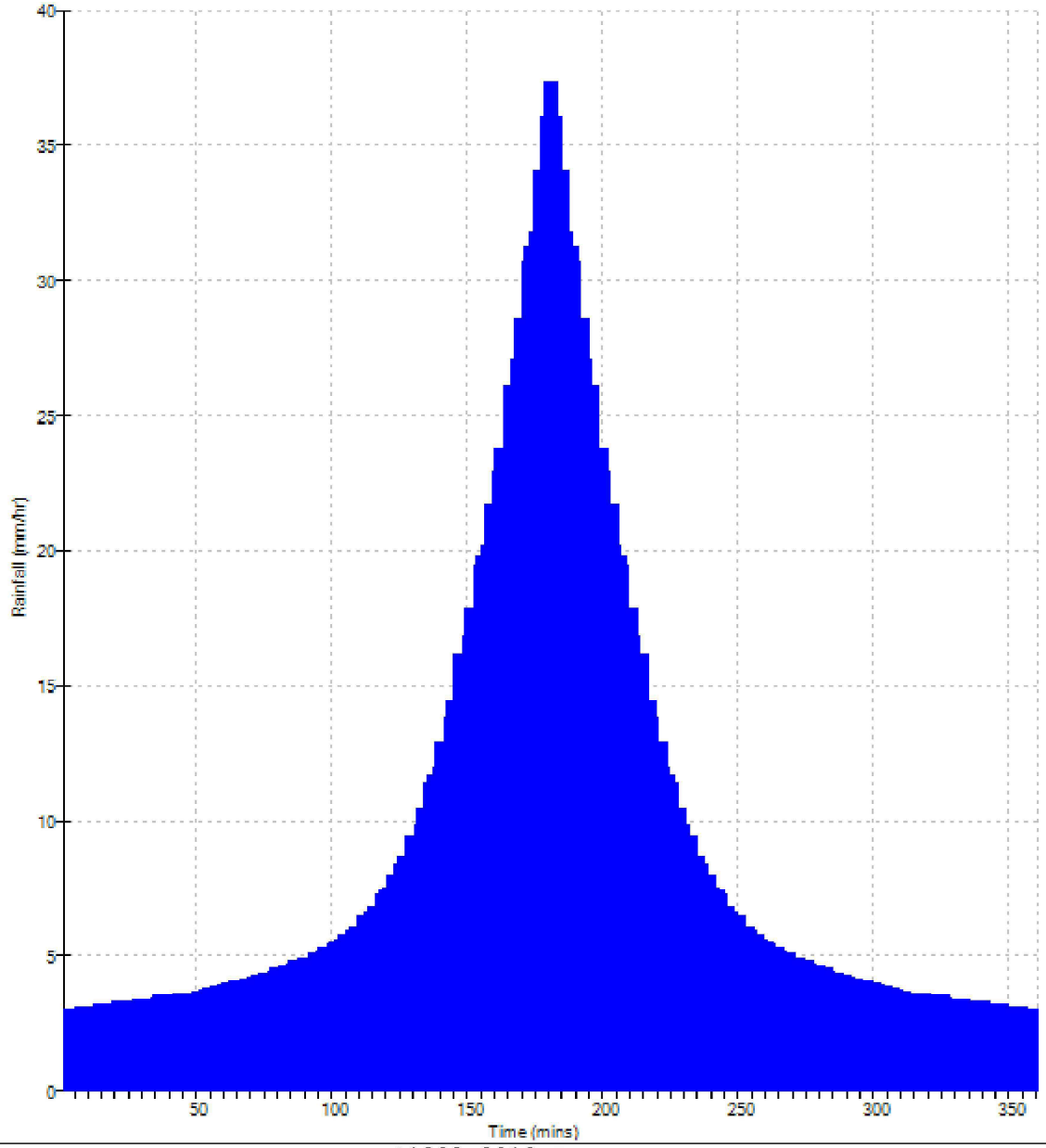
FEH Rainfall Version	2013
Site Location GB	360097 438896
Data Type	Point
Peak Intensity (mm/hr)	48.210
Ave. Intensity (mm/hr)	12.298
Return Period (years)	100.0



Rainfall profile

Storm duration (mins) 360

FEH Data	
FEH Rainfall Version	2013
Site Location GB	360097 438896
Data Type	Point
Peak Intensity (mm/hr)	37.369
Ave. Intensity (mm/hr)	9.533
Return Period (years)	30.0

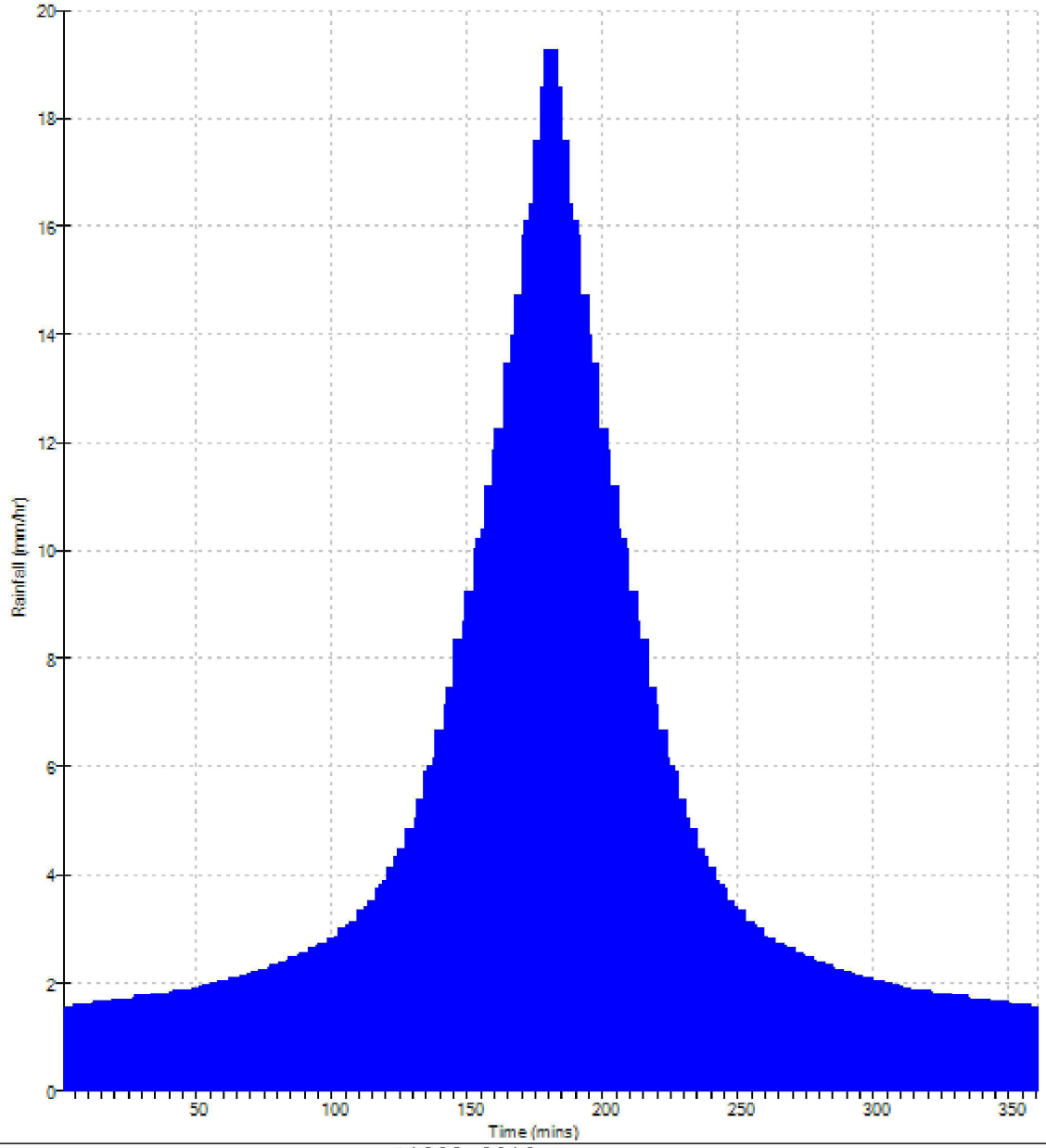


Rainfall profile

Storm duration (mins) 360

FEH Data

FEH Rainfall Version	2013
Site Location GB	360097 438896
Data Type	Point
Peak Intensity (mm/hr)	19.275
Ave. Intensity (mm/hr)	4.917
Return Period (years)	2.0



Greenfield Runoff Volume

FSR Data

Return Period (years)	100
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	18.800
Ratio R	0.281
Areal Reduction Factor	1.00
Area (ha)	6.236
SAAR (mm)	1219
CWI	123.855
Urban	0.000
SPR	47.000

Results

Percentage Runoff (%)	51.35
Greenfield Runoff Volume (m^3)	2178.681

Greenfield Runoff Volume

FSR Data

Return Period (years)	1
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	18.800
Ratio R	0.281
Areal Reduction Factor	1.00
Area (ha)	6.236
SAAR (mm)	1219
CWI	123.855
Urban	0.000
SPR	47.000

Results

Percentage Runoff (%)	46.71
Greenfield Runoff Volume (m^3)	710.686

APPENDIX K: PRELIMINARY PROPOSED DRAINAGE PLANS

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SITE: CHIPPINGS LANE, LONGRIDGE
REF: HYD371
REV: 0
DATE: 08/11/18

BETTS HYDRO CONSULTING ENGINEERS

EXISTING DRAINAGE SITUATION

LEGEND

- Phase 1
- Phase 2 & 3

Existing Drainage Features

- Topography
- Ordinary Watercourse
- Ponds

Existing Sewer Networks

- Public Surface Water Sewer
- Public Foul Water Sewer
- Foul Water Pumping Station

FURTHER NOTES:

This drawing is not a drainage 'design' it is a preliminary drainage strategy showing existing sewer locations.

No hydraulic simulation or assessment of these proposals has been undertaken.

Proposed points of connection to the existing watercourse and sewer require invert levels to be accurately established. Refer to proposed drainage plan.

Surcharging of the proposed outfall will require modelling to satisfy the requirements of united utilities along with full hydraulic analysis.

SITE: CHIPPINGS LANE, LONGRIDGE
REF: HYD371
REV: 1
DATE: 22/11/2021

BETTS HYDRO CONSULTING ENGINEERS

PRELIMINARY DRAINAGE STRATEGY PLAN

LEGEND

- Phase 1
- Phase 2 & 3

Existing Drainage Features

- Ordinary Watercourse
- Ponds

Existing Sewer Networks

- Public Surface Water Sewer
- Public Foul Water Sewer
- Foul Water Pumping Station

Proposed Drainage Connections

- SuDS/Attenuation
- Surface Water Drainage Connection
- Foul Water Drainage Connection(s)

FURTHER NOTES:

This drawing is not a drainage 'design' it is a preliminary drainage strategy showing existing sewer locations.

No hydraulic simulation or assessment of these proposals has been undertaken.

Proposed points of connection to the existing watercourse and sewer require invert levels to be accurately established. Refer to proposed drainage plan.

Surcharging of the proposed outfall will require modelling to satisfy the requirements of united utilities along with full hydraulic analysis.

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APPENDIX L: STORMWATER STORAGE ESTIMATES

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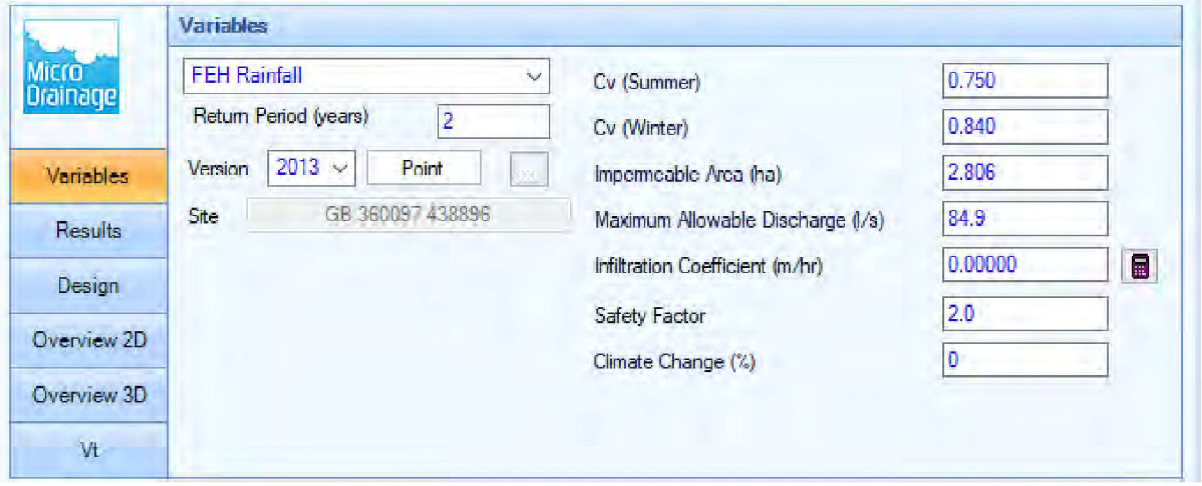
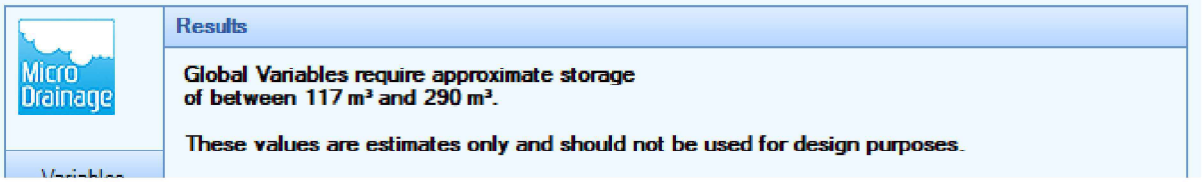
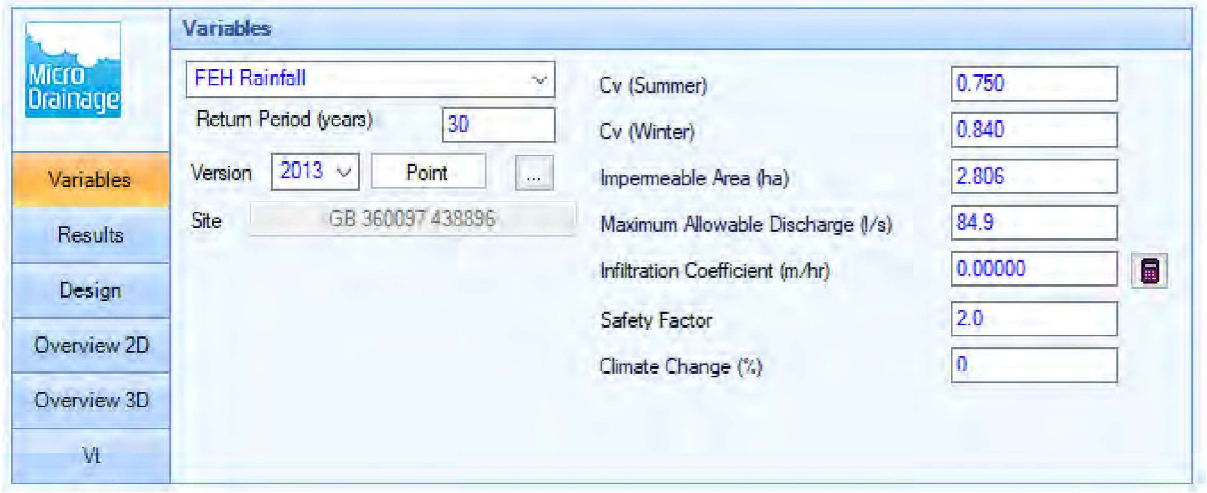
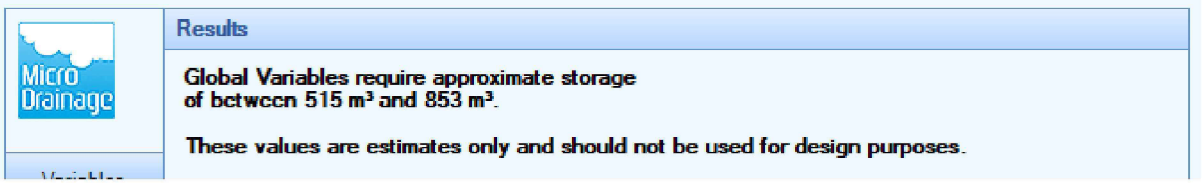
1 YEAR RETURN PERIOD STORM EVENT





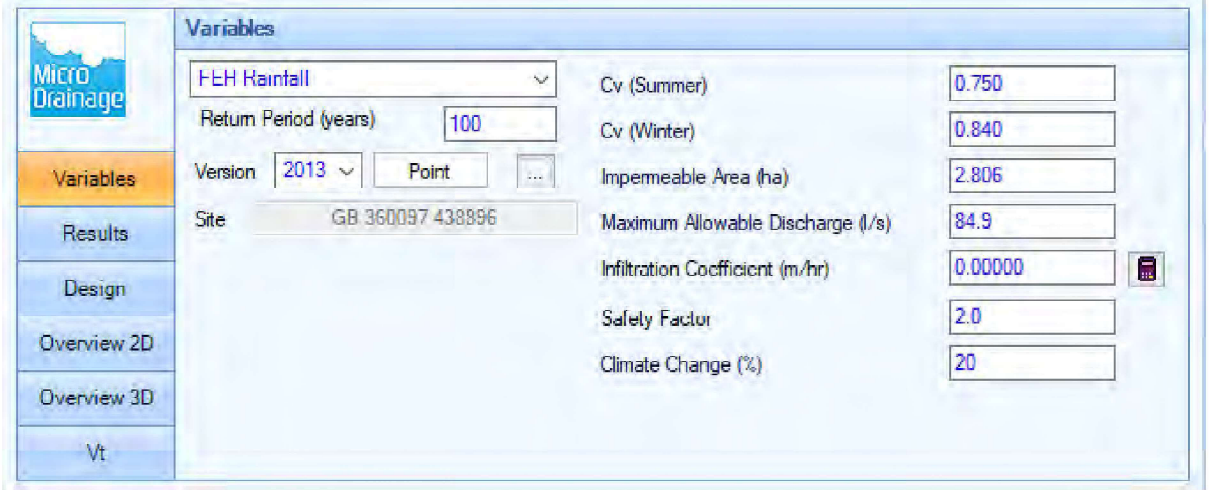
30 YEAR RETURN PERIOD STORM EVENT

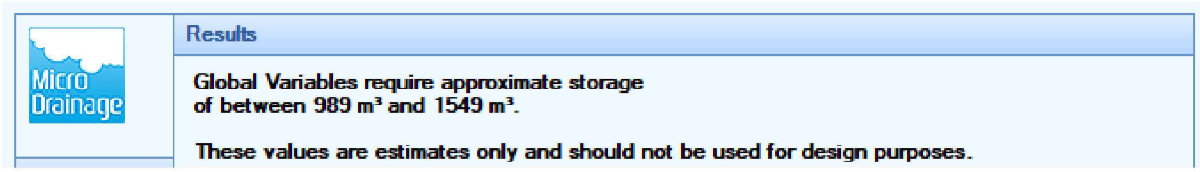




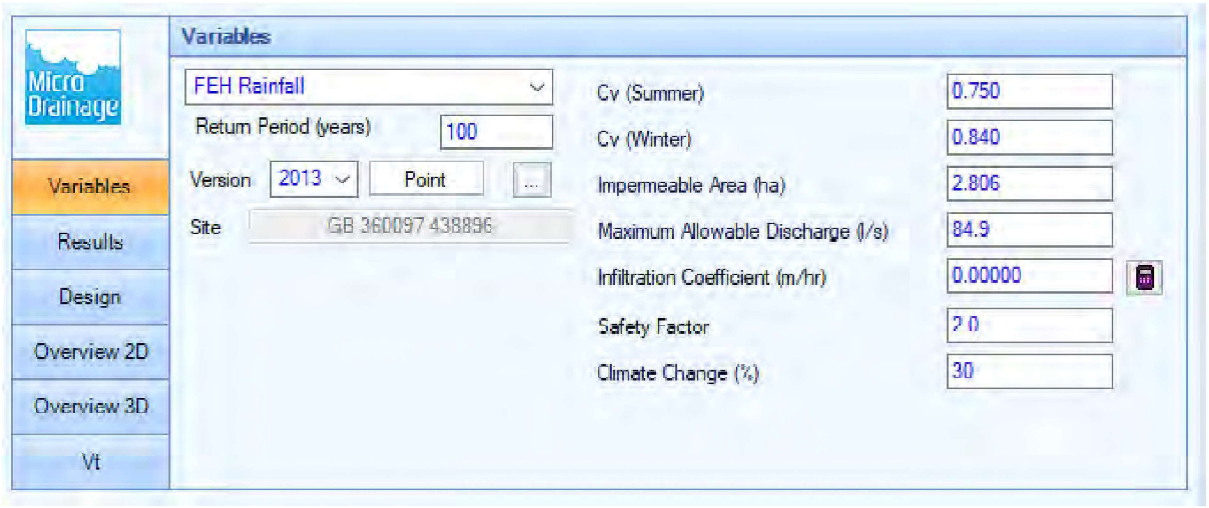
QUICK STORAGE ESTIMATES — CHIPPINGS LANE, LONGRIDGE

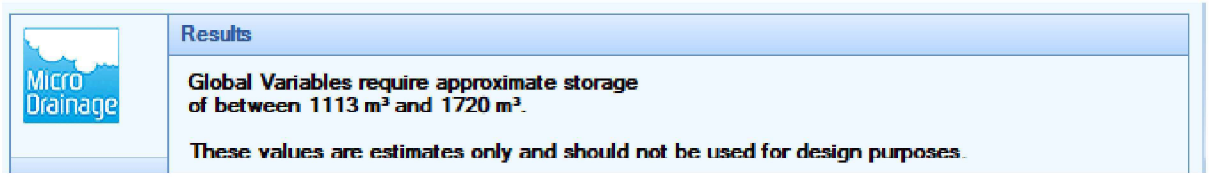
100 YEAR RETURN PERIOD STORM EVENT + 20% CLIMATE CHANGE



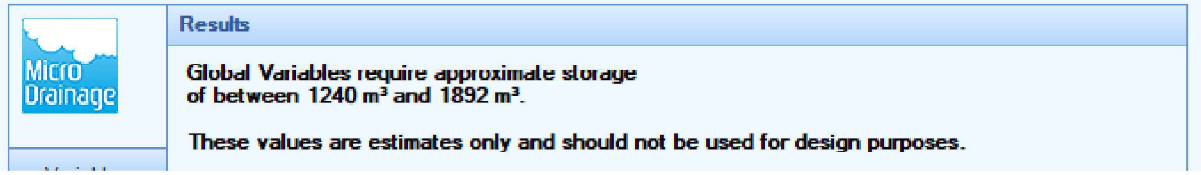


100 YEAR RETURN PERIOD STORM EVENT + 30% CLIMATE CHANGE





100 YEAR RETURN PERIOD STORM EVENT + 40% CLIMATE CHANGE



APPENDIX M: TYPICAL SUDS DETAILS

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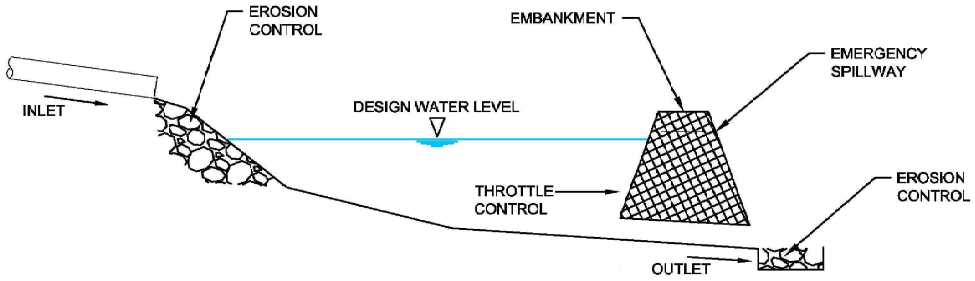
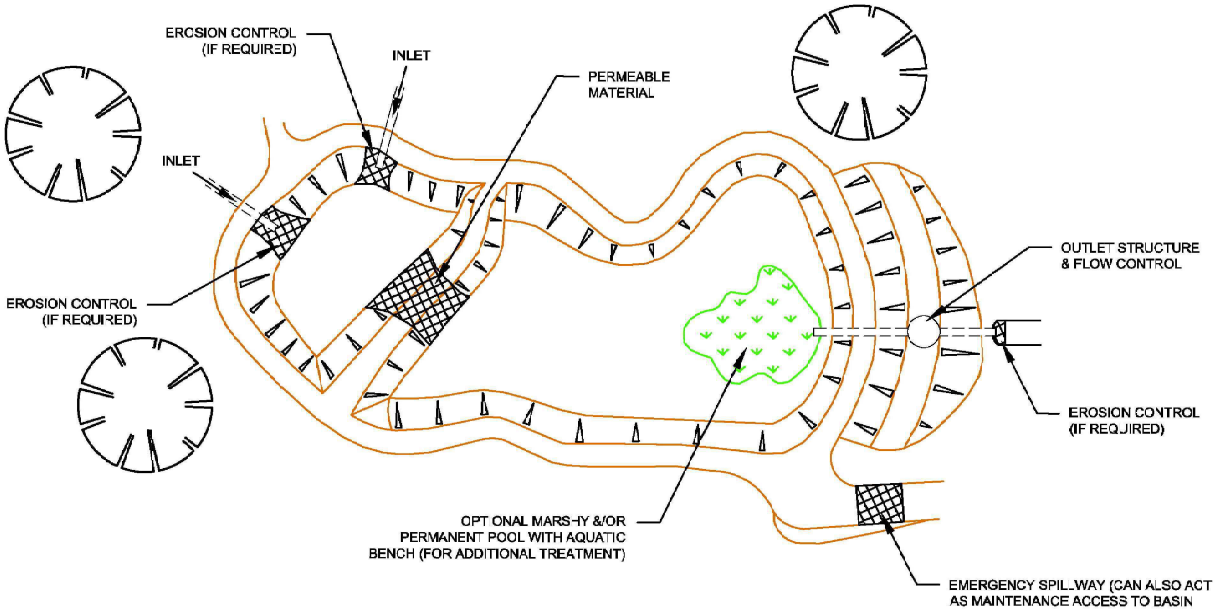
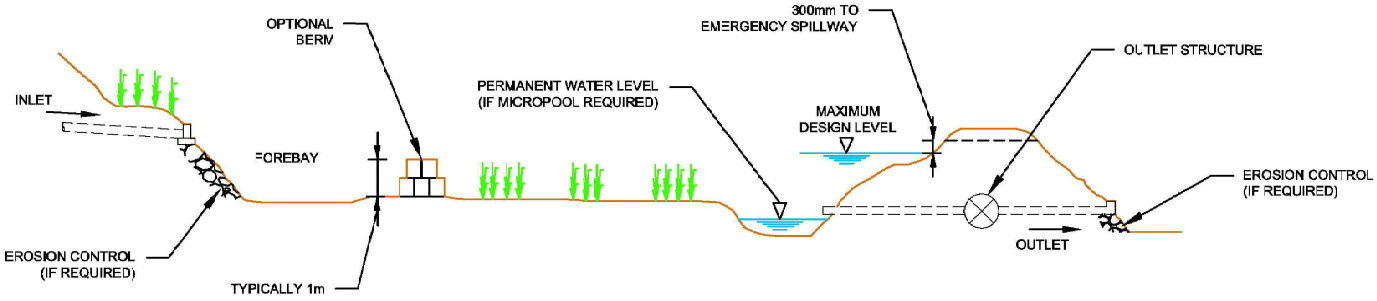


SCHEMATIC OF DETENTION BASIN PROFILE



PLAN VIEW



ELEVATION

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 5, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk

PROJECT: TYPICAL SUDS DETAIL

TITLE: DETENTION BASINS

DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
SEP 2014	@ A3	CP	RDN

PROJECT No:	DRAWING No:	REV:
BETTS	110	A

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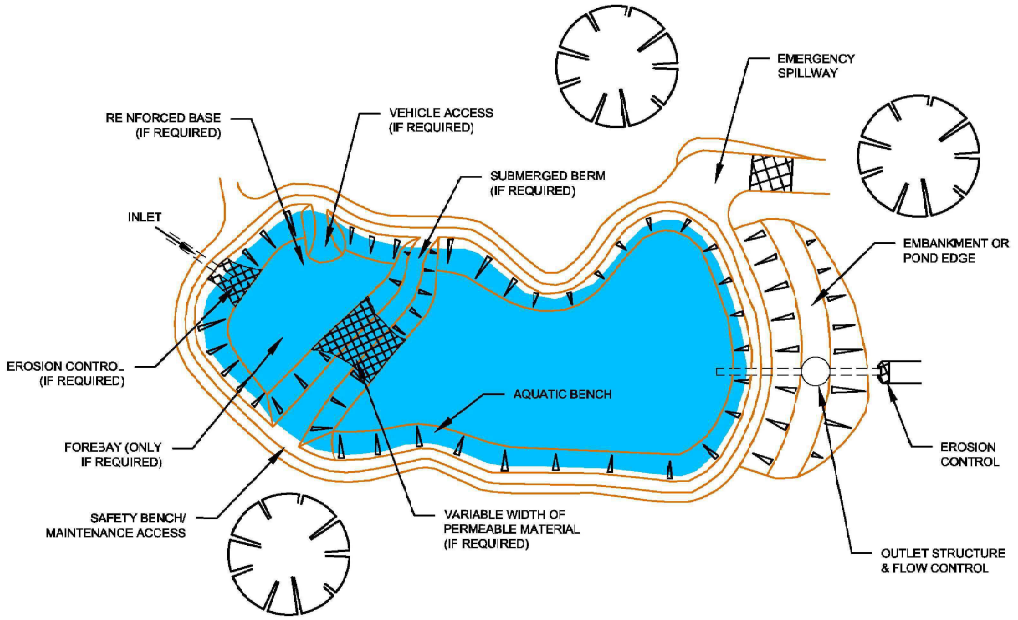

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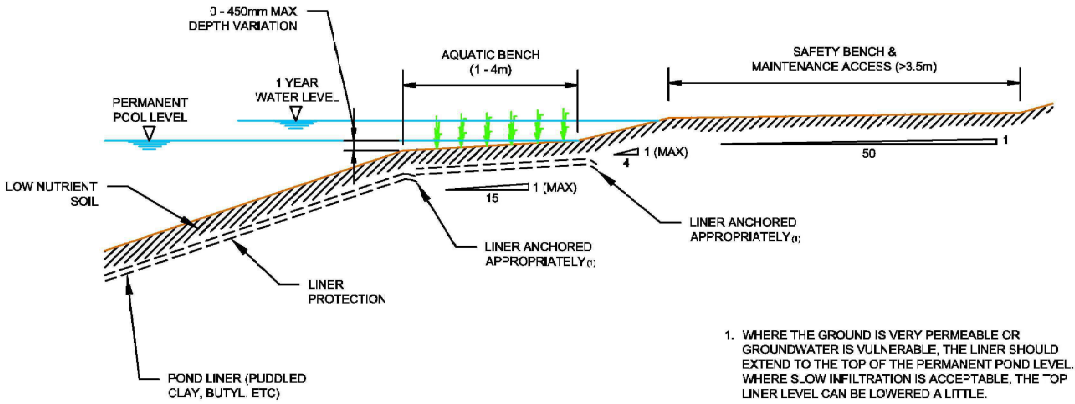
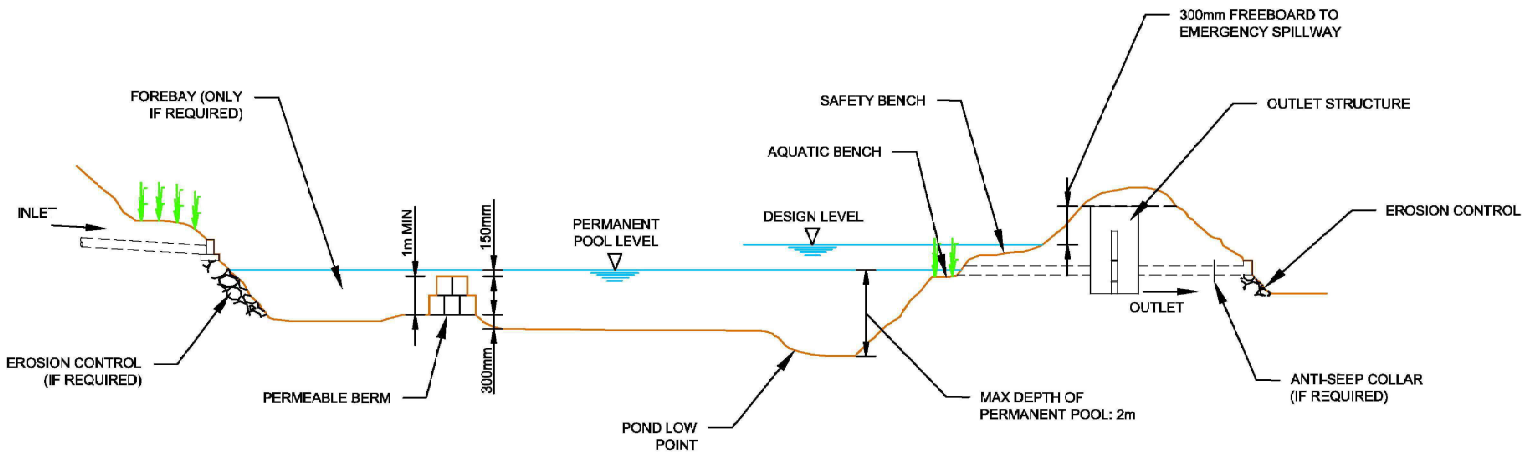


1. WHERE THE GROUND IS VERY PERMEABLE OR GROUNDWATER IS VULNERABLE, THE LINER SHOULD EXTEND TO THE TOP OF THE PERMANENT POND LEVEL. WHERE SLOW INFILTRATION IS ACCEPTABLE, THE TOP LINER LEVEL CAN BE LOWERED A LITTLE.

TYPICAL POND EDGE GEOMETRY



PROFILE

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 5, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk

PROJECT: TYPICAL SUDS DETAIL

TITLE: WET PONDS

DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
SEP 2014	@ A3	CP	RDN

PROJECT No:	DRAWING No:	REV:
BETTS	111	A

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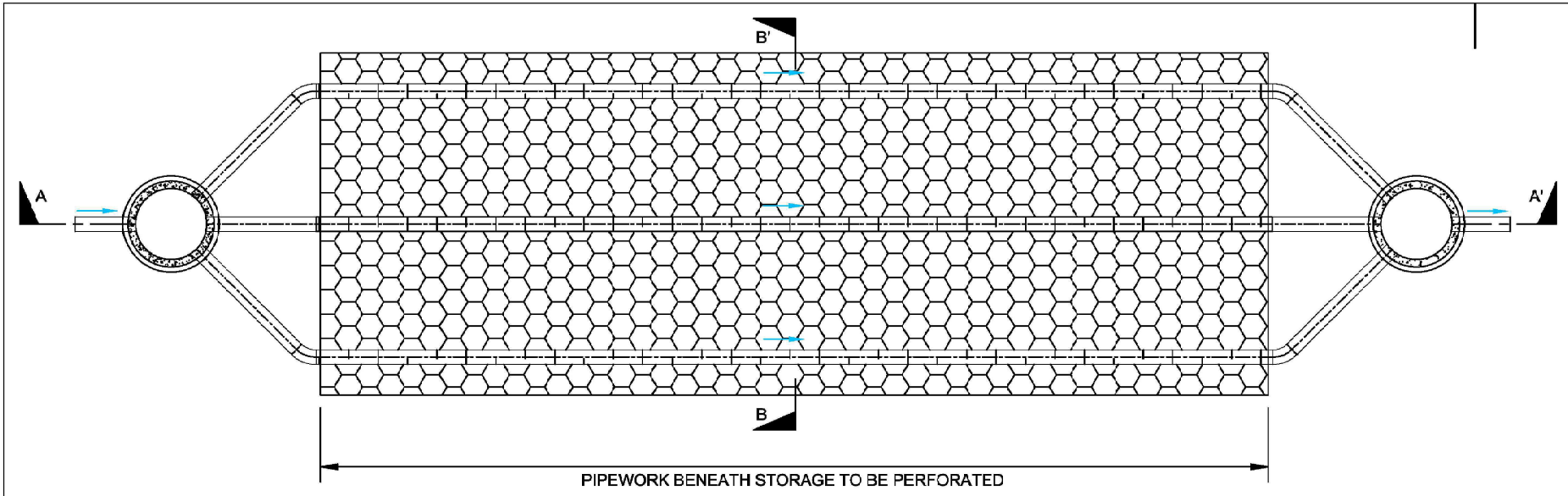

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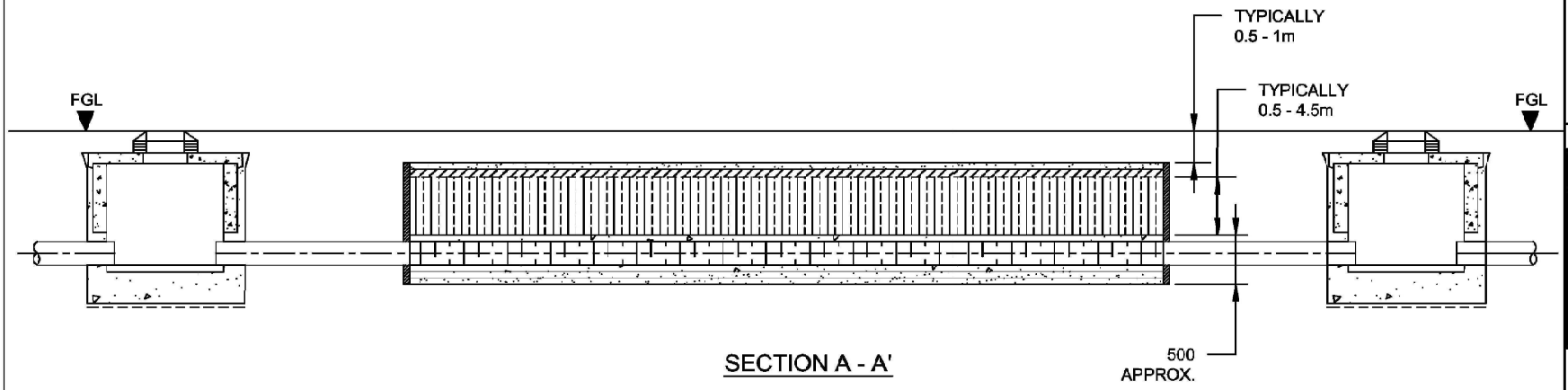
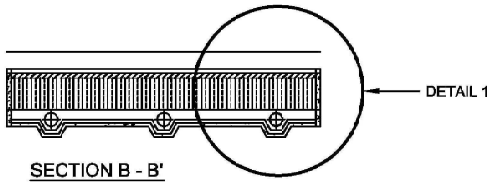
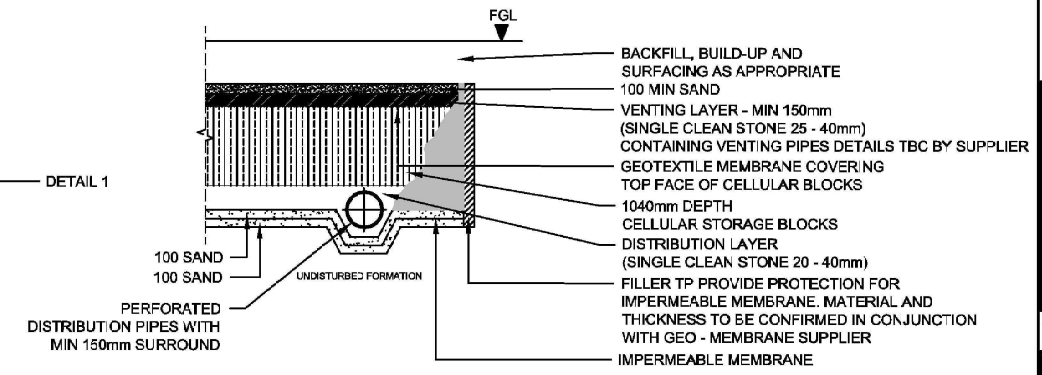


SECTION A - A'

ALL DIMENSIONS AND DEPTHS DEPENDENT ON REQUIRED VOLUME AND LOCAL GROUND CONDITIONS



SECTION B - B'



DETAIL 1

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 5, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk

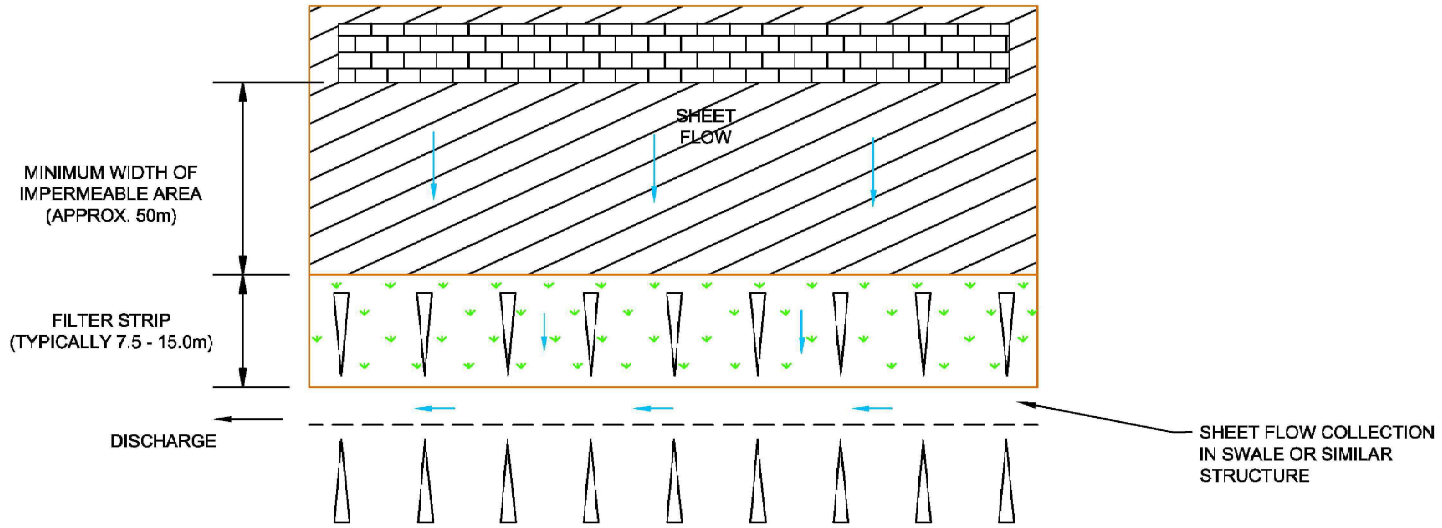
PROJECT: TYPICAL SUDS DETAIL

TITLE: CELLULAR STORAGE

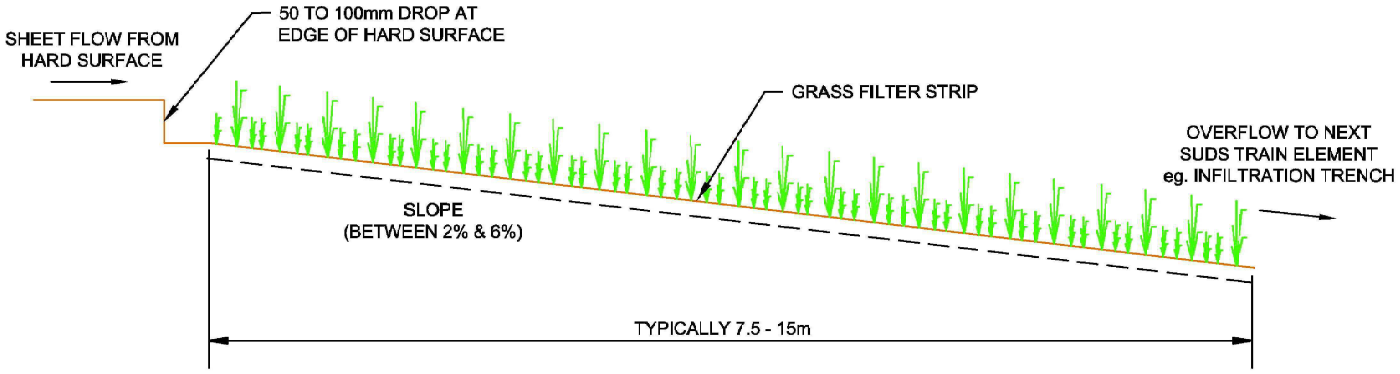
DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
SEP 2014	@ A3	CP	RDN

PROJECT No:	DRAWING No:	REV:
BETTS	113	A

DO NOT SCALE



PLAN



ELEVATION

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 5, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk

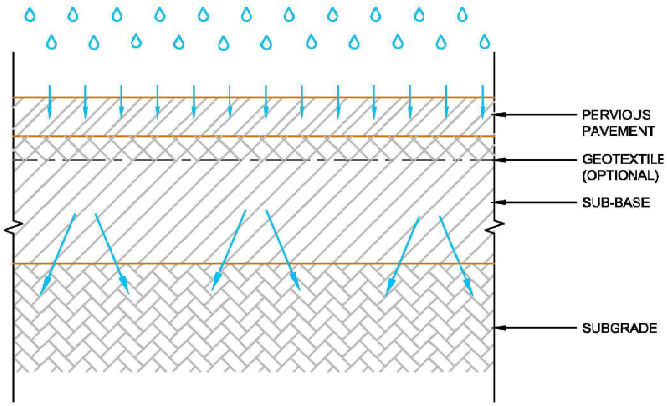
PROJECT: TYPICAL SUDS DETAIL

TITLE: FILTER STRIPS

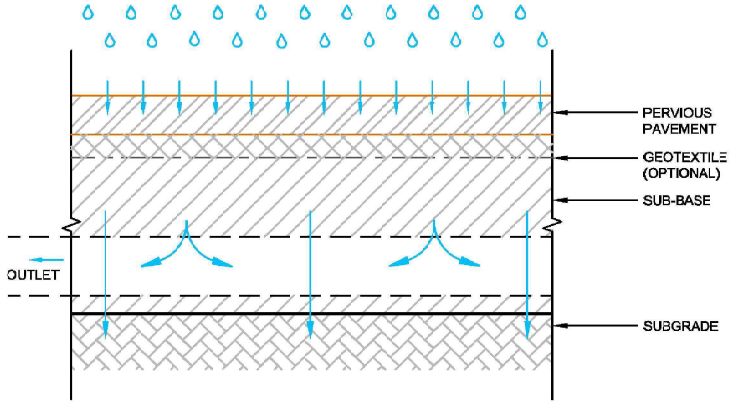
DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
SEP 2014	@ A3	CP	RDN

PROJECT No:	DRAWING No:	REV:
BETTS	107	A

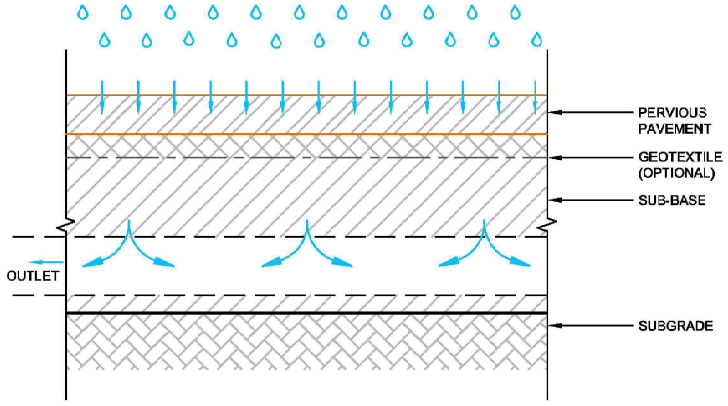
DO NOT SCALE



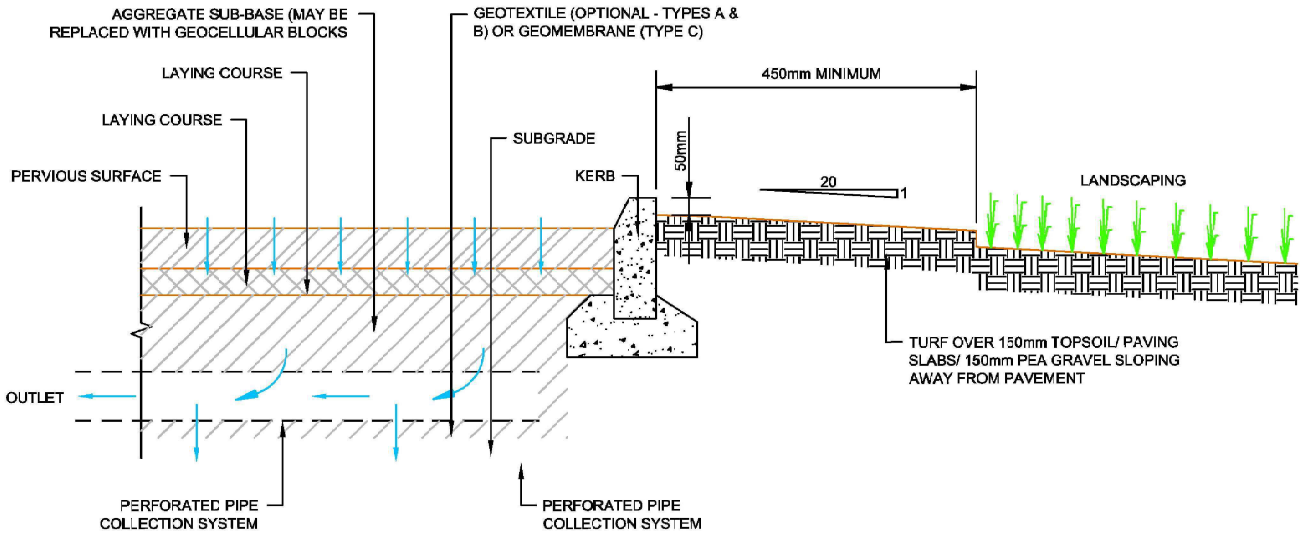
TYPE A: TOTAL INFILTRATIPN



TYPE B: PARTIAL INFILTRATION



TYPE C: NO INFILTRATION



LANDSCAPING DETAIL

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 5, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk

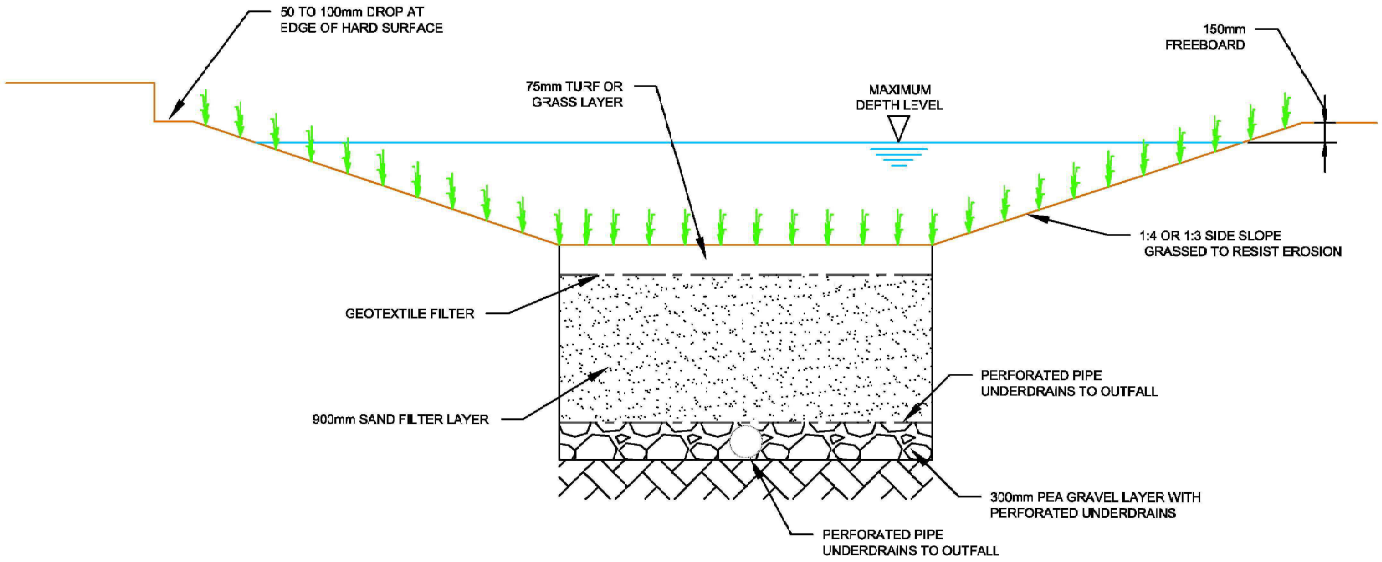
PROJECT: TYPICAL SUDS DETAIL

TITLE: PERVIOUS PAVEMENTS

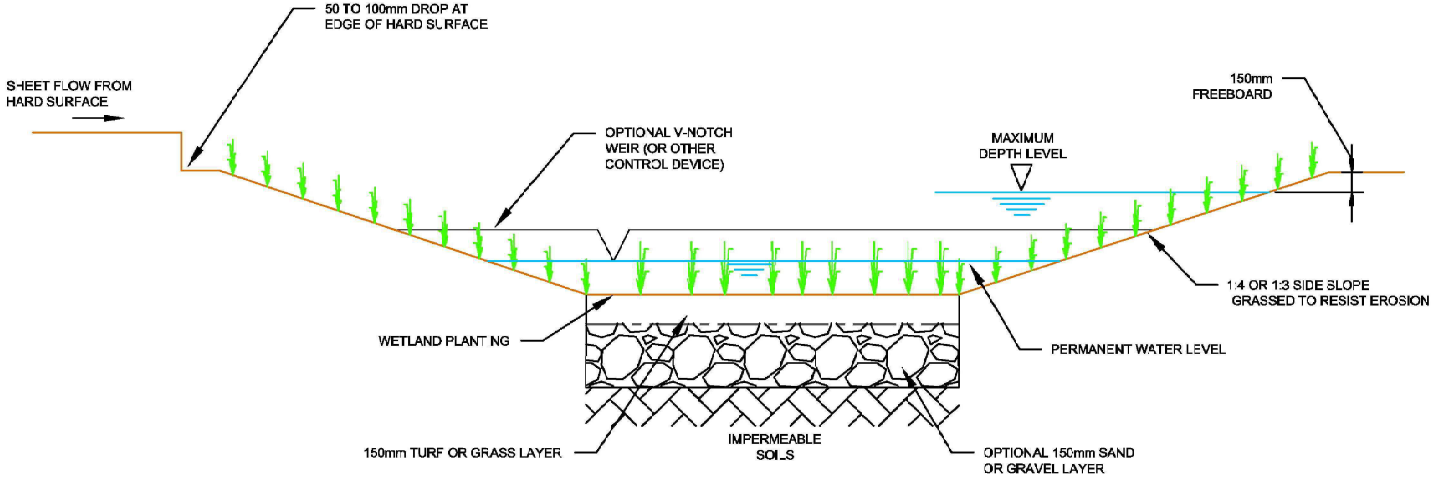
DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
SEP 2014	@ A3	CP	RDN

PROJECT No:	DRAWING No:	REV:
BETTS	105	A

DO NOT SCALE



DRY SWALE



WET SWALE

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 5, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk

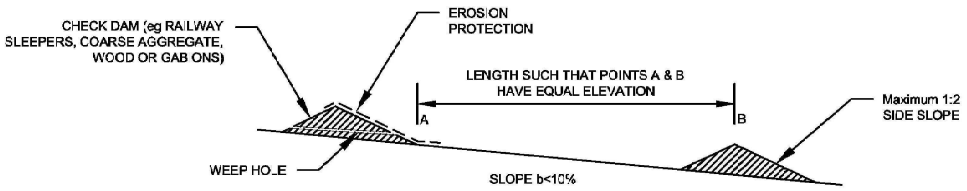
PROJECT: TYPICAL SUDS DETAIL

TITLE: SWALES (1 of 2)

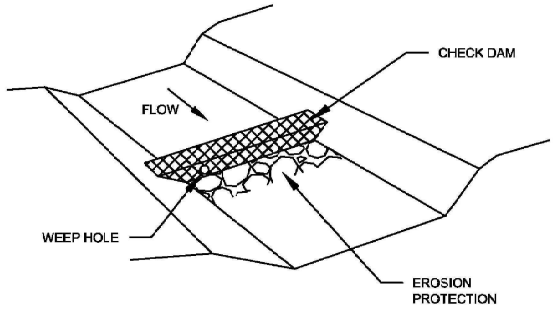
DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
SEP 2014	@ A3	CP	RDN

PROJECT No:	DRAWING No:	REV:
BETTS	103	A

DO NOT SCALE

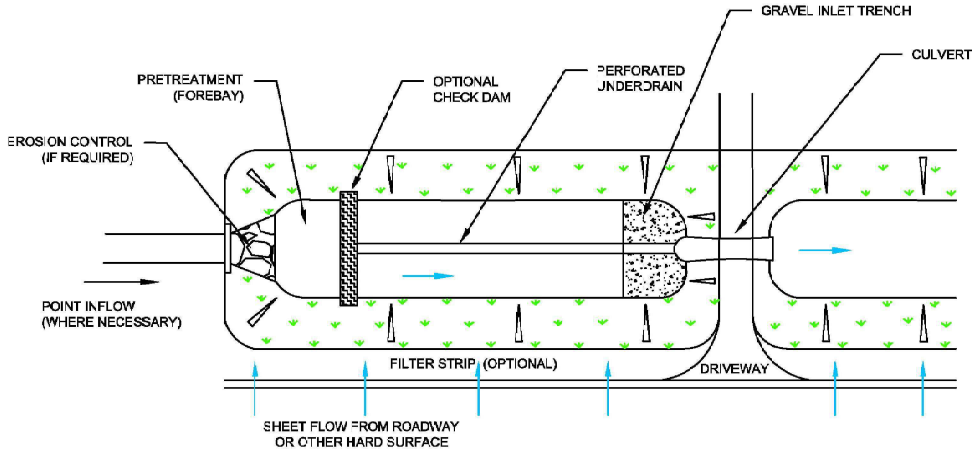


ELEVATION



SCHEMATIC

CHECK DAM



ENHANCED DRY SWALE

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 5, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk

PROJECT: TYPICAL SUDS DETAIL

TITLE: SWALES (2 of 2)

DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
SEP 2014	@ A3	CP	RDN

PROJECT No:	DRAWING No:	REV:
BETTS	104	A

APPENDIX N: NOTES OF LIMITATIONS

The data essentially comprised a study of available documented information from various sources together with discussions with relevant authorities and other interested parties. There may also be circumstances at the site that are not documented. The information reviewed is not exhaustive and has been accepted in good faith as providing representative and true data pertaining to site conditions. If additional information becomes available which might impact our conclusions, we request the opportunity to review the information, reassess the potential concerns, and modify our opinion if warranted.

It should be noted that any risks identified in this report are perceived risks based on the available information.

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