Report on Drainage Strategy to Accompany Planning Application 03/2018/0975 Land East of Chipping Lane, Longridge

by

Barratt Manchester

Revision	Date	Prepared By	Revision Notes

Contents

Drawings

Appendices

1. Introduction

The following document has been prepared to assist the designer's preparation and the readers understanding of the drainage theory and calculations in one reference document.

This document covers Phases 2 & 3 of the development, though part of the Phase 2 site drains into Phase 1 surface water network, therefore Phase 2 supporting evidence is provided only where required to prove the Phases 2 & 3 design.

Phase 1 drainage strategy document will be provided under the separate planning application 3/2019/0870.

2. Site Details

Development Name	Chipping Lane Phases 2 & 3
Site Address	Land off Chipping Lane, Longridge, Preston, PR3 2NA
Longitude, Latitude (or OS Grid Ref)	360321; 437929
Site Description	4 No. open grassed fields separated by mature hedgerows and sporadic trees. Currently used by livestock for grazing.
Site Area (Ha)	7.26Ha approx.
Site Area used for calculating Greenfield Runoff Rates (Ha)	2.69Ha (Ph2B) + 1.71Ha (Ph3) This excludes large areas of open spaces
Existing Impermeable Area (Ha)	0Ha
Is the Site Steeply Sloping (Y/N), If "Yes" Typical Gradient.	Yes 1:30

Table 1

3. Pre-Development Greenfield Runoff Rates (Phases 2 & 3)

Refer to the site specific FRA produced by Betts Hydro dated March 2016

Return Period	**Greenfield Rate (l/s/Ha)**
1 in 1 year (l/s)	11.8
Qbar	13.6
1 in 30 year (l/s)	23.2
1 in 100 year (l/s)	28.3

Table 2

4. Soakaway Testing

A site specific site investigation was carried out by soiltechnics dates February 2016. A copy of the site investigation is presented in Appendix C.

Ground conditions are typically 0.3m of topsoil overlaying cohesive Devensian Till to beyond depths of 4.7m. The Till is comprised of initially 1-1.5m of low to high strength clay, below which the shear strength increases. Varying amounts of silt, sand and gravel were also found.

2 No. soakway tests were carried out as part of the site investigation. It was considered that the Devensian Till is impermeable and therefore indicates that infiltration drainage is NOT a feasible option.

5. Post-Development Surface Water Allowable Discharge Rates (All Phases)

Discharge rates have been limited to existing greenfield runoff rates of Qbar for all storm return periods. Refer to the phase specific FRA, and Table 2 above for details of the greenfield runoff rates.

For the Development Area refer to drawing 459/ED/146.

Phase 1	**Developable Area (Ha)**	**Greenfield Rate (l/s/Ha)**	**Allowable Discharge Rate (l/s)**
1	4.32	8.3*	35.9
2A	1.80	13.6	24.5
2B	2.69	13.6	36.6
3	1.71	13.6	23.3
		TOTAL	**120.2**

Table 3

* Refer to Phase 1 specific FRA, an extract of which is shown in Appendix E.

6. Design Parameters

Engineering Layout Drg No	459/ED/105
Proposed Impermeable Areas Drg No	459/ED/103
Lowest FFLs	107.250
Maximum TWL for Design (Lowest FFL – 0.6m)	106.650
M5-60	18.800
Ratio R	0.282
MADD Factor	2.0
Climate Change Allowance	30%
Discharge Location Minimum Levels	106.860 & 111.120
Surcharge Outfall Levels	104.400 & 109.370
Point of Connection	Watercourse
Point of Connection approved by UU (Y/N)	Yes

Table 4

7. Summary of Drainage Design

The drainage has been designed in accordance with the site specific FRA produced by Betts Hydro dated December 2018.

The drainage has also been designed to comply with DEFRA's non-statutory technical standard for sustainable drainage systems dated March 2015. Compliance to such is demonstrated within Section 13.

Networks 1 & 2 are to drain to the existing sewers within Phase 1. Networks 3 & 4 will drain to the adjacent watercourse named Higgin Brook. Discharge rates have been limited to existing greenfield runoff rates of Qbar for all storm return periods.

Attenuation storage is provided in the form of oversized pipes under highways and public open spaces. Attenuation storage in the highways is sized to provide attenuation for all flows up to and including 1 in 30 year storm events.

For storm events exceeding 1 in 30 year events, long term storage is provided in above ground storage areas to ensure no flooding to properties occurs for all storm events up to and including 1 in 100 year 6 hour storm events plus a 30% allowance for climate change.

An assumption of 1.35Ha of Phase 2 (Phase 2A) was accommodated to drain through Phase 1. For this reason, the restricted flow increased from 35.9l/s to 60.4l/s. These additional areas equated to 156.7 l/s and 57.2 l/s of extra flow to pipes 5.004 and 6.003 respectively.

Since the planning layout has been set, it is confirmed that the Phase 2A area is 1.80Ha. Network 1 has been restricted in order to achieve to design flow in Phase 1.

MicroDrainage simulations are available in Appendix D and demonstrate the Actual Discharge Rates.

Drainage Network	**Allowable Discharge Rate (l/s)**	**Actual Discharge Rate (l/s)**
1+2A	60.3	49.9
3	36.6	41.8
4	23.3	26.3
Total	**120.2**	**118.0 (Difference (-2.2)**

Table 5

8. Urban Creep

An additional 10% has been added to the areas within the Surface Water Network design to represent Urban Creep. This 10% has been applied for all phases; Phase 1 +2A, 2B, and 3.

9. Design for Exceedance

All surface water drainage models have been modelled for storm events greater than the 1 in 100 year event to determine the impact of flooding. The flood locations are shown on the attached Flood Routing and over land flow drawing. Any exceedance flooding have been demonstrated to be managed within the site where reasonable practicable.

This demonstrates that properties are unlikely to flood during extreme flood events.

10. Maintenance

All surface water (coloured blue) on the attached plan, 459/ED/105, will be put forward for adoption under a Section 104 Agreement with United Utilities. Prior to issue of the Vesting Declaration by United Utilities, the drainage shown on the included plan will be maintainable by Barratt Manchester at the expense of Barratt Manchester.

All areas of public open space will be transferred to the management company for adoption and maintenance. This includes the overflow areas/ponds and culverts to the watercourse on the attached plan 459/ED/105. The management and maintenance will be funded by the purchasers/owners of the development by way of an annual fee levied on the owner. In order to ensure the long term operation of the swales, the maintenance contract will stipulate regular maintenance of the SuDS network, in accordance with the management plan.

All highway gullies and highway drains on the attached plan will be put forward for adoption under a Section 38 agreement with Lancashire County Council. After issue of the highway final certificate, the highways and highway drains, gullies and gully pipes on the attached plan 459/ED/105, will be maintainable by the Local Highway Authority at public expense. Prior to the issue of the final certificate by LCC, the roads and drainage will be maintainable by Barratt Manchester at the expense of Barratt Manchester.

All foul drainage (coloured brown) on the attached plan 459/ED/105 will be put forward for adoption under a S104 agreement with United Utilities. Prior to issue of the Vesting Declaration by United Utilities, the drainage shown on the included plan will be maintainable by Barratt Manchester and at the expense of Barratt Manchester.

A draft inspection & maintenance schedule for elements of the SuDS/Drainage infrastructure is shown in Table 6.

Drainage Element	**Maintenance Requirement**	**Frequency**
Surface Water Pipes and Manholes (prior to adoption)	Inspect. Remove excess silt & debris, Clear Blockage	Inspect Annually. CCTV if required. Silt & debris removed as necessary.
Catchpits	Inspect. Remove excess silt & debris, Clear Blockage	Inspected every 3 months. Silt & debris removed as necessary.
Ditches/Swales	Inspect. Remove excess vegetation. Clear blockages, silt & debris.	Inspected every 1 Month. Blockages, silt & debris removed as necessary.
Flow Controls	Inspect. Remove excess silt & debris, clear blockage. Test functionality of Bypass doors.	Inspect Annually Silt & debris removed as necessary. Flow control repaired, maintained as necessary.
Overflow Ponds (and POS)	Inspect. Remove excess vegetation. Clear blockages, silt & debris.	Inspected monthly, or after significant storm events. Blockages, silt & debris removed as necessary.

Table 6

Culverting sections of the existing watercourse may create or exacerbate upstream or downstream bank and bed erosion as well as sediment deposition, as a result of altered water velocities and disruption to the natural transport of sediment. In order to reduce the effects of erosion we plan to do the following:

- The culvert base matches the existing bed to allow a naturalised culvert bed during high velocity flows
- The culvert width is the same width as the natural channel
- The soffit of the culvert is greater than the 1 in 1000 year water levels
- Culvert alignment matches the alignment of the watercourse
- The slope of the culvert base matched the slope of the existing bed of the watercourse
- No steps provided between end of headwall and the existing bed of the watercourse

Additional headwalls onto existing watercourse can also create or exacerbate bank and bed erosion as well as sediment deposition. In order to reduce the effects of erosion we plan to do the following:

- Flows have been restricted to mimic Qbar greenfield runoff rates, flows will not be increased
- Outfall structure sits flush with the existing bank to prevent turbulent flows
- Headwalls to be located on straight sections of watercourse
- Headwall alignment to be at angle of 45^{o} to minimise change of flow direction

- Outflow pipes of velocity less than 1.2 m/s
- Height between outlet invert and watercourse bed minimised

Screens/grilles are fitted on all headwalls with pipes 375mm or greater. Screens serve two purposes: a trash screen to prevent floating debris and a security screen to restrict access from unauthorised people. Screens are fitted with 100mm spacings between bars so as not to hinder passage of fish and other fauna. The maintenance of screens is safer and easier than clearing potential blockages within the culverts themselves. Maintenance will be in line with that described in Table 6.

11. Defect Reporting

Prior to adoption of the highway drains, foul drains, surface water drains, SuDS and culverts, defects may be reported to Barratt Manchester by the local authority, local residents or members of the public.

All defects can be reported to Barratt Manchester Customer Care line using the following details:

Email: manchester@newhomecare.co.uk

Phone: 0161 872 0161 Option 3

Phone (Out-of-Hours): 0345 601 6084

The customer care line's normal working hours are Monday to Friday 9:00 to 17:30, excluding bank holidays. The out-of-hours line is a 24-hour call service.

After adoption, the following numbers may be useful:

Management Company
POS Landcare Ltd
Hillhouse Business Park,
Thornton Cleveleys,
Lancashire
FY5 4QD
Tel: 01253 897 824

Lancashire County Council Highways
www.lancashire.gov.uk/roads-parking-and-travel/report-it/
Tel: 0300 123 6780 (Mon-Fri 8:00 to 17:00, exc. Bank Holidays)

United Utilities
Tel: 0345 672 3723

Environment Agency
Tel: 0800 80 70 60 (24 Hours)

12. Defect Reporting

All non-urgent defects will be repaired within 10 weeks of being reported.

All urgent defects will be made safe within 48 hours, or sooner if practicable. Any works to 'Make Safe' may be a temporary measure in order to protect the public, and allow sufficient time to procure the permanent remedial works. This may include temporary 'fencing off' of the hazard until permanent remedial works can be completed.

United Utilities, Local Authority, Environment Agency, and the Management Company may operate to alternative response times.

Refer to the site landscape maintenance schedule for further details on the site wide schedule.

13. Compliance with DEFRA's Non-Statutory Technical Standards for Sustainable Drainage Systems dated March 2015

Flood risk outside the development

Criteria	Designers Comments
S1 Where the drainage system discharges to a surface water body that can accommodate uncontrolled surface water discharges without any impact on flood risk from that surface water body (e.g. the sea or a large estuary) the peak flow control standards (**S2** and **S3** below) and volume control technical standards (**S4** and **S6** below) need not apply.	The surface water discharges to existing watercourse/sewer, therefore this criteria does not apply.

Peak flow control

Criteria	Designers Comments
S2 For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.	All proposed discharge rates are less than or equal to Qbar. Therefore this criteria is deemed to comply.
S3 For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.	The site is greenfield therefore not applicable. Therefore, this criteria is deemed to comply.

Volume control

Criteria	Designers Comments
S4 Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event.	As the infiltration test results do not allow infiltration drainage, it is not possible to reduce the run-off volume to the greenfield volume, therefore Criteria S6 will apply.
S5 Where reasonably practicable, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event.	The site is Greenfield therefore not applicable.
S6 Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with **S4** or **S5** above, the runoff volume must be discharged at a rate that does not adversely affect flood risk.	As the infiltration test results do not allow infiltration drainage, it is not possible to reduce the run-off volume to the greenfield volume, therefore the discharge rate has been reduced to a maximum of Qbar for all rainfall events up to and including 1 in 100 year 6 hour event.

Flood risk within the development

Criteria	Designers Comments
S7 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30 year rainfall event.	The drainage system has been designed to ensure no flooding occurs for any part of the site for a 1 in 30 year event. Micro drainage simulation for a 1 in 30 year event are attached in Appendix D
S8 The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.	The drainage system has been designed to ensure no flooding to properties occurs for any part of the site for a 1 in 100 year 6 Hour event. For flows in excess of the 1 in 30 year event, flows are allowed to overflow into Long Term Storage areas located in public open spaces. Some minor flooding to highways is accepted for the 1 in 100 year 6 hour event. Flooding is only permitted where it can be demonstrated that minor flooded is contained wholly within the adopted highway and will not flood properties. The location and flood extent are

	shown on the Flood Routing and Overland Flow drawing. Micro drainage simulation for a 1 in 100 year event are attached in Appendix D
S9 The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100 year rainfall event are managed	All surface water drainage models have been modelled for storm events greater than the 1 in 100 Year event to determine the impact of flooding. The Flood locations are shown on the attached Flood Routing and over land flow drawing. Any exceedance flooding has been demonstrated to be managed within the site where reasonably practicable.

Structural integrity

Criteria	Designers Comments
S10 Components must be designed to ensure structural integrity of the drainage system and any adjacent structures or infrastructure under anticipated loading conditions over the design life of the development taking into account the requirement for reasonable levels of maintenance.	All Sewers are to be covered under a S104 agreement with United Utilities for future adoption. All sewers to be built to UU adoptable standards. A 12 month maintenance period is standard with all S104 sewers
S11 The materials, including products, components, fittings or naturally occurring materials, which are specified by the designer must be of a suitable nature and quality for their intended use.	All main sewers to be constructed to adoptable standards. All SUDS to be constructed in accordance with the Typical details as provided.

Designing for maintenance considerations

Criteria	Designers Comments
S12 Pumping should only be used to facilitate drainage for those parts of the site where it is not reasonably practicable to drain water by gravity.	Surface Water Pump Stations are not proposed on this development. A Foul ONLY Pump Stations is provided only where it is not possible to drain foul by gravity.

Construction

Criteria	Designers Comments
S13 The mode of construction of any communication with an existing sewer or drainage system must be such that the making of the communication would not be prejudicial to the structural integrity and functionality of the sewerage or drainage system.	All Sewers are to be covered under a S104 agreement with United Utilities for future adoption. All sewers to be built to UU adoptable standards. Connection to the ordinary watercourse will require LLFA land drainage consent. Details of

	the works have been submitted to the LLFA and subsequently approved. No works to within 8m of an ordinary watercourse will be permitted without LLFA approval.
S14 Damage to the drainage system resulting from associated construction activities must be minimised and must be rectified before the drainage system is considered to be completed.	All Sewers are to be covered under a S104 agreement with United Utilities for future adoption. All sewers to be built to UU adoptable standards. A 12 month maintenance period is standard with all S104 sewers. Connection to the ordinary watercourse will require LLFA land drainage consent. Details of the works have been submitted to the LLFA and subsequently approved. No works to within 8m of an ordinary watercourse will be permitted without LLFA consent.

Drawings
Topographical Survey

STATION COORDINATES			
STN	EASTING	NORTHING	LEVEL
1	360046.052	438075.076	103.669
2	359973.983	437900.946	106.736
3	360102.172	438230.032	102.057
4	360076.497	438151.762	102.828
5	360008.857	437979.182	105.422
6	359999.234	437904.541	106.859
7	360104.416	437864.142	108.238
8	359921.449	437923.762	107.573
9	360119.741	437817.117	108.854
10	360130.204	437783.994	109.568
11	360157.741	437659.066	110.954
12	360079.844	438031.962	104.603
13	360063.229	437955.005	106.341
14	360014.283	437940.169	106.927
15	360114.155	437931.710	106.413
16	360154.700	438003.288	105.614
17	360227.466	438045.530	104.996
18	360097.270	438206.420	102.297
19	360156.766	438199.392	102.063
20	360243.079	438203.966	102.496
21	360260.817	438131.083	104.164
22	360292.389	438086.190	105.355
23	360299.904	438037.938	106.727
24	360225.836	437937.023	106.905
25	360263.673	437997.737	106.553
26	360268.820	437872.795	108.110
27	360294.128	437838.604	110.031
28	360275.391	437806.285	110.249
29	360388.929	437840.149	112.160
30	360354.799	437823.947	111.299
31	360354.542	437796.389	111.674
32	360356.251	437771.532	111.852
33	360465.377	437946.664	113.645
34	360540.863	437934.736	115.716
35	360442.676	438077.345	110.300
36	360637.883	437966.054	117.404
37	360382.216	437955.964	111.717
38	360492.729	437863.633	115.614
39	360703.590	437826.133	122.026
40	360398.931	438016.872	110.454
41	360368.257	438088.084	107.813

SURVEY GRID AND LEVELS ARE DEFINED UTILISING THE LEICA SMARTNET GNSS NETWORK.
ONLY MANHOLES FOUND DURING THE SITE SURVEY ARE INDICATED ON THIS PLAN. FURTHER INVESTIGATION MAY BE REQUIRED TO DETERMINE THE FULL EXTENT OF THE SITE DRAINAGE.

ISSUE	REVISION	DATE
D	GARAGE OFF INGLEWHITE ROAD NEW BOUNDARY FENCE SURVEYED.	09.02.18.
C	INGLEWHITE ROAD SURVEY EXTENDED.	20.09.17.
B	MANHOLE SURVEY ADDED.	01.11.16.

Project
INGLEWHITE ROAD,
LONGRIDGE,
PRESTON.

Drawing title
SITE SURVEY.

Scales 1:500 Date 31.01.2013

Drawing number SDL 2062/1. Rev. D. Drawn by BJ

CLIENT BARRATT HOMES MANCHESTER.
CITY PARK,
4 BRINDLEY ROAD,
MANCHESTER. M16 9HQ.
TEL: 0161 872 0161.

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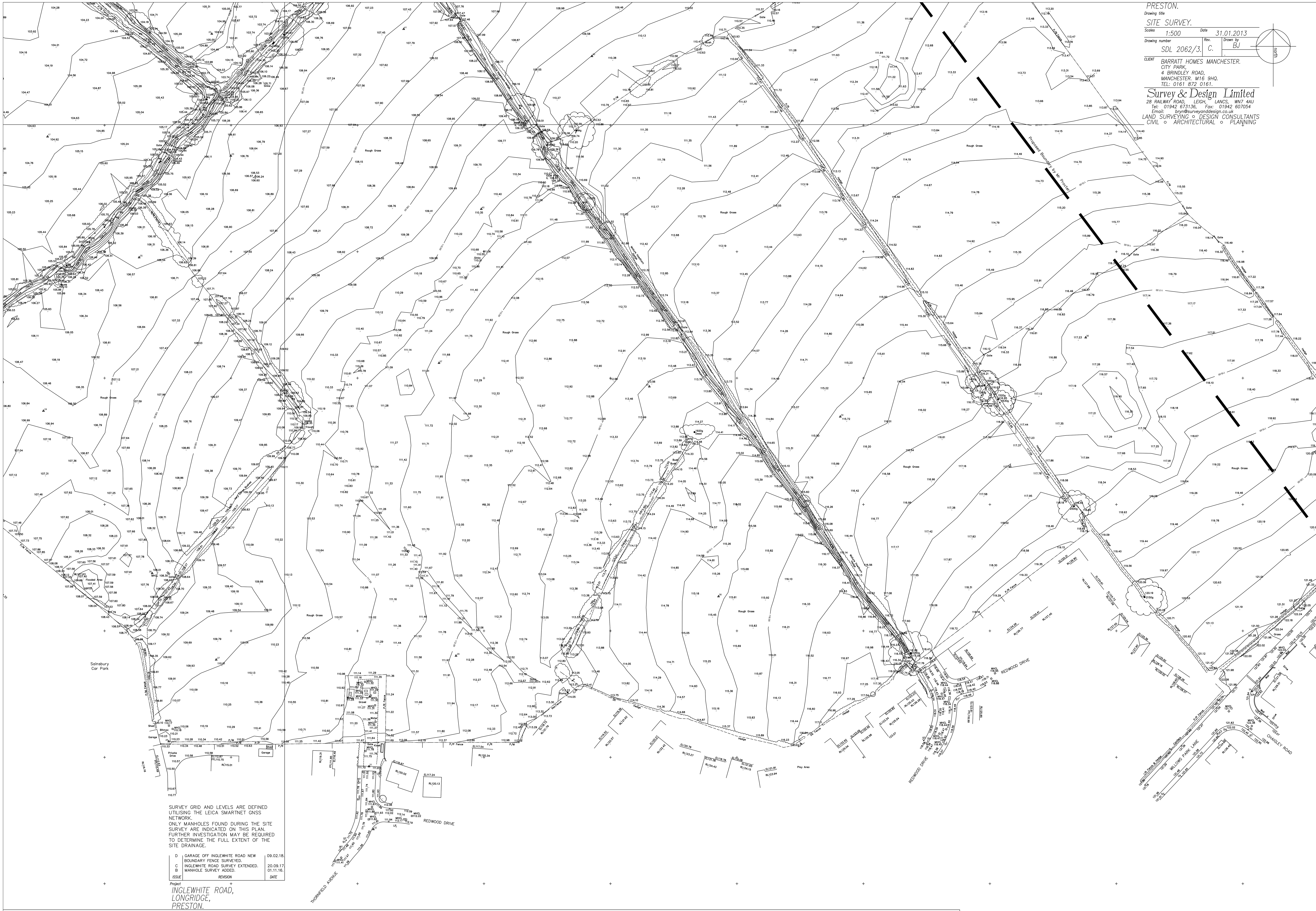

SURVEY GRID AND LEVELS ARE DEFINED UTILISING THE LEICA SMARTNET GNSS NETWORK.
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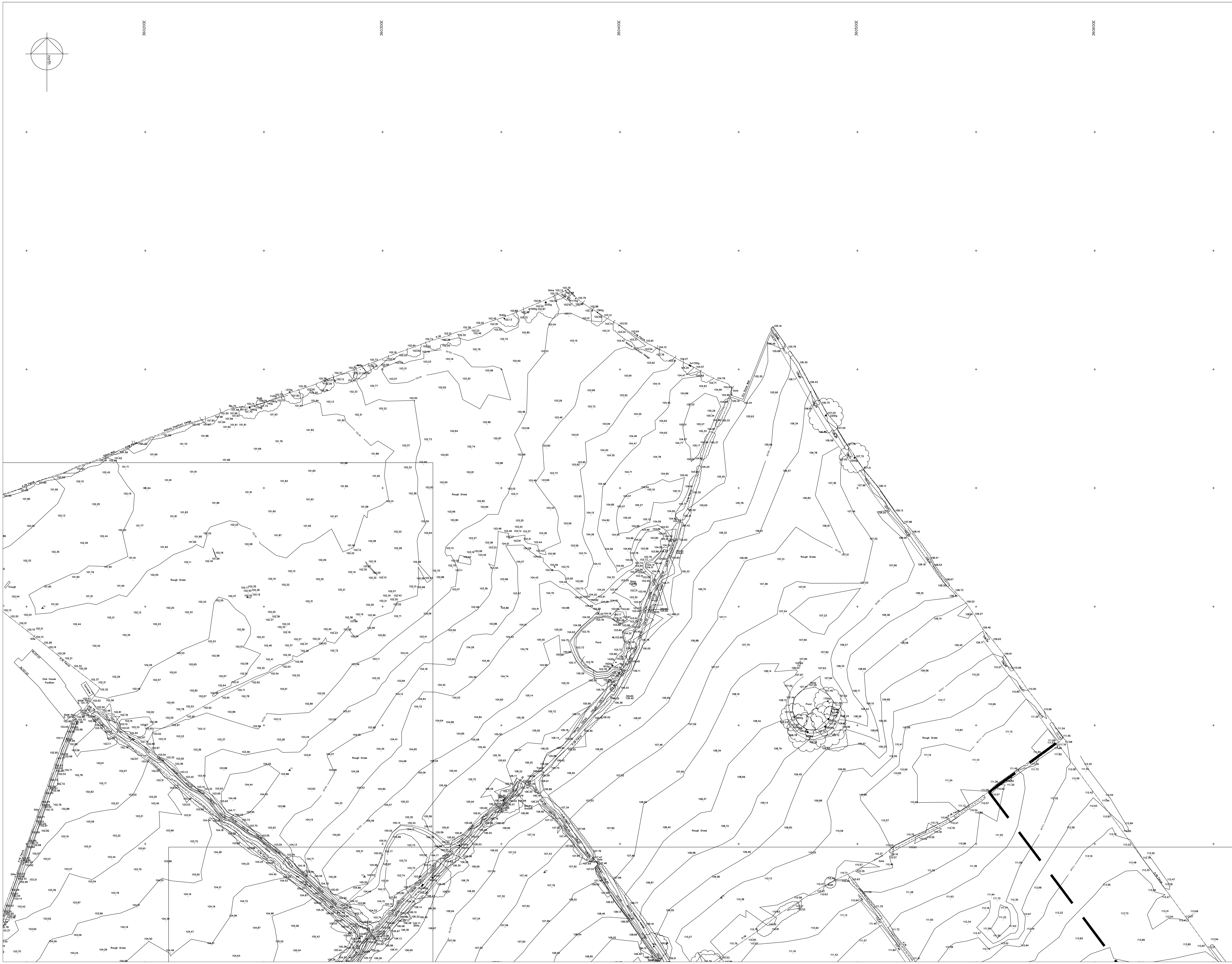

Legend (Topographical)

Fence - C/B Closed board, C/I Corrugated iron, C/L Chain link, Dil Dilapidated, C/P Conc. panel, H/R Hand rail, S/P Steel Palisade, I/R Iron railings, O/B Open board, P/P Post & panel, P/R Post & rail, P/W Post & wire, W/M Wire mesh, Ch/P Chestnut Paling

Overhead cable

Gate

Tree

50.00 Spot level

B	Bollard	KO	Kerb outlet	VP	Vent pipe
Bin	Litter bin	LB	Letter box	WM	Water meter
BS	Bus stop	LP	Lamp post	WO	Water outlet
BT	British Telecom IC	Mkr	Utility marker	UTL	Unable to Lift
CPS	Concrete Paving Slabs	MP	Mile post		Level prefix descriptions
CTV	Cable Television cover	NP	Name plate		
DR	Drain	PM	Parking meter	AL	Arch level
Elec	Electrical IC	P	Post	BL	Bed level
EP	Elec. pole	RE	Rodding eye	CL	Cover level
ER	Earth Rod	RS	Road sign	EL	Eaves level
FT	Floodlight	RWP	Rain water pipe	IL	Invert level
FP	Flagpole	ST	Stop tap	PL	Parapet level
GP	Gate post	SV	Stop valve	RL	Roof/Ridge level
G	Gully	SVP	Soil and vent pipe	SL	Soffit level
GV	Gas valve	Stay	Cable stay	Spr	Arch springing level
Hyd	Hydrant	TCB	Telephone call box	Thr	Threshold level
IC	Inspection Cover	TL	Traffic light	ToW	Top of wall level
JB	Junction box	TP	Telegraph pole	WL	Water level

Levels defining edge of carriageway are observed at channel (bottom of kerb).

STATION COORDINATES

STN	EASTING	NORTHING	LEVEL
1	360046.052	438075.076	103.669
2	359973.983	437900.946	106.736
3	360102.172	438230.032	102.057
4	360076.497	438151.762	102.828
5	360008.857	437979.182	105.422
6	359999.234	437904.541	106.859
7	360104.416	437864.142	108.238
8	359921.449	437923.762	107.573
9	360119.741	437817.117	108.854
10	360130.204	437783.994	109.568
11	360157.741	437659.066	110.954
12	360079.844	438031.962	104.603
13	360063.229	437955.005	106.341
14	360014.283	437940.169	106.927
15	360114.155	437931.710	106.413
16	360154.700	438003.288	105.614
17	360227.466	438045.530	104.996
18	360097.270	438206.420	102.297
19	360156.766	438199.392	102.063
20	360243.079	438203.966	102.496
21	360260.817	438131.083	104.164
22	360292.389	438086.190	105.355
23	360299.904	438037.938	106.727
24	360225.836	437937.023	106.905
25	360263.673	437997.737	106.553
26	360268.820	437872.795	108.110
27	360294.128	437838.604	110.031
28	360275.391	437806.285	110.249
29	360388.929	437840.149	112.160
30	360354.799	437823.947	111.299
31	360354.542	437796.389	111.674
32	360356.251	437771.532	111.852
33	360465.377	437946.664	113.645
34	360540.863	437934.736	115.716
35	360442.676	438077.345	110.300
36	360637.883	437966.054	117.404
37	360382.216	437955.964	111.717
38	360492.729	437863.633	115.614
39	360703.590	437826.133	122.026
40	360398.931	438016.872	110.454
41	360368.257	438088.084	107.813

SURVEY GRID AND LEVELS ARE DEFINED UTILISING THE LEICA SMARTNET GNSS NETWORK.
ONLY MANHOLES FOUND DURING THE SITE SURVEY ARE INDICATED ON THIS PLAN. FURTHER INVESTIGATION MAY BE REQUIRED TO DETERMINE THE FULL EXTENT OF THE SITE DRAINAGE.

ISSUE	REVISION	DATE
C	INGLEWHITE ROAD SURVEY EXTENDED.	20.09.17.
B	MANHOLE SURVEY ADDED.	01.11.16.

Project
INGLEWHITE ROAD,
LONGRIDGE,
PRESTON.

Drawing title
SITE SURVEY.

Scales 1:500 Date 31.01.2013

Drawing number SDL 2062/3. Rev. C. Drawn by BJ

CLIENT BARRATT HOMES MANCHESTER.
CITY PARK,
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Survey & Design Limited
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Tel: 01942 673136, Fax: 01942 607054
Email: bryn@surveyanddesign.co.uk
LAND SURVEYING ○ DESIGN CONSULTANTS
CIVIL ○ ARCHITECTURAL ○ PLANNING

Drawings
Engineering Layout

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STND/19/002A	Manhole Type 2 and Invert Access Detail
STND/19/003A	Shallow Manhole Detail for Small Diameter Pipes (Type 4)
STND/19/004A	Shallow Surface Water Manhole Detail – Restricted Headroom (less than 2.0m) – For Pipe Sizes 450Dia and Above
STND/19/005A	Flow Control Manhole Detail
STND/19/007A	External Backdrop Detail
STND/19/008A	Pipe Bedding Detail
STND/19/010A	Variable Manhole – Guidance Notes
STND/19/011A	Headwall Type 1 and Typical Outlet Grille Detail
STND/19/012A	Typical Outfall Details Type 2 & Type 3

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ENGINEERING KEY

S1 Adoptable S.W. Sewer & Manhole
F1 Adoptable F.W. Sewer & Manhole
Silt Trap Manhole at Overflow Basins
S1 Adoptable S.W. Sewer Headwall
(10.25) S. Water Drag–Out and Invert
10.25 Foul Drag–Out and Invert
Adoptable Road Gully
Street Name Plate

FLOW CONTROL DETAILS

MH Ref.	Specification
S110	ACO Orifice Plate to be Supplied by ACO Technologies. Tel 01462 816666. Ref: SL20190923 1No. 247mm Q–Plate–RW
S324	Crown Flow Control Device to be Supplied by Crown Water Systems. Tel 01344 886 996. Ref: 4280619 1No. 230mm QR5 Type Vortex Flow Control Unit. Head=3.20m, Flow=42.4 l/s.
S414	Crown Flow Control Device to be Supplied by Crown Water Systems. Tel 01344 886 996. Ref: 4280619 1No. 192mm QR5 Type Vortex Flow Control Unit. Head=2.6m, Flow=26.6 l/s.

REV	DESCRIPTION	DATE	DRAWN
C	Site lifted to reduce soil leaving site. FFLs and cover levels revised.	01.11.19	CD
B	Easement from S201–S49 & F321–F23 added; Flow control units updated to Crown spec.; Pond water levels revised to suit new calcs; Existing sewer in Road 19 revised; S109 & F104 revised.	06.09.19	CD
A	Plot drainage added	01.07.19	CD

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Fax: 0161 855 2828

Job
Chipping Lane
Longridge
Phases 2 & 3

Title
Section 104
Drainage Layout

Design By	Date	Drawing Number	Rev
CD	April 2019	459/ED/105	C
C.A.D By	Scale @ A0		
CD	1:500		

Drawings
Developable Areas Plan

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Phase	Developable Area (Ha)	Greenfield Runoff Rate per Hectare (l/s/Ha)	Allowable Runoff Rate (l/s)
1	4.32	8.3	35.9
2A	1.80	13.6	24.5
2B	2.69	13.6	36.6
3	1.71	13.6	23.3
		TOTAL	120.2

Network	Maximum Allowable Discharge (l/s)	Actual Discharge Rates (l/s)
1+2A	60.3	49.9
2B	36.6	41.8
3	23.3	26.3
TOTAL	120.2	118.0

REV	DESCRIPTION	DATE	DRAWN

BARRATT
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4 Brindley Road
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M16 9HQ
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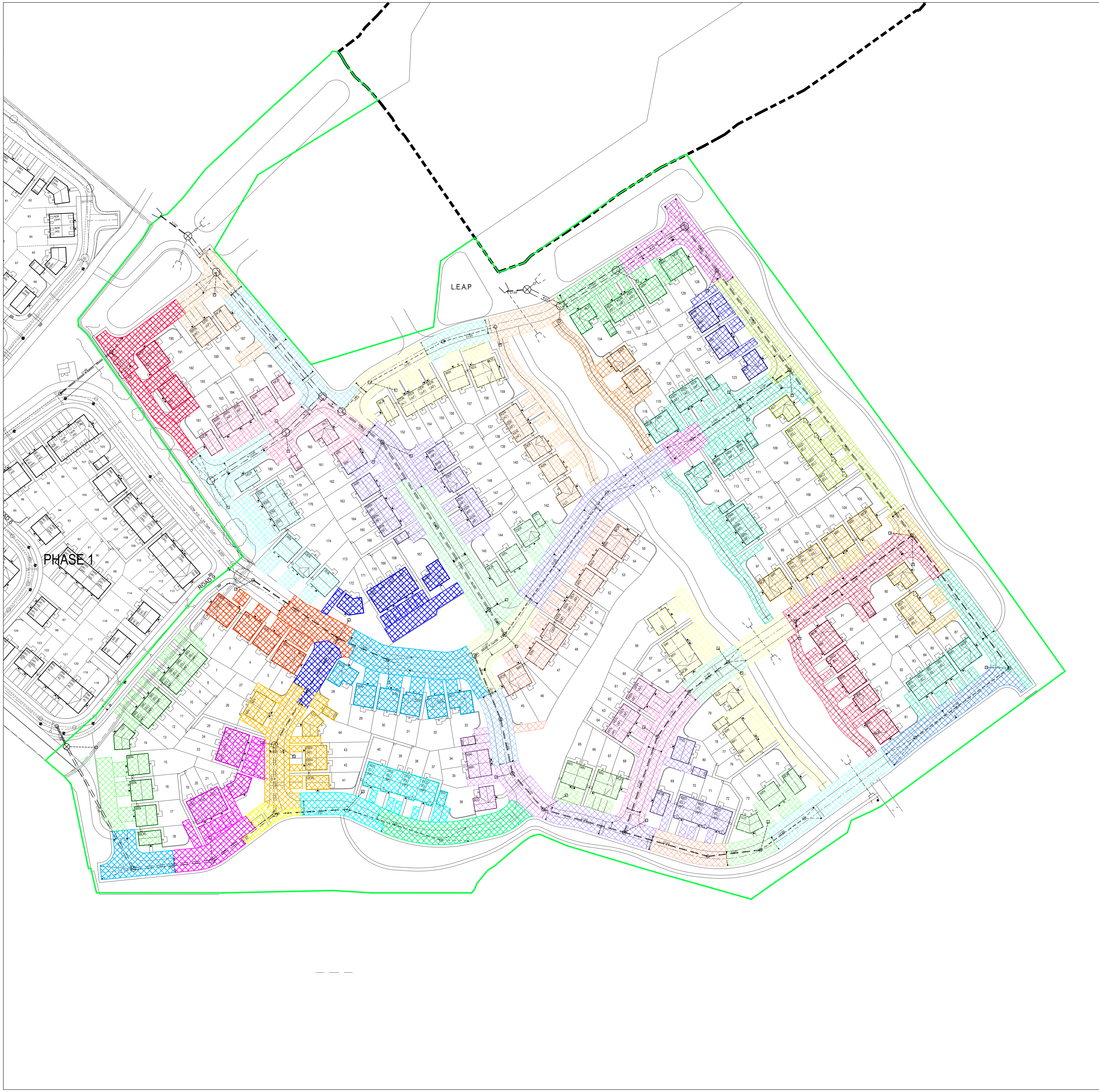
Fax: 0161 855 2828

Job
Chipping Lane
Longridge
Phases 1, 2 & 3

Title
Developable Areas Plan

Design By	Date	Drawing Number	Rev
CD	Oct 2019	459/ED/146	-
C.A.D By	Scale @ A0		
CD	1:1000		

Drawings
Surface Water Drainage Area Plan



	Inc. 10% Urban Creep
1-1.000 = 0.075 Ha	1-1.000 = 0.083 Ha
1-1.001 = 0.081 Ha	1-1.001 = 0.089 Ha
1-1.002 = 0.091 Ha	1-1.002 = 0.100 Ha
1-1.003 = 0.013 Ha	1-1.003 = 0.014 Ha
1-1.004 = 0.084 Ha	1-1.004 = 0.092 Ha
1-1.005 = 0.031 Ha	1-1.005 = 0.034 Ha
1-1.006 = 0.098 Ha	1-1.006 = 0.108 Ha
1-2.000 = 0.110 Ha	1-2.000 = 0.121 Ha
1-3.000 = 0.049 Ha	1-3.000 = 0.054 Ha
1-3.001 = 0.062 Ha	1-3.001 = 0.068 Ha
2-1.000 = 0.076 Ha	2-1.000 = 0.084 Ha
3-1.000 = 0.120 Ha	3-1.000 = 0.132 Ha
3-1.001 = 0.023 Ha	3-1.001 = 0.025 Ha
3-1.002 = 0.079 Ha	3-1.002 = 0.087 Ha
3-1.003 = 0.075 Ha	3-1.003 = 0.083 Ha
3-1.004 = 0.028 Ha	3-1.004 = 0.031 Ha
3-1.005 = 0.051 Ha	3-1.005 = 0.056 Ha
3-1.006 = 0.026 Ha	3-1.006 = 0.029 Ha
3-1.007 = 0.034 Ha	3-1.007 = 0.037 Ha
3-1.008 = 0.081 Ha	3-1.008 = 0.089 Ha
3-1.009 = 0.102 Ha	3-1.009 = 0.112 Ha
3-1.010 = 0.110 Ha	3-1.010 = 0.121 Ha
3-1.011 = 0 Ha	3-1.011 = 0 Ha
3-1.012 = 0.051 Ha	3-1.012 = 0.056 Ha
3-1.013 = 0.047 Ha	3-1.013 = 0.052 Ha
3-1.014 = 0 Ha	3-1.014 = 0 Ha
3-2.000 = 0.046 Ha	3-2.000 = 0.051 Ha
3-2.001 = 0.042 Ha	3-2.001 = 0.046 Ha
3-2.002 = 0.024 Ha	3-2.002 = 0.026 Ha
3-3.000 = 0.081 Ha	3-3.000 = 0.089 Ha
3-4.000 = 0.093 Ha	3-4.000 = 0.102 Ha
3-4.001 = 0.021 Ha	3-4.001 = 0.023 Ha
3-4.002 = 0.081 Ha	3-4.002 = 0.089 Ha
3-5.000 = 0.109 Ha	3-5.000 = 0.120 Ha
3-5.001 = 0.090 Ha	3-5.001 = 0.099 Ha
4-1.000 = 0.046 Ha	4-1.000 = 0.051 Ha
4-1.001 = 0.071 Ha	4-1.001 = 0.078 Ha
4-1.002 = 0.090 Ha	4-1.002 = 0.099 Ha
4-1.003 = 0.099 Ha	4-1.003 = 0.109 Ha
4-1.004 = 0.041 Ha	4-1.004 = 0.045 Ha
4-1.005 = 0.045 Ha	4-1.005 = 0.050 Ha
4-1.006 = 0.068 Ha	4-1.006 = 0.075 Ha
4-1.007 = 0.046 Ha	4-1.007 = 0.051 Ha
4-1.008 = 0 Ha	4-1.008 = 0 Ha
4-2.000 = 0.143 Ha	4-2.000 = 0.157 Ha
4-3.000 = 0.015 Ha	4-3.000 = 0.017 Ha
4-3.001 = 0.157 Ha	4-3.001 = 0.173 Ha

REV	DESCRIPTION	DATE	DRAWN

BARRATT
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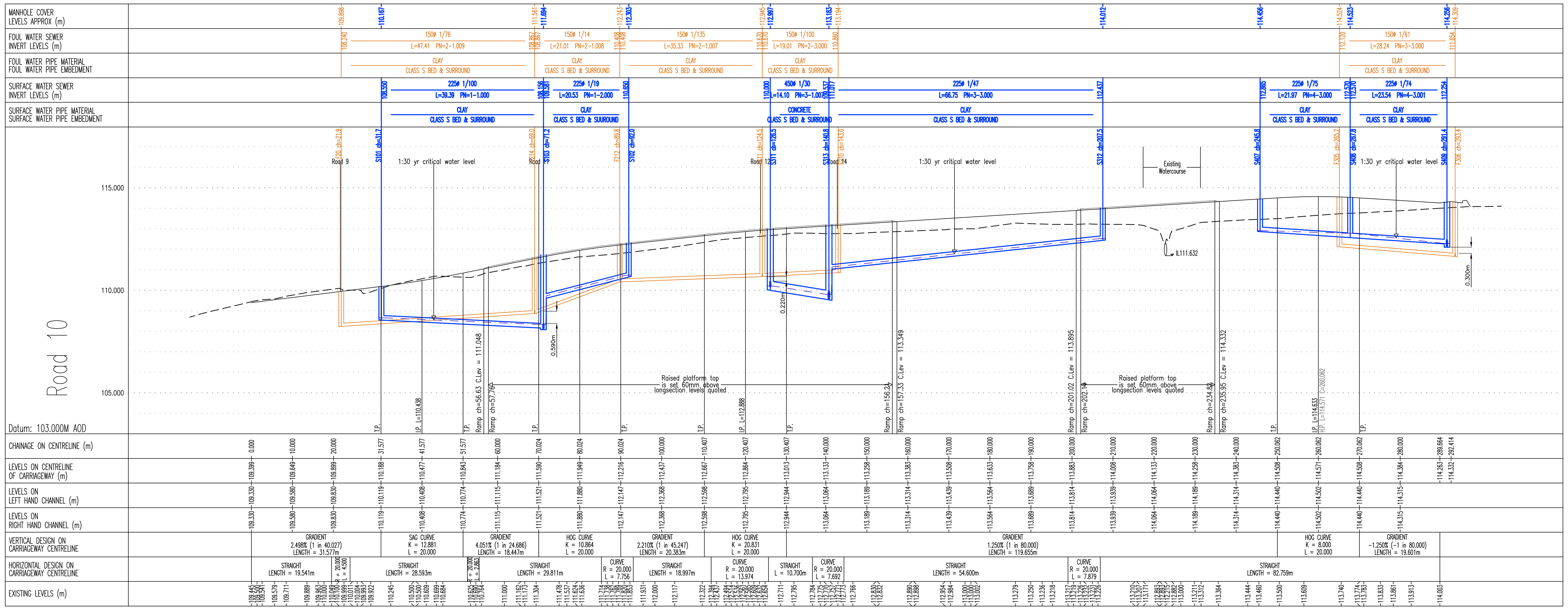
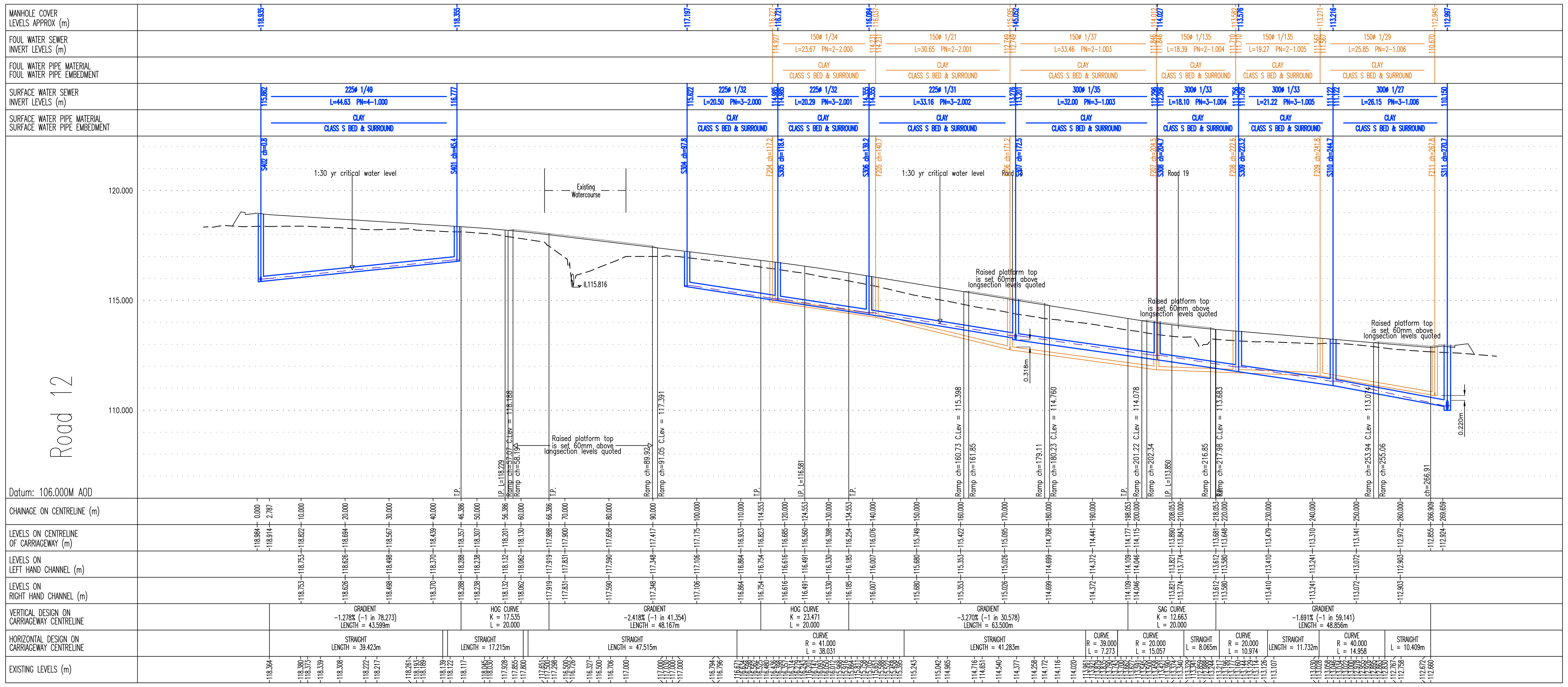
Job
Chipping Lane
Longridge
Phases 2 & 3

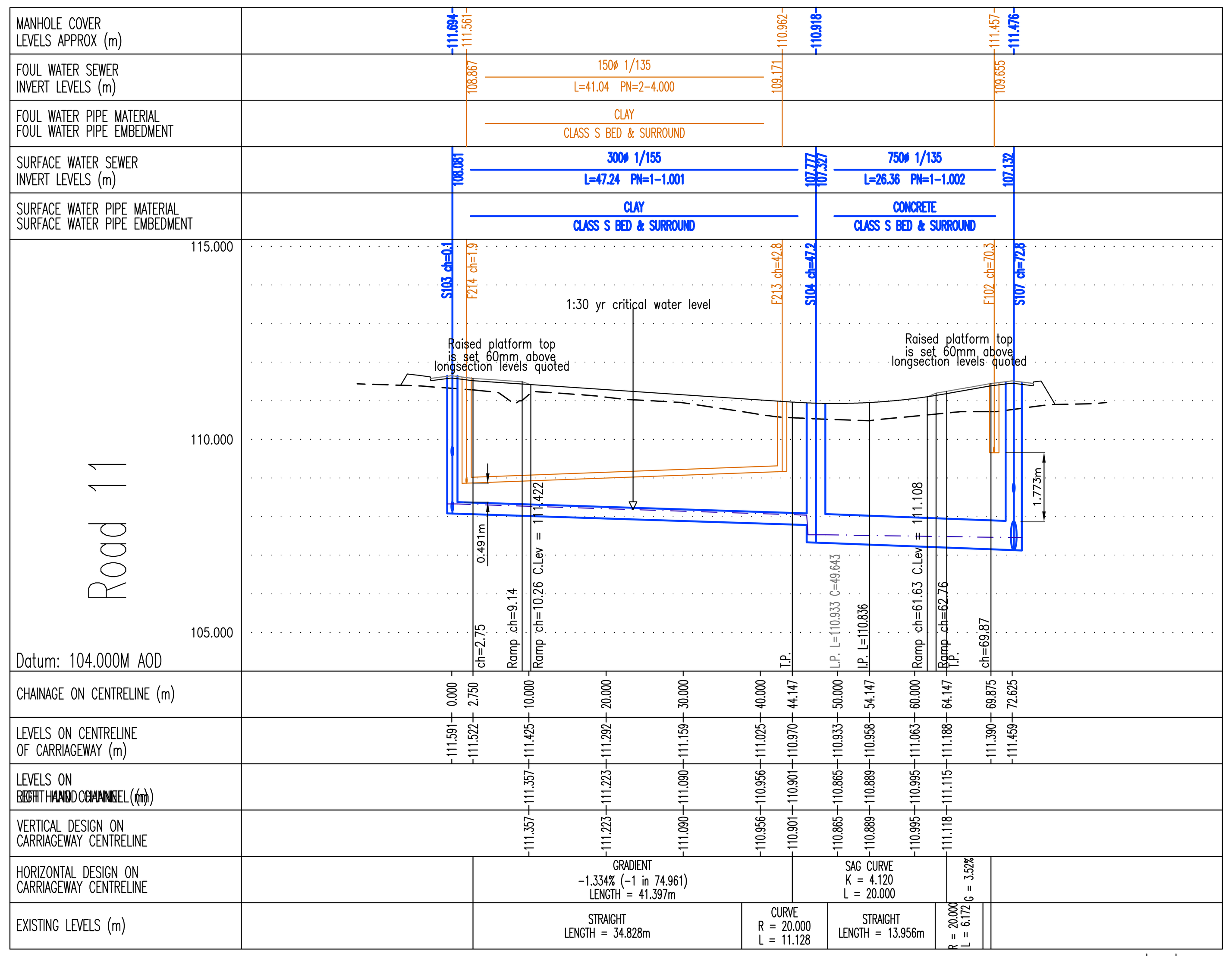
Title
Surface Water Drainage Areas

Design By	Date	Drawing Number	Rev
CD	April 2019	459/ED/103	-
C.A.D By	Scale @ A0		
CD	1:500		

Drawings
Longsections







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STND/01/001B	Standard Detail No 4 (Type 1 Manhole) Standard Detail No 5 (Type 2 Manhole) Standard Detail No 6 (Manhole Accesses)
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STND/01/004B	Manhole and French Drain Details MH3, MH4, MH5 and PS6
STND/01/005B	Manhole Details and Brick Invert Renovation MH6, MH7, MH8, and BS1
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STND/05/001B	Pipe Embedment Details

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SCALES
HORZ: 1/500
VERT: 1/100

REV	DESCRIPTION	DATE	DRAWN
B	Site lifted to reduce soil leaving site. Highways and drainage cover levels revised to suit	01.11.19	CD
A	Top water levels labelled; Pipe codes corrected; F20 revised to as–built level	10.09.19	CD

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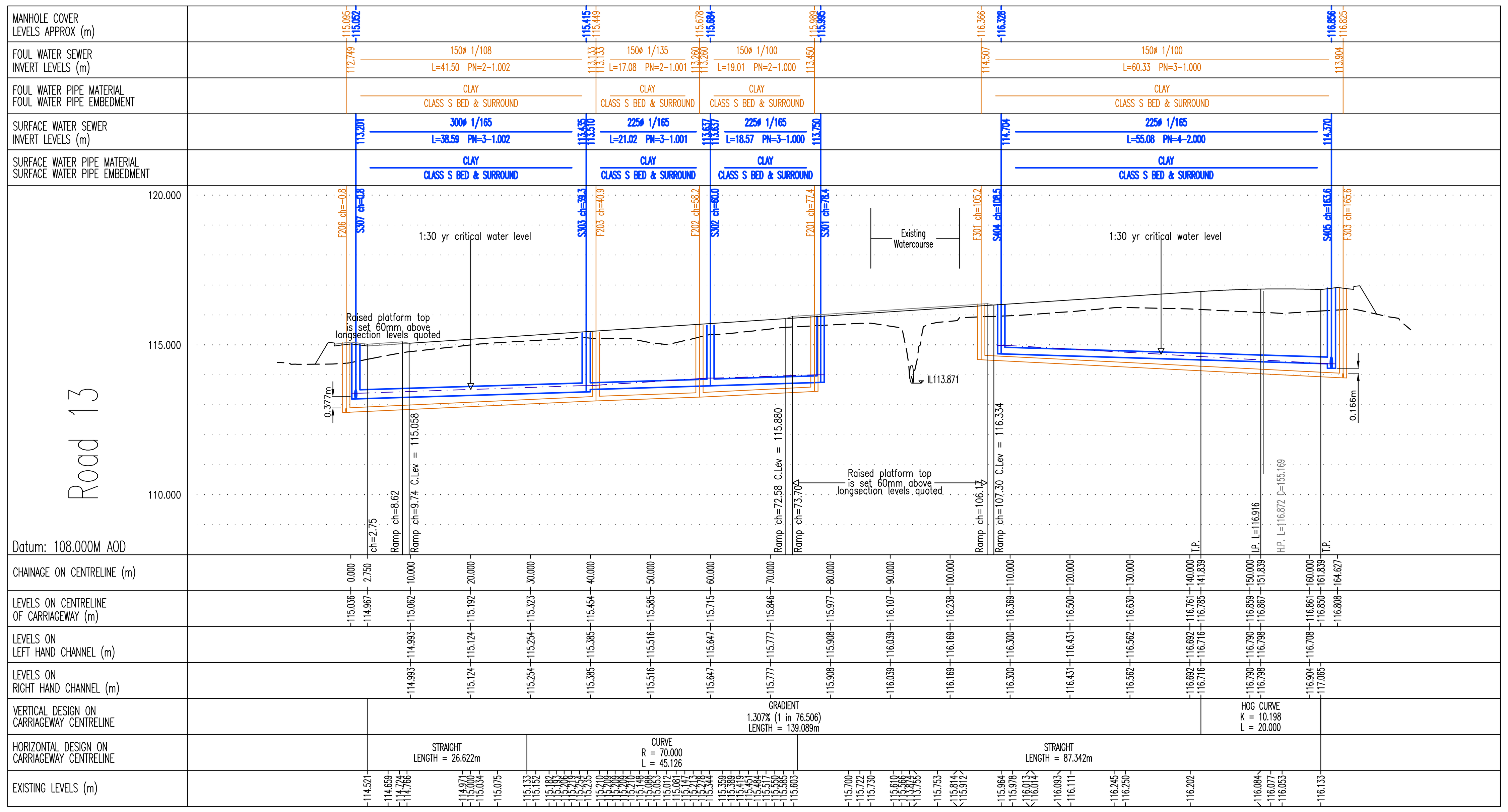
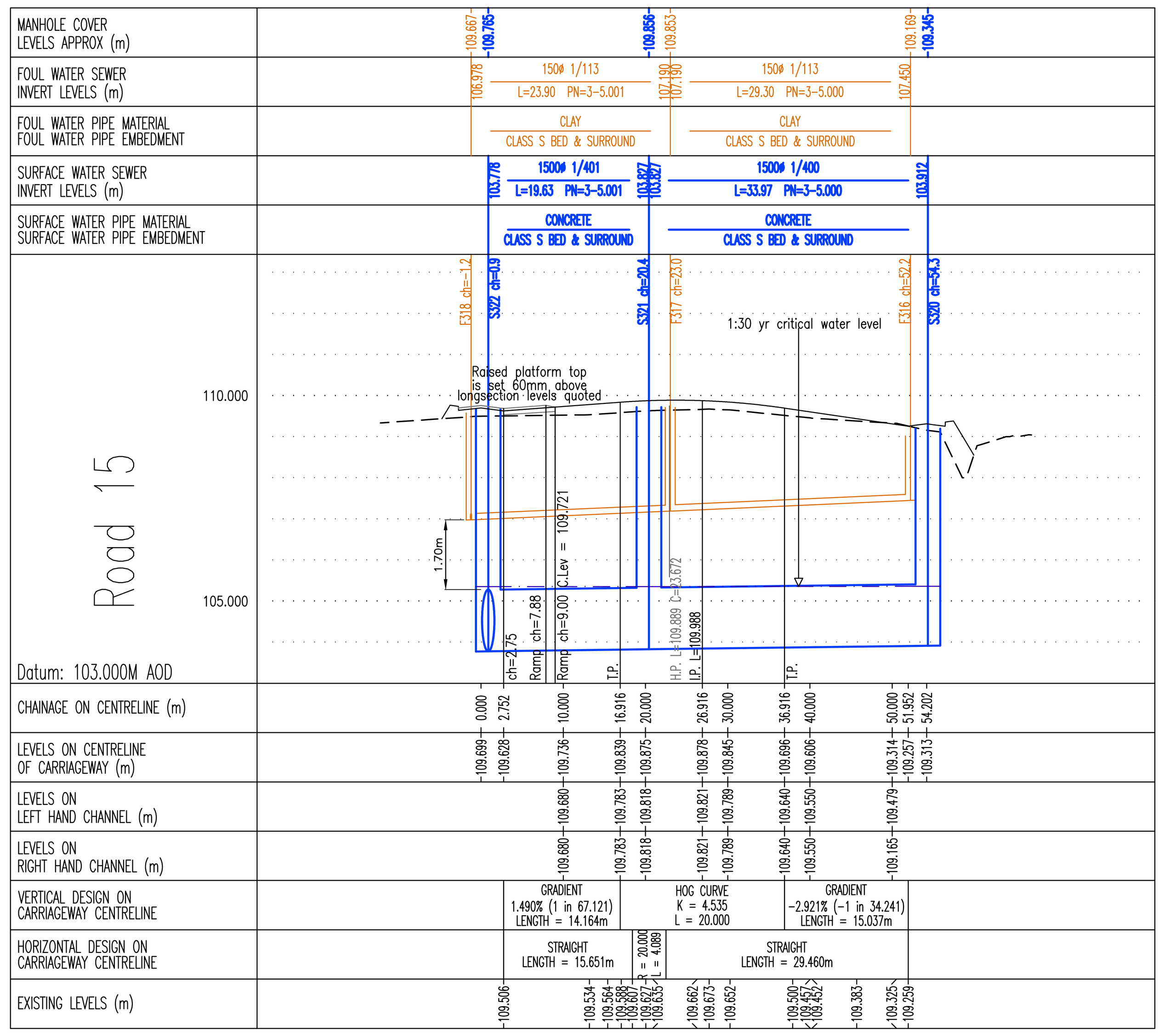
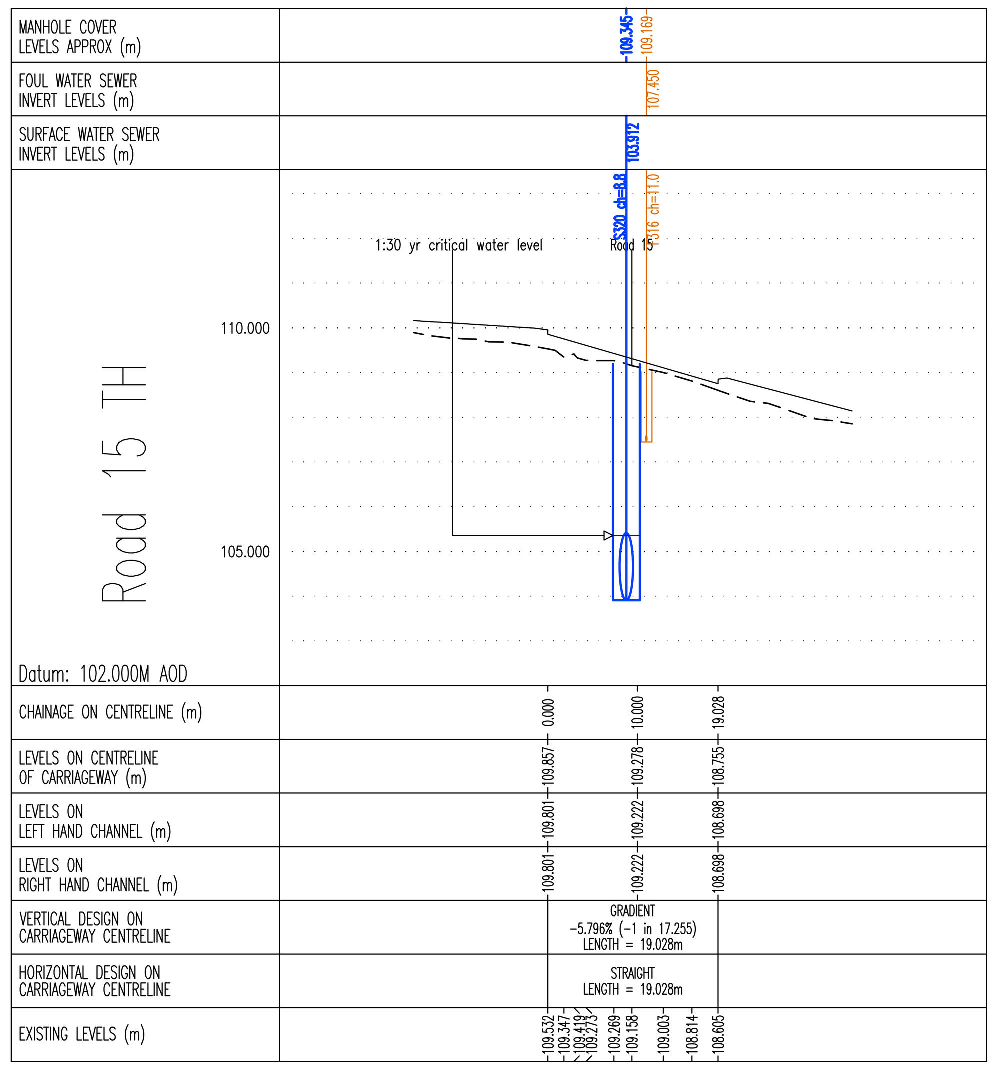
Job
Chipping Lane
Longridge
Phases 2 & 3

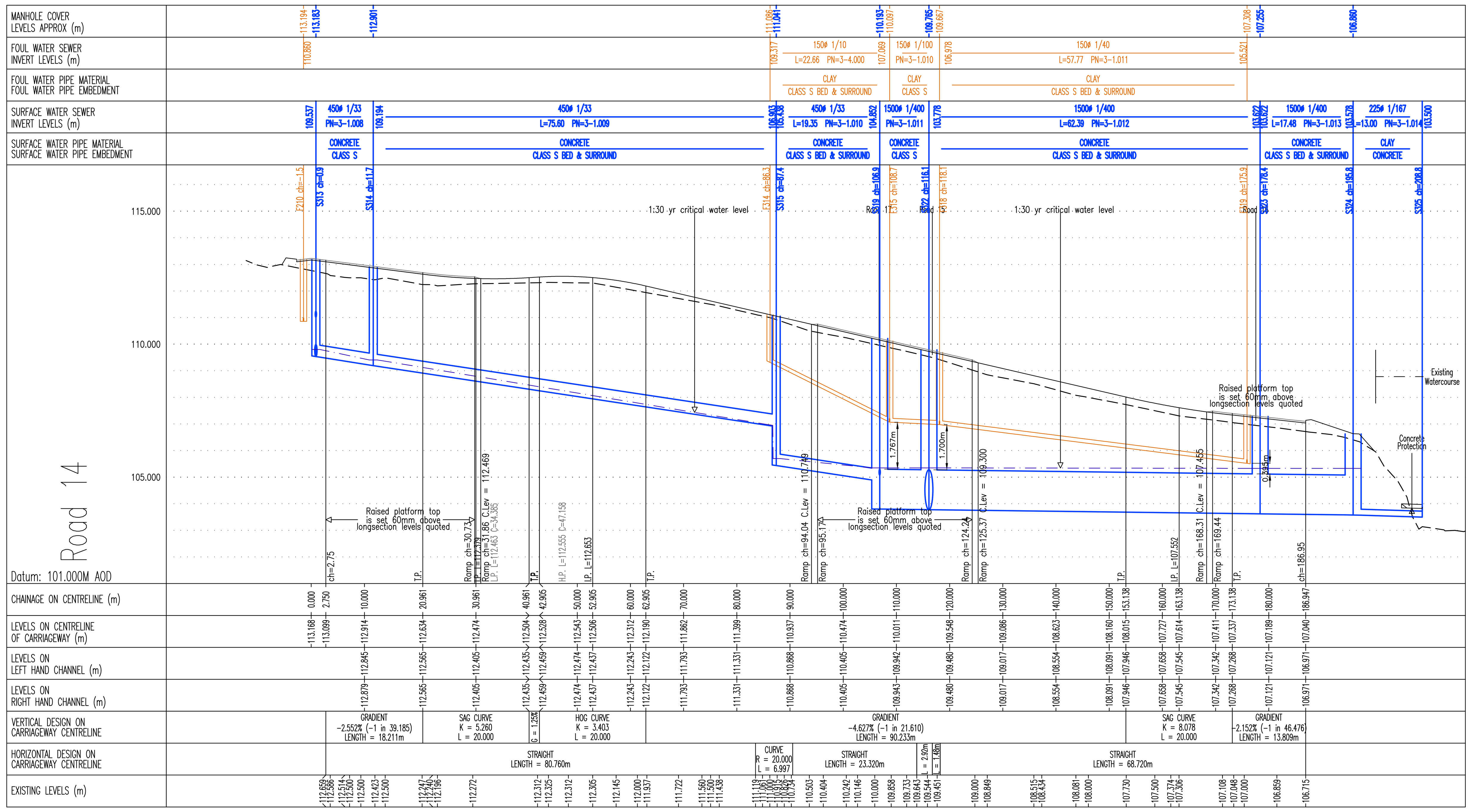
Title
Engineering Longsections
Sheet 1
Roads 10-12

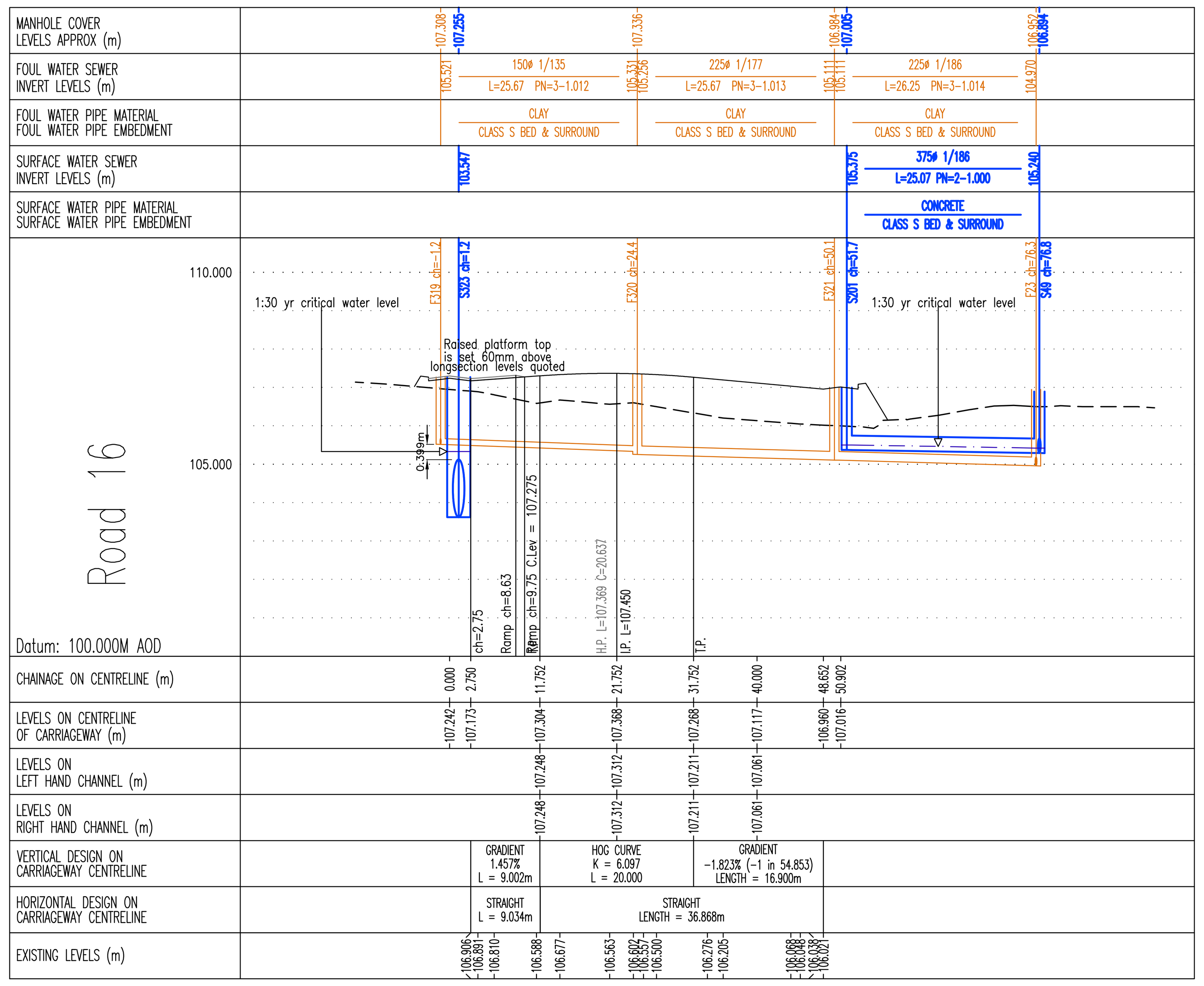
Design By	Date	Drawing Number	Rev
CD	April 2019	459/ED/108	B
C.A.D By	Scale @ A0		
CD	1:500H; 1:100V		

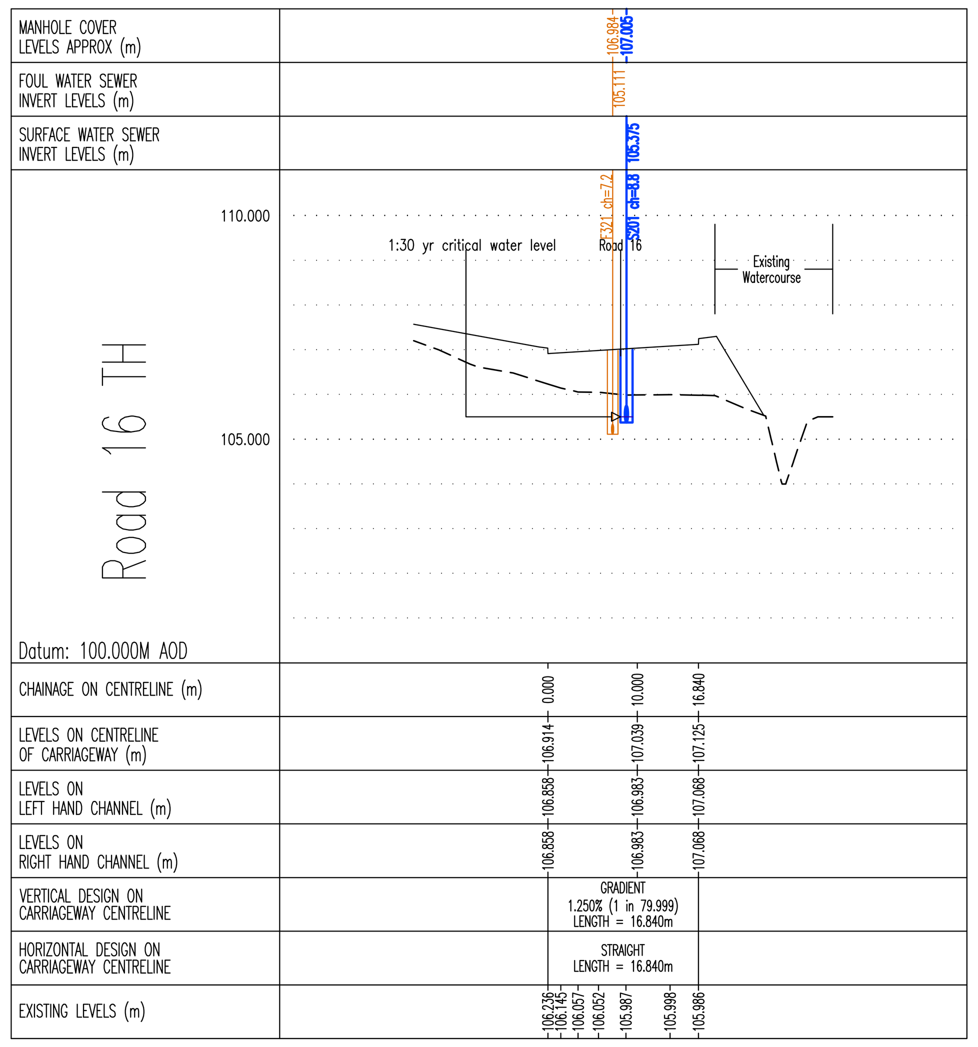












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SCALES

HORZ: 1/500
VERT: 1/100

REV	DESCRIPTION	DATE	DRAWN
B	Site lifted to reduce soil leaving site. Highways and cover levels revised to suit	01.11.19	CD
A	Top water levels labelled; Pipe codes corrected; Connections off Road 16 revised to suit as–built levels	10.09.19	CD

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Job
Chipping Lane
Longridge
Phases 2 & 3

Title
Engineering Longsections
Sheet 2
Roads 13-16

Design By	Date	Drawing Number	Rev
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C.A.D By	Scale @ A0		
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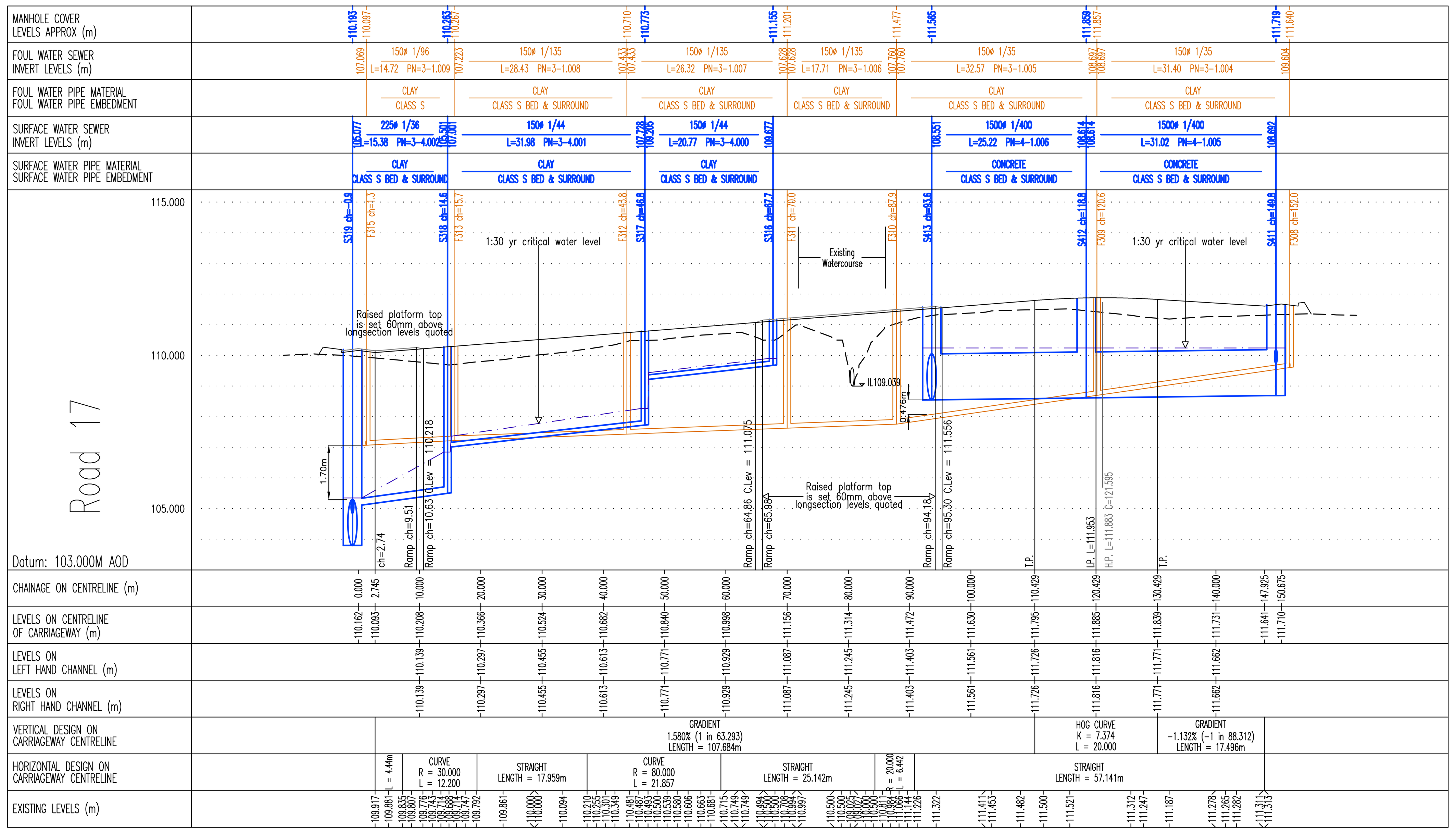

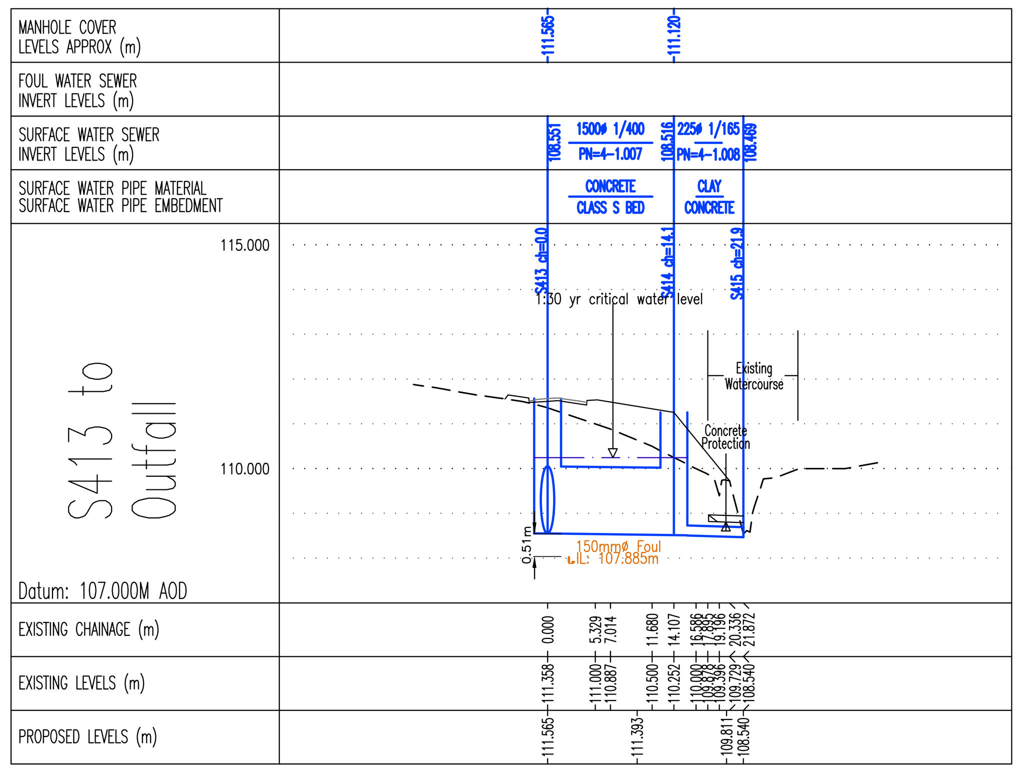

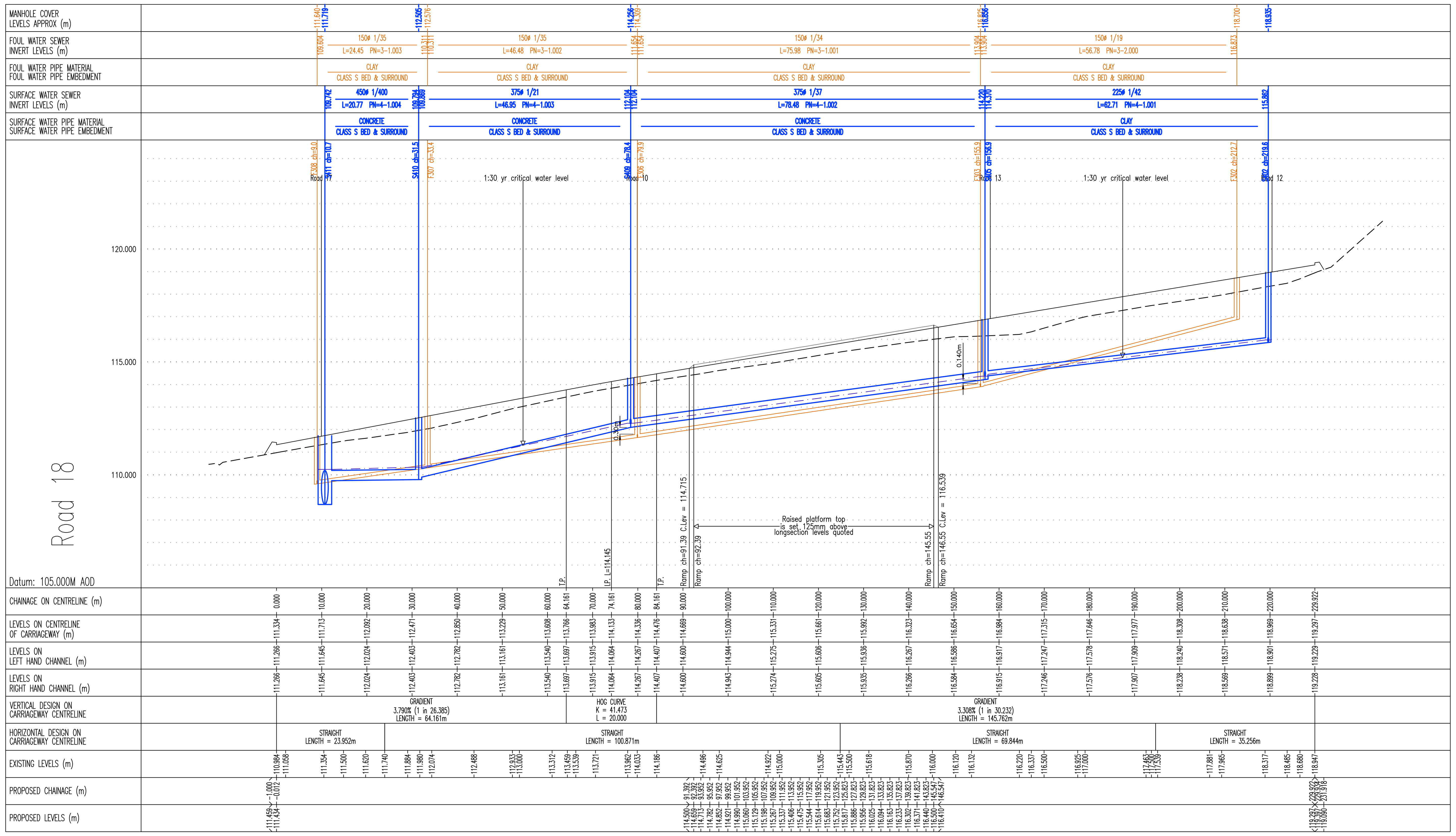

ENGINEERING LAYOUT NOTES

1. All adoptable drainage works have been designed and are to be constructed in accordance with "Sewers for Adoption, 6th Edition, and United Utilities 'Guidelines for Sewer for adoption 6th Edition'. Where specification conflicts, UU guidlines shall take presidence.

United Utilities Standard details to be used are:

STND/00/006B	Typical Outfall Details D, E and F
STND/00/007C	Typical Details G & H Outlet Grille and safety grille to materials access shaft
STND/01/001B	Standard Detail No 4 (Type 1 Manhole) Standard Detail No 5 (Type 2 Manhole) Standard Detail No 6 (Manhole Accesses)
STND/01/002C	Standard Details 7, 8, 9 and 10 Ladders, Safety Chains and Handrailing.
STND/01/003B	Typical Details A, B, and C External and Internal Backdrops and Connection Details
STND/01/004B	Manhole and French Drain Details MH3, MH4, MH5 and PS6
STND/01/005B	Manhole Details and Brick Invert Renovation MH6, MH7, MH8, and BS1
STND/01/006B	Typical Details I and J – Segmental Shafts
STND/05/001B	Pipe Embedment Details

2. All clay pipe work shall be Extra Strength Clayware to BS 295 and BS 65 (SW pipes only).

3. All precast concrete pipework shall be to Class 120 in accordance with BS5911 Part 1, BS EN 1916 and bear the BS kitemark.

4. All adoptable drainage to be bedded in Class S granular surround unless otherwise stated.

5. All Concrete manholes and Soakaways rings, Concrete cover slabs and Con to be manufactured to BS EN 1917 and BS 5911:Part 3.

6. Rising Mains to be Black Polyethylene Pipes complying to BS EN 13244-2. Polyethylene fittings, including fusion joints, and electro-fusion fittings shall comply with BS EN 13244-2.

7. All levels relate to Ordnance Datum. Contractor to ensure that this drawing is read in conjuction with the site specific Topographical Survey provided by Barratt Manchester and the Benchmark information provided.

8. This drawing is to be read in accordance with all other relevant drawings.

9. The contractor shall be responsible for ensuring that any existing invert levels indicated on the drawings are correct before work commences.

10. All proposed connections to the sewer shall be 150ø unless stated otherwise.

11. All private house drainage shall be 100ø and all drag-out connections shall be 150ø at a minimum gradient of 1:80 unless otherwise stated and laid in accordance with Part H of the the Building Regulations.

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SCALES

HORZ: 1/500
VERT: 1/100

REV	DESCRIPTION	DATE	DRAWN
B	Site lifted to reduce soil leaving site. Highways and cover levels revised	01.11.19	CD
A	Top water levels labelled; Pipes codes corrected	06.09.19	CD

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Longridge
Phases 2 & 3

Title
Engineering Longsections
Sheet 3
Roads 17-18

Design By	Date	Drawing Number	Rev
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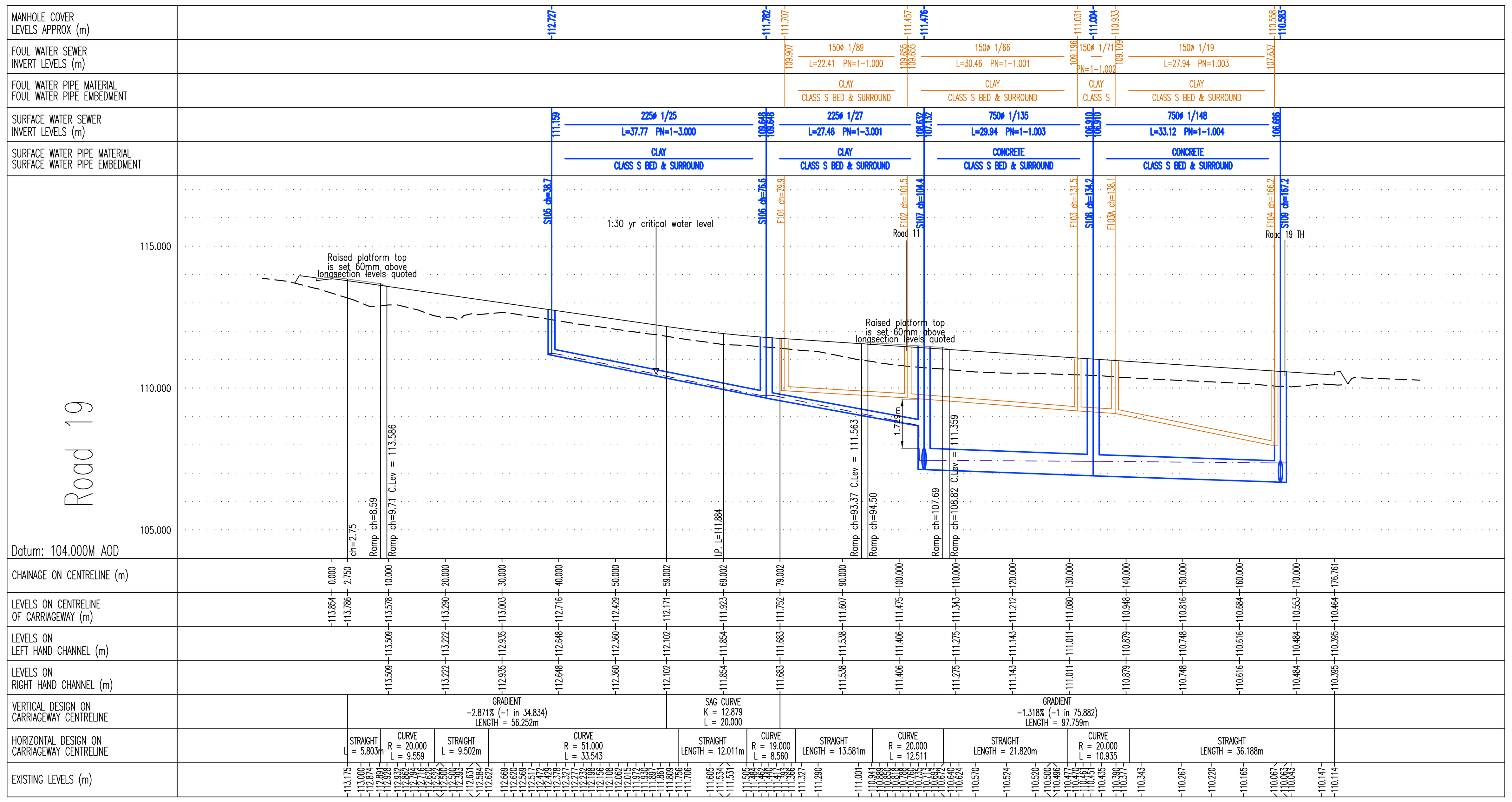
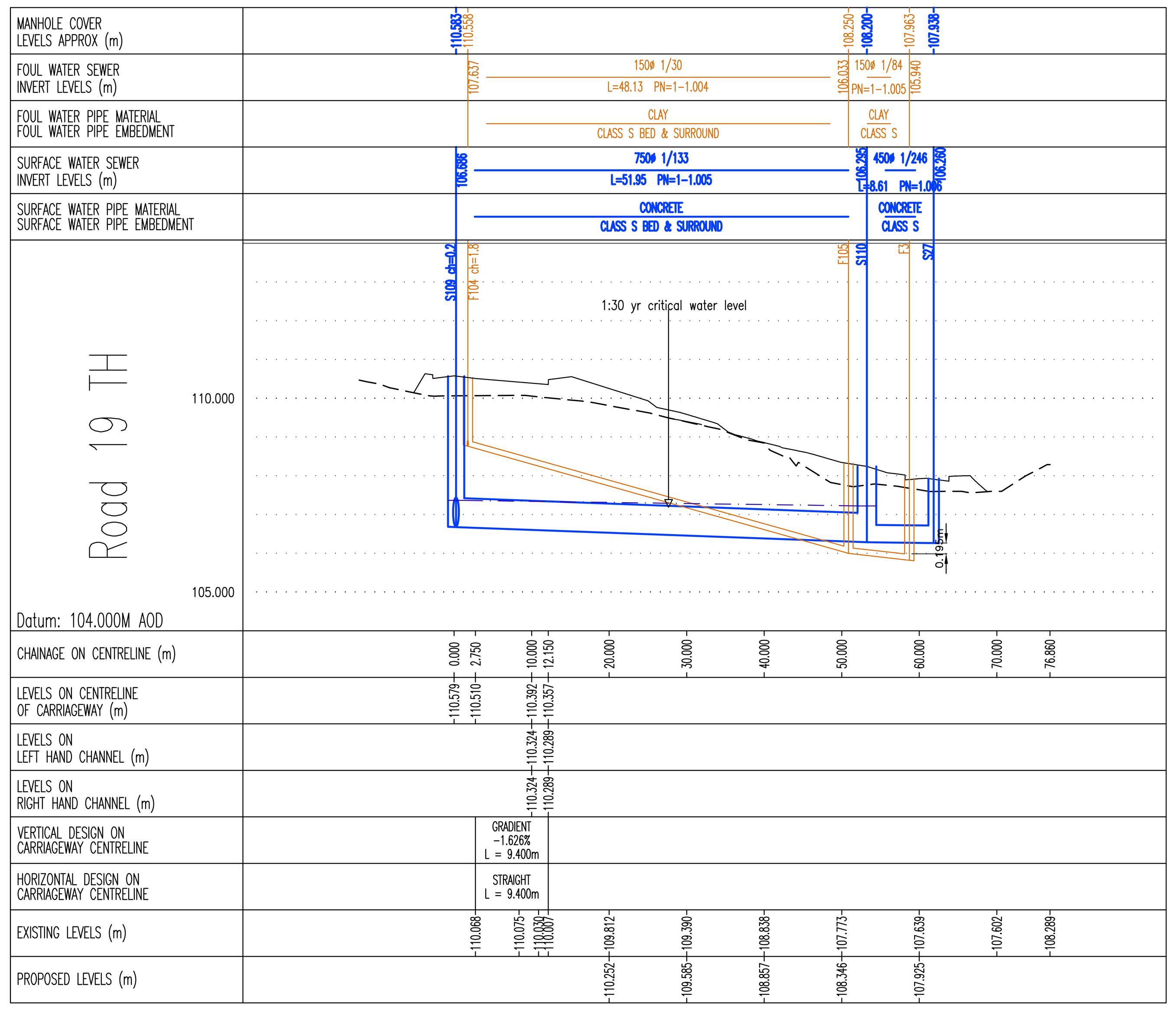
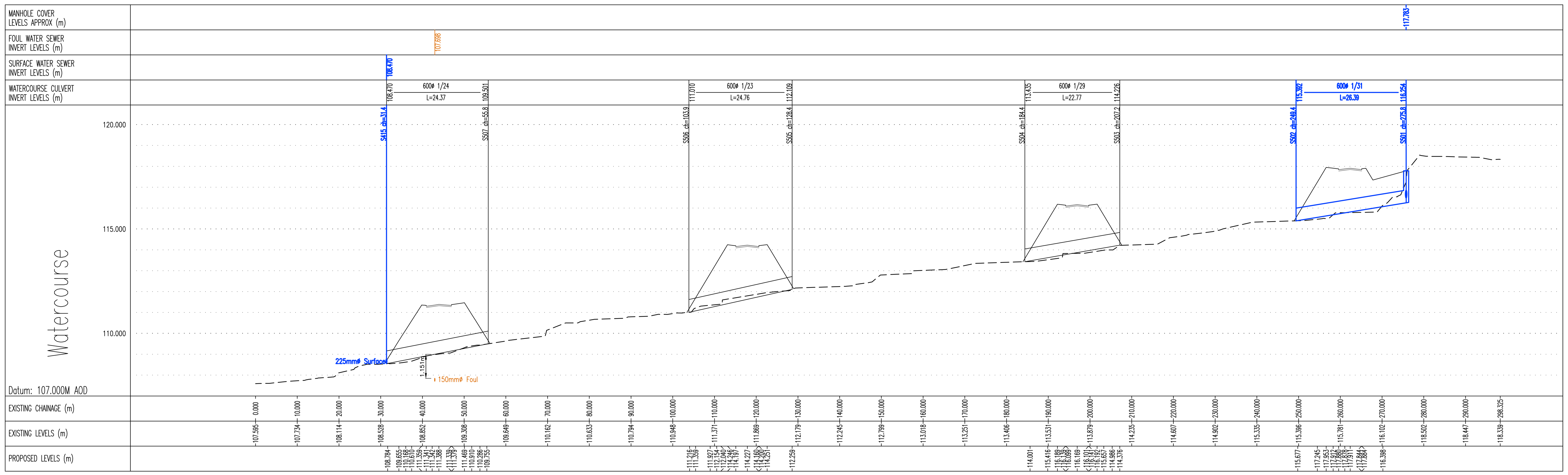
C.A.D By	**Scale @ A0**		
CD	1:500H; 1:100V		







WARNING TO HOUSE-PURCHASERS
Property Misdescriptions Act 1991

Buyers are warned that this is a working drawing and is not intended to be treated as descriptive material describing, in relation to any particular property or development, any of the Specified matters prescribed by any Order made under the above Act. The contents of this drawing may be subject to change at any time and alterations and variations can occur during the progress of the works without revision of the drawing. Consequently the layout, form, content and dimensions of the finished construction may differ materially fron those shown. Nor do the contents of this drawing constitute a contract, part of any contract or warranty.

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SCALES
HORZ: 1/500
VERT: 1/100

REV	DESCRIPTION	DATE	DRAWN
B	Site lifted to reduce soil leaving site. Highways and cover levels revised	01.11.19	CD
A	Top water levels labelled; F3 & S27 revised to as–built levels	10.09.19	CD

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Job
Chipping Lane
Longridge
Phases 2 & 3

Title
Engineering Longsections
Sheet 4
Road 19 & Watercourse

Design By	Date	Drawing Number	Rev
CD	May 2019	459/ED/111	B
C.A.D By	Scale @ A0		
CD	1:500H; 1:100V		

Drawings
Flood Route Plan

WARNING TO HOUSE-PURCHASERS
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REV	DESCRIPTION	DATE	DRAWN
A	Road contours and finished floor levels revised	01.11.19	CD

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Chipping Lane
Longridge
Phases 2 & 3

Title
Flood Routing Plan

Design By	Date	Drawing Number	Rev
CD	May 2019	459/ED/115	A
C.A.D By	**Scale @ A0**		
CD	1:500		

Drawings
Plot Drainage

WARNING TO HOUSE-PURCHASERS
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REV	DESCRIPTION	DATE	DRAWN
A	Site lifted to reduce soil leaving site. Levels revised to suit	01.11.19	CD

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Job
Chipping Lane
Longridge
Phases 2 & 3

Title
Plot Drainage
Sheet 1

Design By	Date	Drawing Number	Rev
CD	June 2019	459/ED/128	A
C.A.D By: CD	Scale @ A0: 1:200		

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REV	DESCRIPTION	DATE	DRAWN
A	Site lifted to reduce soil leaving site. Levels revised to suit	01.11.19	CD

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Job
Chipping Lane
Longridge
Phases 2 & 3

Title
Plot Drainage
Sheet 2

Design By	Date	Drawing Number	Rev
CD	June 2019	459/ED/129	A
C.A.D By	Scale @ A0		
CD	1:200		

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REV	DESCRIPTION	DATE	DRAWN
A	Site lifted to reduce soil leaving site. Levels revised to suit	01.11.19	CD

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Job
Chipping Lane
Longridge
Phases 2 & 3

Title
Plot Drainage
Sheet 3

Design By	Date	Drawing Number	Rev
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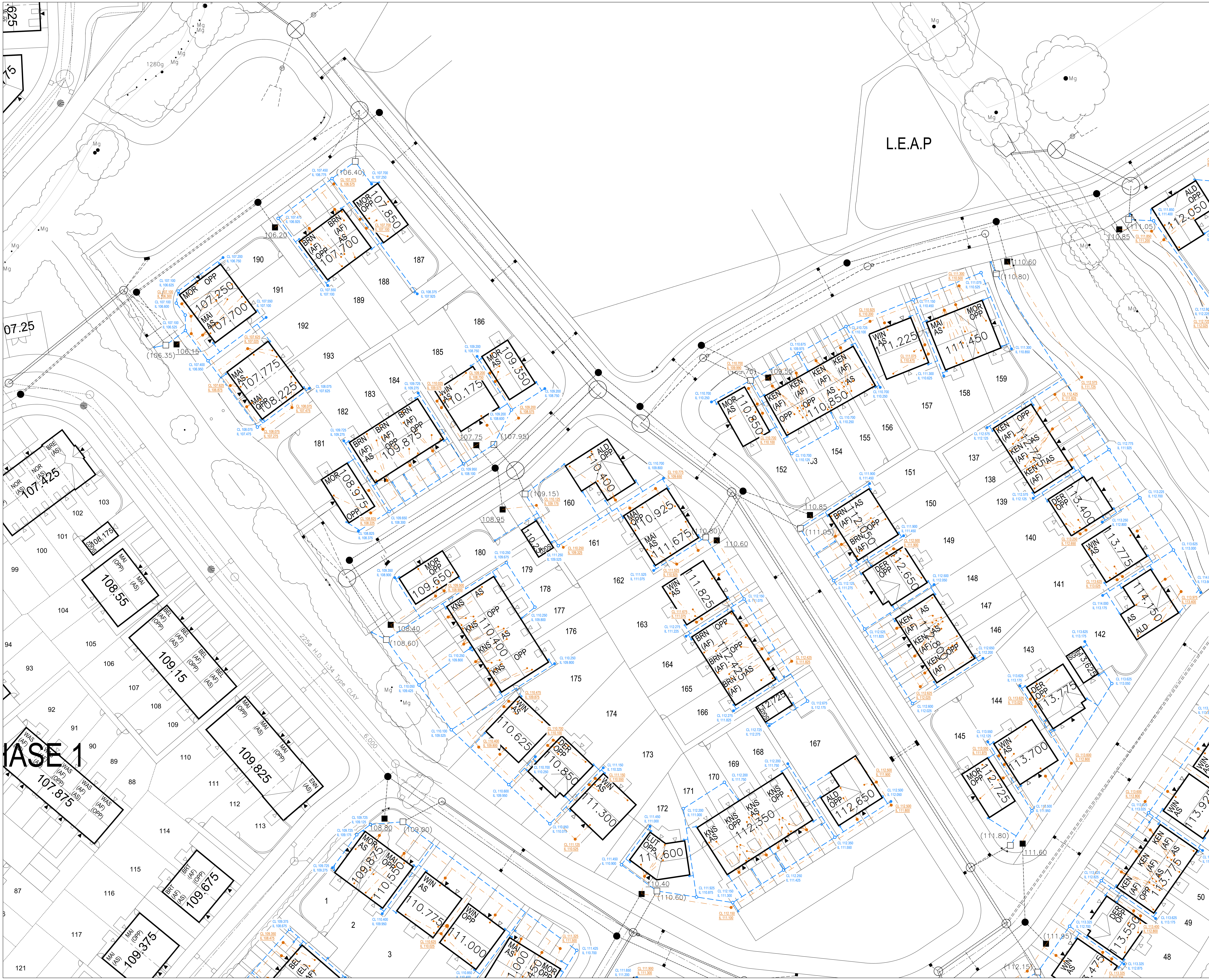

REV	DESCRIPTION	DATE	DRAWN
A	Site lifted to reduce soil leaving site. Levels revised to suit	01.11.19	CD

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Job
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Longridge
Phases 2 & 3

Title
Plot Drainage
Sheet 4

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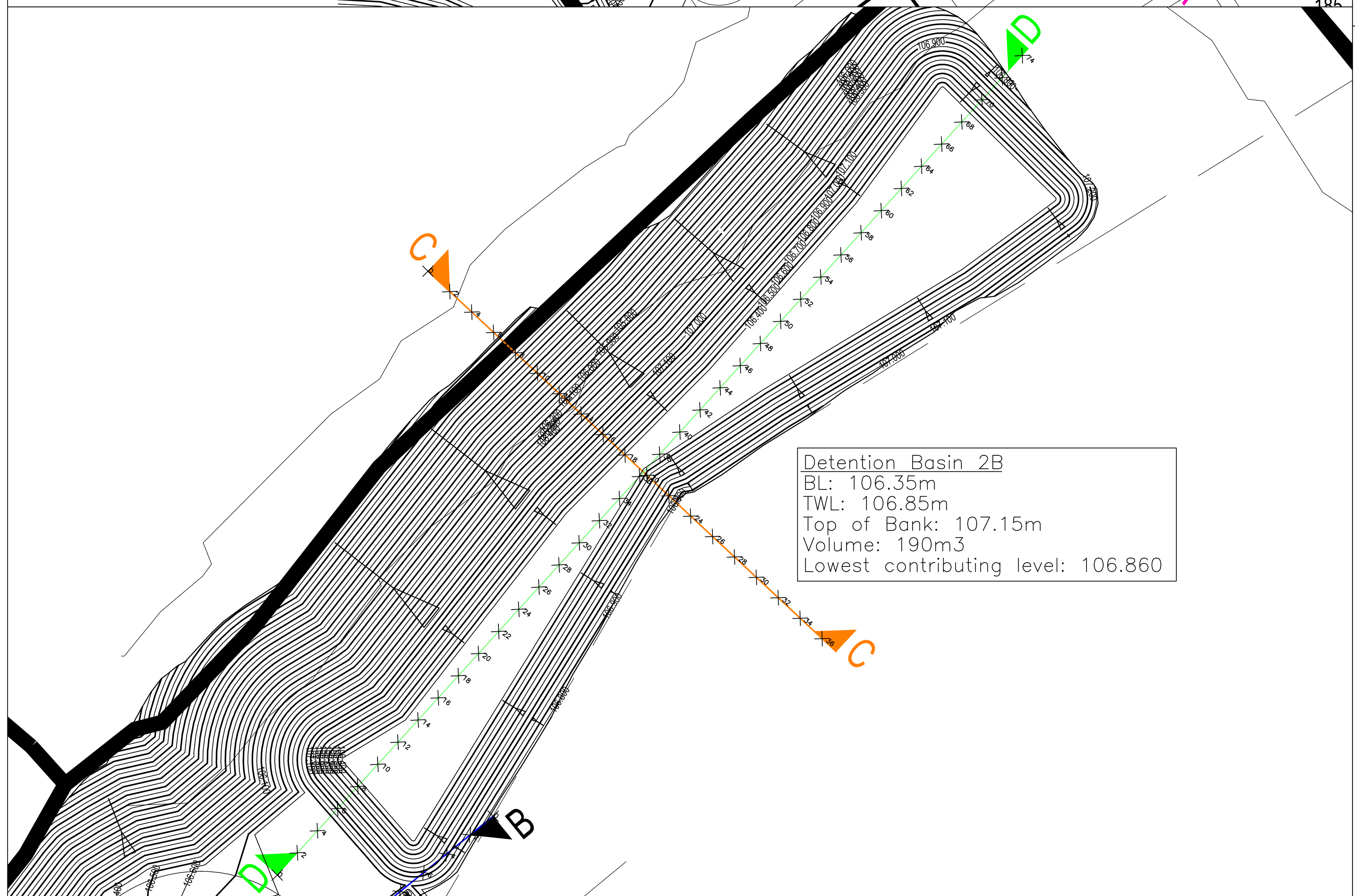
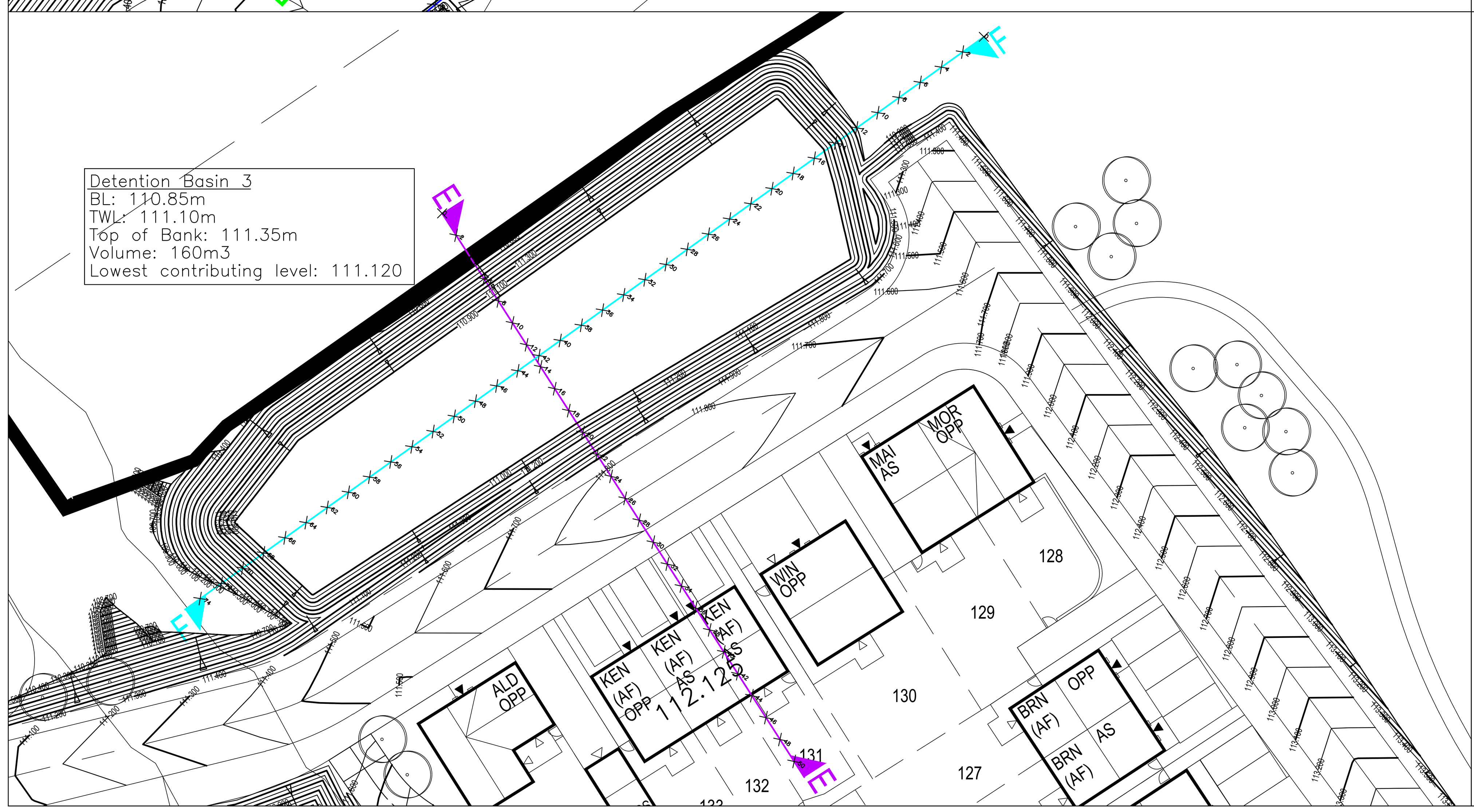
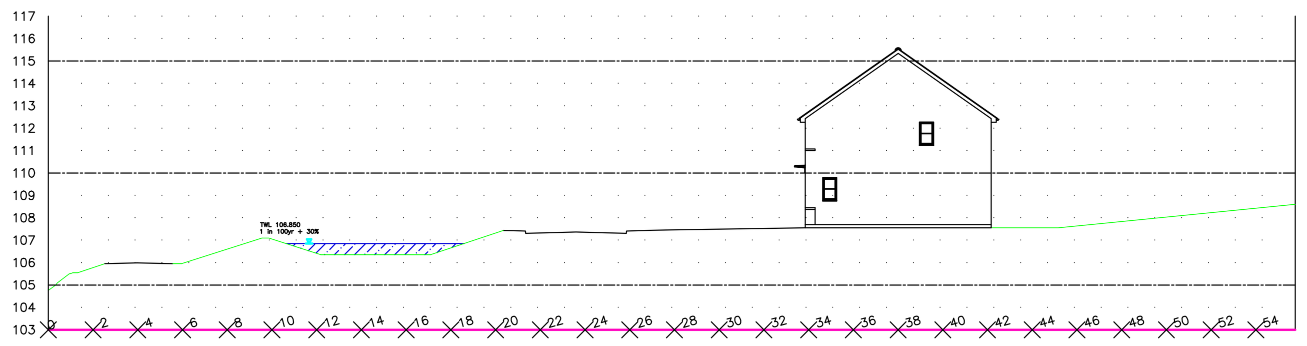
C.A.D By: CD	Scale @ A0: 1:200		

Drawings
Overflow Pond Details



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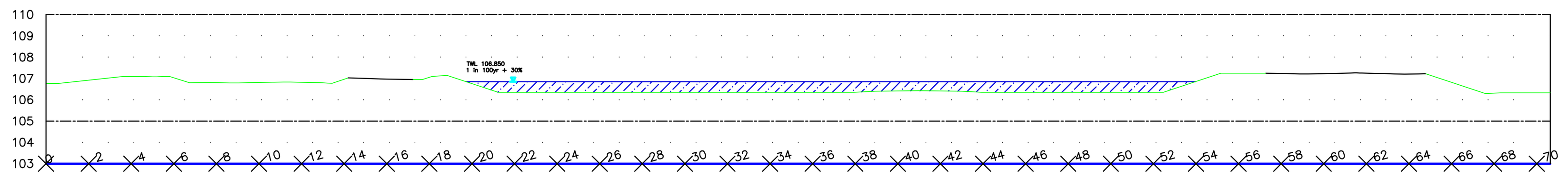
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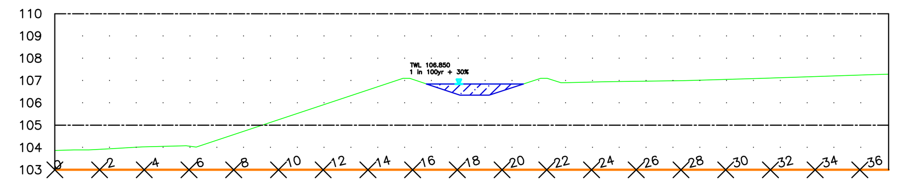
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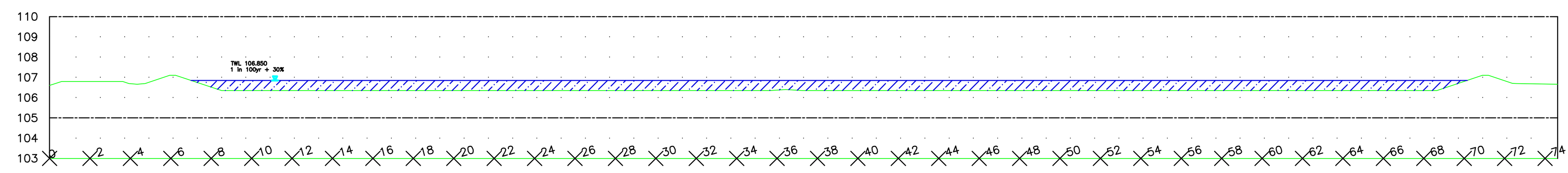
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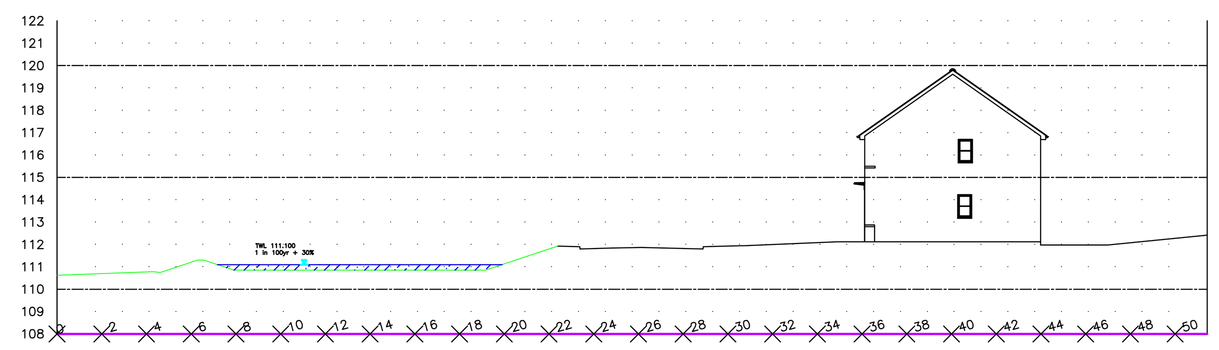
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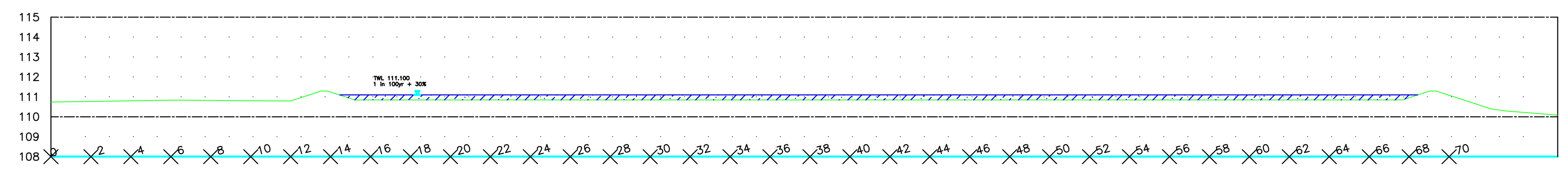
Section F-F

REV	DESCRIPTION	DATE	DRAWN
B	Revised in line with external levels issued November 2019	01.11.19	CD
A	Chainages added; Scale of plan views corrected	29.07.19	CD

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Job
Chipping Lane
Longridge

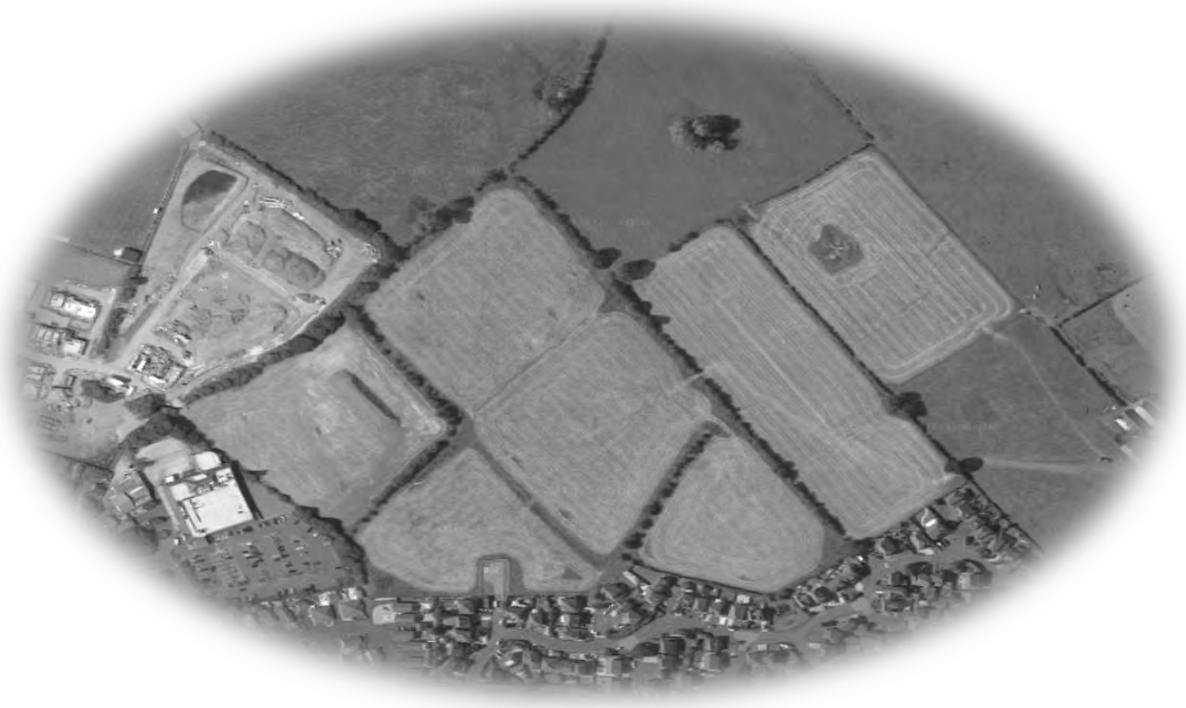
Title
Pond Cross Sections

Design By	Date	Drawing Number	Rev
FB	26.06.19	459/ED/127	B
C.A.D By: FB	Scale @ A0: 1:200		

Appendix A
Flood Risk Assessment

LAND OFF CHIPPING LANE
PHASE 2 & 3
LONGRIDGE

FLOOD RISK ASSESSMENT AND DRAINAGE MANAGEMENT STRATEGY



For

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DECEMBER 2018

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LAND OFF CHIPPING LANE
PHASE 2 & 3
LONGRIDGE

FLOOD RISK ASSESSMENT AND
DRAINAGE MANAGEMENT STRATEGY

Document Tracking Sheet

Document Reference:	HYD371_CHIPPING.LANE_FRA&DMS
Revision:	1.0
Date of Issue:	05TH DECEMBER 2018
Report Status:	DRAFT

Prepared by:

Megan Berry BSc (Hons)
Graduate Flood Risk Analyst

Checked by:

Dominic Kearney BEng (Hons) MSc PhD
Principal Hydraulic Analyst

Authorised by:

Richard Nicholas BEng (Hons) MBA
Director

Revision History:

Rev:	**Date:**	**Status:**	**Prepared by:**	**Checked by:**	**Issued by:**
1.0	05.12.2018	FINAL	MB	DK	MB
0	20.11.2018	DRAFT	MB	DK	MB

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EXECUTIVE SUMMARY

This Flood Risk Assessment and Drainage Management Strategy was commissioned by Barratt Homes referred to hereafter as 'the client'. This report has been prepared to support a full planning application for the construction of a residential development on land to the east of Chipping Lane in Longridge. Phase 1 has planning approval (Ref: 3/2014/0764) and is supported by a separate, approved Flood Risk Assessment and Drainage Management Strategy (HYD068_CHIPPING.LANE_FRA&DMS). This assessment therefore focuses on the residential development proposed as part of Phase 2 & 3 only. Phase 2 & 3 collectively cover 10.66ha, although the proposed development area covers a smaller portion at 6.24ha.

Flood Risk

The site is located wholly within Flood Zone 1 based on the Environment Agency Flood Map for Planning. The proposals are for a residential-led development, which is considered 'More Vulnerable' in Table 2: Flood Risk Vulnerability Classification within Planning Practice Guidance. This 'More Vulnerable' development is confirmed to be appropriate within Flood Zone 1, providing there is no increase in flood risk elsewhere due to the proposals.

Consultations with the Environment Agency, Ribble Valley Borough Council, Lancashire County Council and United Utilities have been undertaken and did not identify any historical incidents of flooding to the site or within the neighbouring areas. This assessment has considered all sources of flood risk. This includes the existing Ordinary Watercourse crossing the site which is understood to outfall into Higgin Brook 1km north of the site. As part of Phase 1, hydraulic modelling of the Ordinary Watercourse was undertaken to determine the potential flow risks associated with the proposed culverting the Ordinary Watercourse for vehicular crossing as part of Phase 1. The outcomes of the modelling exercise evidenced the risk to the proposals from the existing Ordinary Watercourse is low. The full Hydraulic Assessment has been appended to this assessment for full details. To summarise the proposed Phase 2 & 3 development area will, following the implementation of mitigation measures remain flood free in all key storm events, including the 1 in 100-year (1% AEP) plus Climate Change event without having any impact on the neighbouring land/properties.

The site is at 'very low' to 'low' flood risk from the reviewed sources of flooding. The primary source of flood risk is considered to be from surface water where the risk varies across the site from 'very low' to 'high' within the natural low-lying areas of site. The risks post-development from surface water will be effectively managed through implementation of the mitigation measures proposed within this assessment, including appropriate ground levels design and inclusion of a suitable surface water management infrastructure. To minimise flood risk from surface water it would also be recommended that natural drainage routes through the site be maintained within the proposals, including the existing Ordinary Watercourse, crossing the site from the southern boundary to the north.

Drainage Strategy

To ensure surface water flood risk to others does not increase, it is important to ensure surface water run-off is appropriately managed in accordance with the sustainable drainage hierarchy. Three methods have therefore been reviewed for the appropriate management of surface water run-off. These have been applied in the order of priority being; discharge via infiltration, to a watercourse and finally to public sewerage system. Based on the ground conditions identified by the published online datasets, infiltration is not considered to provide a viable drainage solution for the development due to the impermeable strata. A ground investigation report (Ref: STN3505NM-G01) was also undertaken for Phase 1 and identified soakaways were not suitable to be used as a method for managing surface water run-off. As infiltration rates can vary on a site by site basis, the Local Planning Authority may still require onsite Soakaway Testing to be undertaken to evidence this is true for Phase 2 & 3, prior to full commencement of works.

Assuming infiltration is not feasible, the next method in the drainage hierarchy should be discharge to a watercourse. Most of the site naturally drains to the Ordinary Watercourse crossing the site at present and the proposals are therefore to mimic the existing situation, discharging surface water run-off from the site to the watercourse using the existing onsite features where practical. Detailed design will need to confirm feasibility of a site wide gravity solution, although this is anticipated as most of the site naturally drains in this manner at present. It is assumed that multiple outfalls to the watercourse will be required given the scale of the development and formal consents will be required from Lancashire County Council for any works to the Ordinary Watercourse, including agreement of the proposed discharge rates and points of connection.

In accordance with Lancashire County Council there will be a requirement to maintain easements from existing Ordinary Watercourses. Lancashire County Council typically require an 8m easement to be maintained from the Top of Bank of the watercourses into the development areas. The easement should provide clear and unimpeded access for future maintenance. This includes no fencing, walls or buildings within the designated easement. Ordinary Watercourses are usually required to remain open channel where possible however, culverting of the watercourse for crossing purposes is typically accepted by Lancashire County Council as with Phase 1, providing the culverting is kept to a minimum and follows Lancashire's design requirements. Early discussion with Lancashire County Council is advised to get approval of any culvert proposals.

In accordance with the SuDS Manual and the Non-Statutory Technical Standards for Sustainable Drainage Systems, all sites should endeavour to achieve as close to pre-development greenfield rates as viable. The proposals are to therefore discharge to the watercourse crossing the site mimicking pre-development greenfield situation, QBar is calculated to be 84.9l/s and will need to be proportioned between the multiple proposed points of outfall. Restricting the discharge rates will generate a storage requirement during extreme storm events, this will need to be considered in terms of onsite attenuation as part of detailed design. It would be beneficial to implement SuDS features at the outfall location(s) such as ponds or basins for attenuation, conveyance and water quality benefits, although this will need to be considered during detailed design.

This Flood Risk Assessment and Drainage Management Strategy has been prepared in consultation with the relevant interested parties and incorporates their comments where possible. The report is considered to be commensurate with the scale and nature of the development proposals and in summary, the development can be considered appropriate in accordance with the Planning Practice Guidance.

CONTENTS

Figures & Tables

Specialist Software

- MicroDrainage WinDES (v.14.1) – Calculation of Greenfield run-off rates IH124/ICP-SUDS, Greenfield run-off volumes, rates of rainfall and stormwater storage estimates.
- Flood Estimation Handbook FEH – Determination of Catchment Descriptors and depths of rainfall.

Abbreviations & Acronyms

AEP	Annual Exceedance Probability
BGL	Below Ground Level
BGS	British Geological Survey
CC	Climate Change
CSAI	Cranfield Soil and Agrifood Institute
EA	Environment Agency
FEH	Flood Estimation Handbook
FRA	Flood Risk Assessment
LCC	Lancashire County Council
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
mAOD	Metres Above Ordnance Datum
NGR	National Grid Reference
NPPF	National Planning Policy Framework
NSRI	National Soil Resources Institute
OS	Ordnance Survey
PFRA	Preliminary Flood Risk Assessment
PPG	Planning Practice Guidance
QSE	Quick Storage Estimate
QBAR	Mean Annual Flood
RVBC	Ribble Valley Borough Council
SfA	Sewers for Adoption
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
TWL	Top Water Level

UU	United Utilities

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1.0 INTRODUCTION

1.1 Planning Policy Context

1.1.1 All forms of flooding and their impact on the natural and built environment are material planning considerations. The revised National Planning Policy Framework (NPPF) sets out the Government's objectives for the planning system, and how planning should facilitate and promote sustainable patterns of development, avoiding flood risk and accommodating the impacts of climate change. Government policy with respect to development in flood risk areas is contained within the revised NPPF and the supporting Planning Practice Guidance (PPG) (refer to extracts in **Appendix A**).

1.1.2 A Flood Risk Assessment and Drainage Management Strategy (FRA&DMS) has been completed in accordance with the revised NPPF and the PPG to review all sources of flood risk both to and from the proposed development. The report also considers the most appropriate drainage options including the implementation of Sustainable Drainage Systems (SuDS) in line with national policy.

1.1.3 The proposals are considered to be predominantly 'residential' in nature and as such is classified as 'More Vulnerable' in Table 2: Flood Risk Vulnerability Classification, within the Planning Practice Guidance. The PPG confirms that this type of land use is appropriate for Flood Zone 1, providing there is no increase in flood risk elsewhere due to the proposals.

1.2 Site Context

1.2.1 This FRA&DMS has been prepared to support a full planning application for Phase 2 & 3 of the residential-led development, on land to the east of Chipping Lane in Longridge. This assessment is to support Phase 2 & 3 of the wider/residential-led scheme, Phase 2 and 3 will comprise of 184no. residential dwellings collectively with some land allocated for a new school. Phase 1 (for 363no. residential dwellings) already has planning approval (Ref: 3/2014/0764) and is supported by a separate, approved FRA&DMS (Ref: HYD068_CHIPPING.LANE_FRA&DMS).

1.3 Consultation

1.3.1 The preparation of this report has been undertaken in consultations with the following interested parties; the Environment Agency (EA), United Utilities (UU), Lancashire County Council (LCC) and Ribble Valley Borough Council (RVBC). Consultation responses can be seen in **Appendix B, C** and **D**. The NPPF advises that the LPA should consult with the EA who will provide advice and guidance on flood issues at a strategic level and in relation to planning applications.

2.0 EXISTING SITE LOCATION

2.1 Location

2.1.1 The proposed development site will be access via the access road for Phase 1 from Chipping Lane to the west. The Ordnance Survey National Grid Reference (OS NGR) for the site is E: 360405, N: 437794 and the nearest postcode is PR3 3HB (see Location Plan in **Appendix E**). Phase 1 of the wider scheme already has planning approval and is highlighted by the green line in **Figure 1**. This assessment however focuses on Phase 2 & 3 only, which is referred to as 'the site' and is outlined in red in **Figure 1**.

2.1.2 The total site area covers 10.66ha, although when the proposed public open space, recreational areas and the land allocated for the new school are considered, the actual residential development area will cover 6.24ha. The site is bounded to the north and east by undeveloped agricultural land and to the south lies residential dwellings off Redwood Dive. Phase 1 is located to the west of the site with neighbouring residential development, the site will also be accessed from the west through Phase 1.

Figure 1: Aerial Photograph of site (Bing Maps, 2018)

2.2 Existing and Historical Land Use

2.2.1 The preparation of this report has identified that the site is currently undeveloped agricultural land to the east of Chipping Lane in Longridge. The site comprises of low-density vegetation with taller shrubs along some field boundaries. There are existing onsite drainage features present including the Ordinary Watercourse flowing north into

Higgin Brook. Historically the site was utilised for agricultural purposes and no other historical land uses have been determined during the preparation of this report.

2.3 Topography

2.3.1 The topographic levels naturally vary onsite given the land-use. The site generally falls towards the Ordinary Watercourse flowing adjacent to the northern field boundary and to the Ordinary Watercourse crossing the site. There is an overall fall from 121.50mAOD in the south to 106.41mAOD in the north. A full topographical survey has been carried out and is included in **Appendix F.**

3.0 DEVELOPMENT PROPOSALS

3.1 Nature of the development

3.1.1 This planning application is for the construction of 184no. residential dwellings on undeveloped land located to the east of Chipping Lane in Longridge (outlined in red within **Figure 2**). The proposals will be complete with access via the approved Phase 1 scheme, footpaths, car parking, external works lighting, landscaping, boundary walls/fencing, external services and drainage as shown on the illustrative masterplan in **Figure 2** (full layout in **Appendix G**).

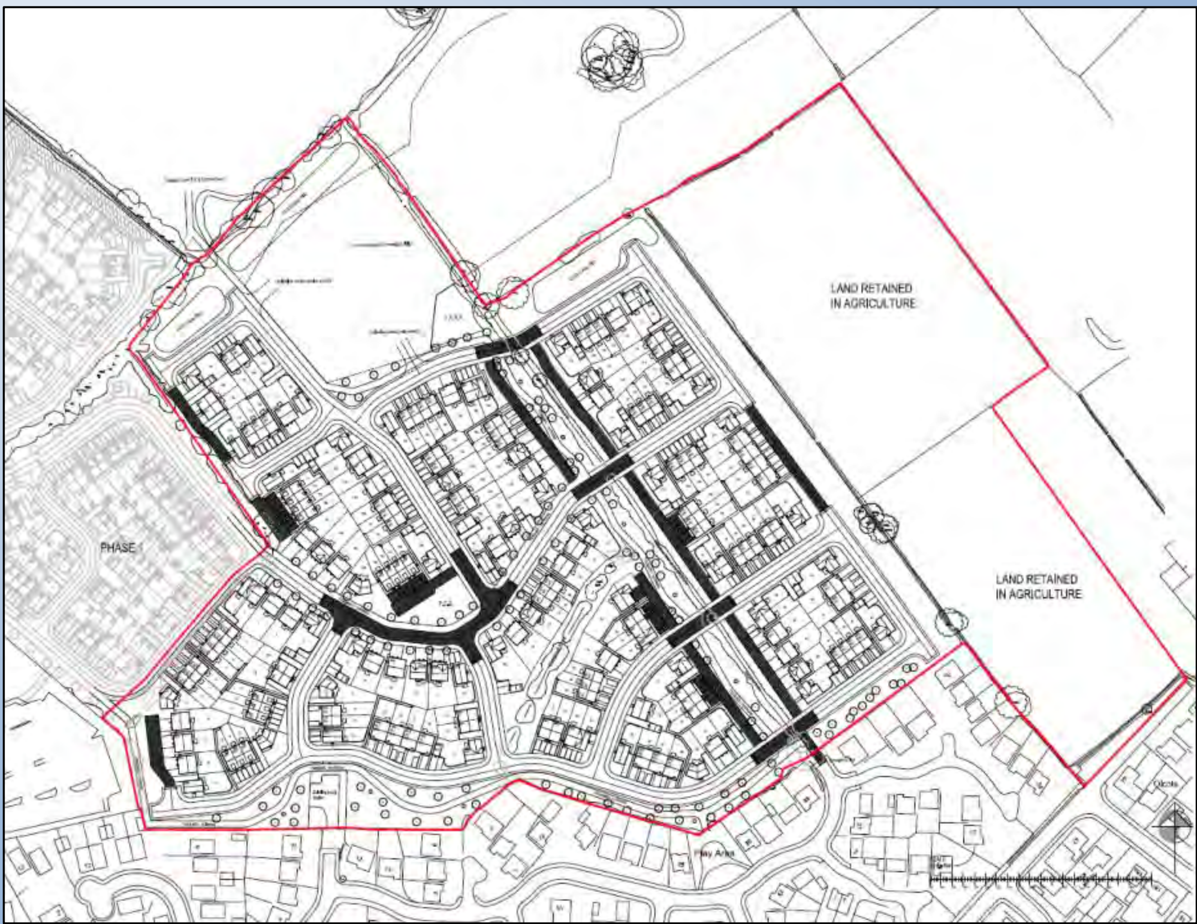

Figure 2: Illustrative Masterplan (2018)

3.1.2 The total site area covers 10.66ha and is considered to be 100% permeable at present. Due to the nature of the proposals, the proposed residential development area is smaller than the total site and covers 6.24ha. The development area excludes areas which are proposed to remain undeveloped, used for recreation and allocated for the new school. The post-development impermeable areas of the site will increase due to the nature of the development, to approximately 2.81ha which is 45% of the proposed development area.

3.1.3 There are Ordinary Watercourses present on and adjacent to the site which have been considered within the proposals. In accordance with Lancashire County Council (LLFA) there is a requirement to maintain easements from existing Ordinary Watercourses. LCC typically require an 8m easement to be maintained from the Top of Bank of the watercourses into the development area. The easement should provide clear and unimpeded access for future maintenance. This includes no fencing, walls or buildings should be present within the designated easement. Ordinary Watercourses are required to remain open channel where possible however, culverting of the watercourse for crossing purposes is typically accepted by LCC. Culverting of the watercourse for vehicle crossing as with Phase 1 is allowed providing the culverting is kept to a minimum and follows LCC design requirements. Early discussion with LCC is advised to get approval of any culvert proposals.

3.1.4 In review of Untied Utilities (UU) sewer records, a foul water pumping station has been identified onsite adjacent to the southern boundary, this pumping station has been accounted for within the planning proposals. A public foul water sewer (375mm.dia) associated with the pumping station has also been identified onsite adjacent to the southern boundary. In addition, there is also a public surface water sewer (375mm.dia) which presently crosses the development site from the southern boundary towards Phase 1.

3.1.5 National and local policy identifies that Sustainable Drainage Systems (SuDS) should be incorporated into new development where at all feasible. As shown on the proposed planning layout there is scope to incorporate some SuDS features such as a pond/basin within the proposed open space/amenity areas. There is also a blue/green corridor shown on the planning layout to border the Ordinary Watercourse crossing the site. Detailed design will however be required to confirm the specific types, subject to ground investigations and detailed levels review.

4.0 SOURCES OF FLOOD RISK

4.1 Fluvial Flood Risk

4.1.1 Information relating to flood risk at the site has been obtained from the Environment Agency and from the Gov.uk website. The Flood Map for Planning shows that the site is wholly located within Flood Zone 1 as seen in **Figure 3**, the site is also identified to be at 'very low' risk of fluvial flooding based on the long-term fluvial flood risk mapping (refer to mapping in **Appendix B**).

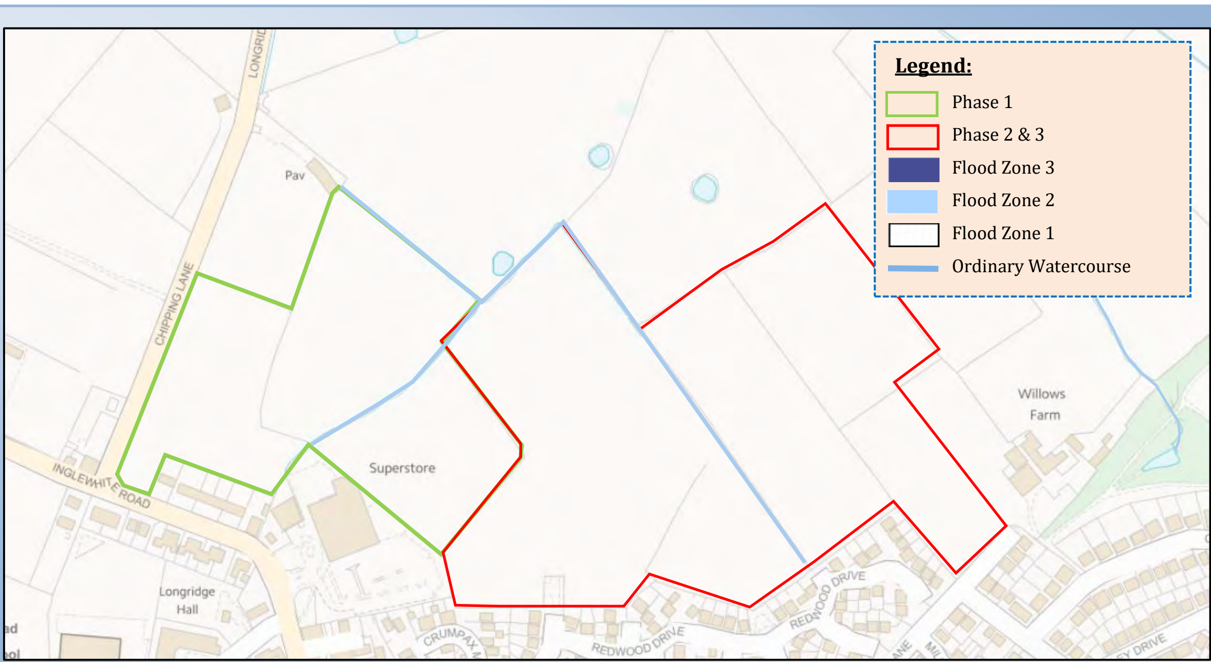

Figure 3: Fluvial/Tidal Flood Zone Map for Planning Extract (GOV.UK 2018)

4.1.2 There is an existing Ordinary Watercourse crossing the development site, which flows north until the watercourse outfalls into Higgin Brook approximately 1km to the north. Higgin Brook flows north and eventually outfalls into the River Loud (Main River) located approximately 1.2km north of site. Due to the distance of site to the nearest Main River, the risk associated is 'very low'.

4.1.3 In terms of the Ordinary Watercourse, consultations with the EA, RVBC and LCC also did not identify any historic flooding at the site and review of the topographic survey suggests that the existing site levels are 800mm above the bed levels of the Ordinary Watercourses crossing the site. Due to the nature and scale of the existing Ordinary Watercourse, the flood risk associated is considered to be 'very low'.

4.1.4 The LLFA (LCC) will require a maintenance easement to be maintained from the existing Ordinary Watercourse for future maintenance. The LCC typically require an 8m easement to be maintained from the Top of Bank of Ordinary Watercourses into the development area. The easement should provide clear and unimpeded access for future maintenance including no fencing, walls or buildings. Ordinary Watercourses are also required to remain open channel where possible. Culverting of the watercourse for crossing purposes however, is typically accepted by LCC as with Phase 1 of development, providing the culverting is kept to a minimum and follows LCC design requirements. Early discussion with LCC is advised to get approval of any culvert proposals.

4.1.5 As part of the Phase 1 application, hydraulic modelling of the Ordinary Watercourse crossing the site was undertaken to determine the potential flow risks associated with the proposed part culverting the Ordinary Watercourse for crossing. The section below draws on outcomes of the modelling exercise to further evidence the risk to the proposals from the Ordinary Watercourse is low.

Hydraulic Assessment

4.1.6 For full details of the Ordinary Watercourse model build and parameters, refer to the full separate Hydraulic Assessment (HA) Report which has been included in **Appendix H**). This section of the Flood Risk Assessment will summarise the key findings of the separate report. The HA used The Flood Estimation Handbook (FEH) to obtain the catchment descriptors for Higgin Brook upstream of a point north of the development site. Three smaller sub-catchments (Sub A, Sub B and Sub C) upstream of the 600mm culvert located adjacent to Chipping Lane to the north of the site were identified using LiDAR data (see Hydraulic Assessment in **Appendix H** for full methodology).

4.1.7 The Revitalised Flood Hydrograph (ReFH) method was then applied for each sub-catchment based on catchment descriptors. The full hydrographs for all sub-catchments in all return periods are shown in **Appendix H**. The HA considered the following events:

- 1 in 5 year (20% AEP)
- 1 in 30 year (3.3% AEP)
- 1 in 100 year (1% AEP)
- 1 in 100 year (1% AEP) plus Climate Change (CC)

4.1.8 The results of the simulations have been presented in the form of longitudinal profile and cross sections (including peak water levels) included in **Appendix H**. The results show that water levels remain in bank for most of the Ordinary Watercourse reach in all Annual Exceedance Probabilities in the existing scenarios. In the proposed scenario a 600mm diameter pipe, approximately 26m long, was inserted upstream to simulate a proposed culvert crossing. Comparison of the existing and post development levels in the 1% AEP plus climate change event shows that peak levels remain largely unchanged, although with some small increases in places. These increases are relatively small and do not increase flood risk to the proposed development or neighbouring areas.

4.1.9 Sensitivity analysis was carried out on the model parameters and showed that water levels were not particularly sensitive to changes in channel roughness, therefore the impact of the proposed development on flood depths in vicinity of the site and the wider floodplain are low and within modelling tolerances. Overall, when the outcomes of the proposed scenario of the previously completed FRA are considered, the risk of the proposed development as part of Phase 2 & 3 is minimal.

Safe Access and Egress

4.1.10 The access road to site was previously approved as part of the Phase 1 application (Ref: 3/2014/0764). This is shown on the EA's Flood Zone Map for Planning, to also be located within Flood Zone 1. Safe access and egress will therefore be maintained via Chipping Lane (through Phase 1).

4.2 Tidal Flood Risk

4.2.1 The coastline is located approximately 30km west of the proposed site and the Ribble Estuary is located approximately 20km west of site. Due to the distance from the coast, the associated flood risk from these sources is considered to be 'very low'. This is supported by the EA's Fluvial/Tidal Flood Zone Map for Planning as the site is shown to be located within Flood Zone 1.

4.3 Flood Risk Vulnerability Classification and Flood Zone Compatibility

4.3.1 The proposals are solely 'residential' in nature and as such is classified as 'More Vulnerable' in Table 2: Flood Risk Vulnerability Classification within the PPG. Table 3: Flood Risk Vulnerability and Flood Zone 'Compatibility' within the PPG confirms that this type of land use is appropriate for Flood Zone 1, providing there is no increase in flood risk elsewhere due to the proposals.

4.4 Surface Water Flood Risk

4.4.1 Surface water flooding occurs when rainwater is unable to drain away through the normal drainage systems or soak into the ground but lies on or flows over the ground instead. The risk associated with surface water run-off is indicated by the long-term flood mapping (extract shown in **Figure 4**).

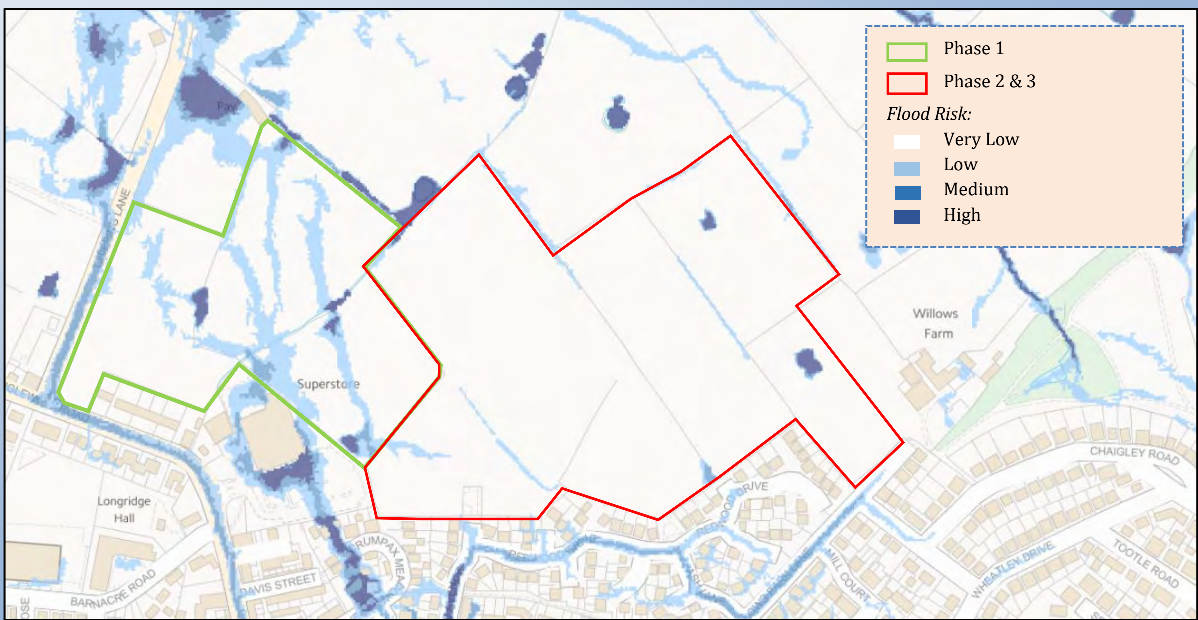

Figure 4: Surface Water Flood Map Extract (GOV.UK, 2018)

4.4.2 As indicated in **Figure 4**, the site is predominantly at 'very low' to 'low' risk from flooding associated with surface water. There are however some existing areas of 'medium' to 'high' risk shown onsite. A review of the existing topography shows that these higher flood risk areas are closely associated with the natural low-lying drainage ditches or existing water bodies including the Ordinary Watercourse and existing pond features onsite. These low-lying areas would be susceptible to ponding in the extreme rainfall events as the surrounding ground levels are elevated in comparison (refer to **Appendix F** for topographic survey).

4.4.3 The flood risk to the proposals from surface water will be inherently reduced, post-development through the design and implementation of a sustainable surface water drainage regime onsite. Interception methods may be beneficial along any boundary where run-off can enter site or cause risk to others. For any residual risks it is advised that (following any re-grade of the site) FFL are raised above the external levels to provide overland flood routes for excess surface water run-off; this will help protect properties from excess surface water run-off.

Pluvial (Overland run-off) Flood Risk

4.4.4 Intense rainfall that is unable to soak into the ground or enter drainage systems can run-off land and result in flooding. Local topography and the land use can have a strong influence on the direction and depth of flow. The topography of the surrounding undeveloped areas means there is little potential for overland flows to impact on the site, as levels generally fall towards the existing watercourses.

4.4.5 The volume and rate of overland flow from land can be exacerbated, if development increases the percentage of impermeable area. Any overland flows generated by the development must be carefully controlled; safe avenues directing overland flow away from adjacent development is advised.

Sewer Flood Risk

4.4.6 In urban areas, rainwater is frequently drained into surface water sewers or sewers containing both surface and waste water known as 'combined sewers'. Foul water flooding often occurs in areas prone to overland flow and can result when the sewer is overwhelmed by heavy rainfall and will continue until the water drains away.

4.4.7 United Utilities (UU) records identify there to be a foul water pumping station onsite adjacent to the southern boundary (see sewer records in **Appendix C**). This pumping station has been accounted for within the planning proposals and a public foul water sewer (375mm.dia) associated with the pumping station has also been identified onsite adjacent to the southern boundary. In addition, there is also a public surface water sewer (375mm.dia) which presently crosses the development site from the southern boundary towards Phase 1. Consultation with UU, identified no recorded historical sewer flooding issues on or near to the proposed development site (see **Appendix C** for correspondence).

4.5 Groundwater Flood Risk

4.5.1 High groundwater levels are usually the key source of groundwater flooding, which occurs when excess water emerges at the grounds surface (or within manmade underground structures such as basements). Groundwater flooding is often more insistent than surface water flooding and would typically last for weeks/months rather than days meaning the result to property is often more severe.

4.5.2 In general terms groundwater flooding can occur from three main sources:

- If groundwater levels are naturally close to the surface, then this can present a flood risk during times of intense rainfall. No groundwater flood risk has been identified during consultation with the various interested parties.
- Seepage and percolation occur where embankments above ground level hold water. In these cases, water travels through the embankment material and emerges on the opposite side of the embankment. At present there are no reported problems with groundwater flooding.
- Groundwater recovery/rebound occurs where the water table has been artificially depressed by abstraction. When the abstraction stops the water table makes a recovery to its original level. There is the potential for groundwater flooding in low lying areas where groundwater levels have been depressed below their pre-pumping conditions, where these were at or close to ground level. As with the seepage scenario the likelihood of flooding from this source is low.

4.5.3 The mapping data for groundwater shows that the site is underlain by a Secondary A Bedrock Aquifer with Secondary 'Undifferentiated' Superficial Deposits (**Appendix B**). The site has been identified to be in a Low Groundwater Vulnerability Area to a Minor Aquifer.

4.5.4 No historical groundwater flooding of the site has been identified during consultation with the various interested parties. Irrespective, it is advised that external levels fall away from the property (where feasible) to minimise the flood risk from a variety of sources. By keeping the finished floor levels elevated relative to the externals, this should help create an overland flow route.

4.6 Artificial Sources of Flood Risk

4.6.1 National policy states that an FRA should consider the potential risks from a variety of other flood sources including artificial sources (such as risks from reservoirs and canals).

Reservoirs

4.6.2 The EA recognises reservoirs as bodies of water over 25,000cu.m, the site is not considered to be influenced by any flooding associated with a breach or failure in the neighbouring reservoirs.

4.6.3 There are a number of small bodies of water (less than 25,000cu.m) located to the north of the development site and are understood to aid in the natural drainage of the surrounding area. The risk they pose to site is considered to be 'low' due to the natural topography and the scale/nature of these small drainage features.

Canals

4.6.4 The nearest identified canal systems to the proposed development site is the Lancaster Canal located approximately 1km to the west of site. Due to the proximity and the local topography, the associated flood risk is considered to be 'low'.

4.6.5 Irrespective, it is advised that external levels fall away from the property (where feasible) to minimise the flood risk from a variety of sources. By keeping the Finished Floor Levels elevated relative to the externals, this should help create an overland flood flow route in the event of a breach or any other source of flooding that could lead to overland flow.

4.7 Historical and Anecdotal Flooding Information

4.7.1 An internet-based search for flooding did not identify any historical flooding directly to the site however, the internet-based search did identify surface water flooding issues to the neighbouring Longridge area during extreme storm events. Furthermore, review of the Lancashire County Council's and Ribble Valley Borough Council's Preliminary Flood Risk Assessment and Strategic Flood Risk Assessment, did not highlight any historic flooding pertinent to this FRA.

4.7.2 Consultation with various interested parties including the EA also failed to highlight any historical flooding on the site. No historical sewer flooding issues onsite were highlighted by UU or within the wider area (correspondence in **Appendix B** and **C** respectively).

4.8 Flood Risk Mitigation Measures & Residual Risks

4.8.1 The site is located within Flood Zone 1 and considered to be at little risk of fluvial/tidal flooding. To observe a conservative approach however, mitigation measures have been proposed below to safeguard the development with regards to other potential residual sources of flood risk and to consider the uncertainties of climate change in accordance with the NPPF and PPG.

Mitigation Measures

4.8.2 For 'more vulnerable' development located within Flood Zone 1, it is typical to set the Finished Floor Levels (FFL) of residential dwellings to a minimum of 150mm above the existing ground levels. By ensuring the FFLs are raised sufficiently above the external levels (following any re-grade) should mitigate any risk of flooding from a variety of sources, including groundwater and surface water run-off risks at the proposed development.

4.8.3 Any overland flows generated by the development must be carefully controlled. Safe avenues directing overland flow way from any existing and proposed buildings are advised. Some areas of the site are shown to be at higher risk from surface water, these areas correspond with the existing drainage ditches and pond features. It would be recommended that the existing drainage features be retained where practical and/or mimicked within the development to make allowance for natural conveyance through the proposals.

4.8.4 In accordance with LCC there is a requirement to maintain an easement from the existing Ordinary Watercourse for future maintenance. The LCC typically require an 8m easement to be maintained from the Top of Bank of Ordinary Watercourses into the development area. The easement should provide clear and unimpeded access for future maintenance including no fencing, walls or buildings. Ordinary Watercourses are also required to remain open channel where possible. Culverting of the watercourse for crossing purposes however, is typically accepted by LCC as occurred on Phase 1 of development, providing the culverting is kept to a minimum and follows LCC design requirements. Early discussion with LCC is advised to get approval of any culvert proposals.

4.8.5 To minimise the flood risk to the neighbouring properties it is recommended that the surface water run-off generated by the proposals be managed effectively with the peak rates of run-off being restricted to the equivalent of the pre-development situation (with betterment). The proposed onsite surface water drainage system will need to be sized to contain the 1 in 30yr return period event below ground with exceedance from storm events up to and including the 1 in 100yr return period storm event with a 40% allowance for climate change being contained onsite.

4.8.6 As with any drainage system blockages within either the foul or surface water system have the potential to cause flooding or disruption. It is important that should any drainage systems not be offered for adoption to either the Water Company or the Local Authority then an appropriate maintenance regime should be scheduled with a suitably qualified management company for these private drainage systems.

Residual Risks

4.8.7 If an extreme rainfall event exceeds the design criteria for the drainage system it is likely that there will be some overland flows that are unable to enter the system, it is important that these potential overland flows are catered for within the development site if the capacity of the drainage system is exceeded.

5.0 SURFACE WATER MANAGEMENT

5.1 Pre-Development Surface Water Run-off

5.1.1 Phase 2 & 3 of the development covers 10.66ha. The proposed development area (excluding areas onsite such as the POS areas and the area allocated for a new school) and will cover 6.24ha based on the proposed planning proposals. At present the development area is 100% permeable and is understood to drain naturally to the onsite Ordinary Watercourse, which ultimately outfalls into Higgin Brook located to the north of the site.

5.1.2 The peak rates and volumes of run-off generated by Phase 2 & 3's development area has been calculated for the peak events shown in **Table 1** (full details **Appendix J**). The surface water run-off rates have been calculated using the FEH Statistical Method.

Site Area	Run-Off Rates				Run-Off Volumes	
	1 In 1 Year	1 In 30 Year	1 In 100 Year	QBar	1 In 1 Year	1 In 100 Year
6.236ha	73.8l/s	144.3l/s	176.5l/s	84.9l/s	710.7cu.m	2178.7cu.m

Table 1: Pre-Development Surface Water Run-Off Rates (Betts Hydro, 2018)

5.2 Post Development Surface Water Run-Off

5.2.1 At present the indicative proposals show the development area to cover 6.24ha of the wider site. Based on the planning layout we have estimated that the post-development impermeable areas will increase to approximately 45% of the development area. The unrestricted post-development run-off rates have been detailed in **Table 2**.

Site Area	Run-Off Rates		
	1 In 1 Yr	1 In 30 Yr	1 In 100 Yr +CC
2.806ha	150.2l/s	291.3l/s	488.5l/s

Table 2: Post-Development Un-Restricted Run-Off Rates (Betts Hydro, 2018)

5.2.2 In accordance with national and local planning policies it is necessary to restrict surface water run-off rates where at all practical to mimic a pre-development greenfield situation. The proposals will therefore be to discharge surface water run-off from site mimicking the pre-development greenfield situation (**Table 1**). Further details of proposed drainage strategy can be found in Section 5.6.

5.3 Sustainable Drainage Systems (SuDS)

5.3.1 Sustainable Drainage Systems (SuDS) can address the four key sustainability objectives including: water quantity, water quality, amenity and biodiversity. Peak surface water discharge rates to watercourses and sewers should be appropriately managed and where possible reduced. Preference should always be given to SuDS over the traditional methods of buried sewers wherever possible and practical.

5.3.2 It would be beneficial to implement wider green space/Public Open Space area(s) in one or more locations within site, where SuDS features could be implemented. Multiple benefits to using SuDS include the improvement of bio-diversity, aesthetics, ecology and water quality. Opportunities should also be taken to provide soft landscaping where at all possible on site to assist in minimising surface water run-off.

5.3.3 Given the indicative layout, there may be the opportunity to incorporate SuDS methods such as swales and ponds (**Figure 5**) within the non-developed areas, to provide a degree of treatment before flows are carried offsite. It would also be recommended that permeable paving and bio-filtration be considered in non-adopted areas where at all feasible; to assist locally with surface water management (subject to optimum ground conditions). If infiltration is not feasible then a connection into the main drainage systems would be needed.

Figure 5: SuDS Photographs (SusDrain, 2012)

5.3.4 Promoting SuDS to deal with surface water at the source, will limit the required attenuation and in turn reduce the volume of surface water in the nearby watercourse and sewer infrastructure. There may be the potential to utilise SuDS features for conveyance/attenuation of surface water flows within the proposed drainage strategy, opposed to the traditional below ground storage methods. Detailed design should confirm whether this site would be suitable for incorporation of SuDS following more detailed analysis of levels, ground conditions and attenuation requirements.

5.4 Methods of Surface Water Management

5.4.1 At present the development area for Phase 2 & 3 covers 6.24ha and the proposed impermeable area is assumed to increase from 0% to 45%. There are three methods that have been reviewed for the management and discharge of surface water. These may be applied individually or collectively to form a complete strategy and should be applied in the order of priority listed below:

- Discharge via infiltration
- Discharge to watercourse
- Discharge to public sewerage system

5.5 Discharge via Infiltration

5.5.1 Any impermeable areas that can drain to soakaway or an alternative method of infiltration would significantly improve the sustainability of any surface water systems.

5.5.2 The Cranfield Soil and AgriFood Institute (CSAI), Soilscapes viewer identifies the soils to be slowly permeable, seasonally wet, slightly acid but base-rich loamy and clayey. The British Geology Survey (BGS) mapping data indicates that the bedrock geology consists of a mixture of Bowland Shale Formation (Mudstone) and Pendleside Sandstone Member (Sandstone) and has superficial deposits associated with Till and Devensian.

5.5.3 Based on the ground conditions identified by the published online datasets, it can be considered that infiltration would not likely provide a viable drainage solution for the development site due to the impermeable strata. A ground investigation report (Ref: STN3505NM-G01) was also undertaken for Phase 1 and identified soakaways were not suitable to be used as a method for managing surface water run-off. Infiltration rates however, vary on a site by site basis and therefore it would be recommended further investigation in the form of Soakaway Testing to BRE365, takes place within Phase 2 & 3 areas upon planning approval, to confirm these areas are also not suitable for an infiltration-based solution.

5.6 Discharge to Watercourse

5.6.1 Assuming infiltration is not suitable for managing all the surface water run-off generated by the development, the next method in the drainage hierarchy is discharge surface water to a watercourse. As previously mentioned, most of the site naturally drains into the Ordinary Watercourse crossing the development site.

5.6.2 The surface water run-off generated by the development is therefore proposed to mimic the existing situation and discharge into the existing Ordinary Watercourse crossing the development site, as illustrated in the preliminary drainage proposals plan (**Figure 6**). This approach is similar to that proposed and agreed for the earlier Phase 1 and mimics the existing situation through the current mechanisms of run-off management.

5.6.3 Detailed design will need to be carried out to confirm whether a site wide gravity solution can be achieved. Although, the site naturally drains to the Ordinary Watercourse at present, when the development proposed levels are considered and formal connections made. It is likely that multiple surface water outfalls will be required to accommodate the layout proposals, the specifics will be confirmed during detailed design.

5.6.4 Consents will be required from LCC who are the LLFA and responsible in part for Ordinary Watercourses in terms of proposed works. Consent would be required for any new outfall structures on the Ordinary Watercourse, and any culverting (to accommodate crossings shown on the layout). Agreement would also be required for the proposed rates of discharge to the Ordinary Watercourse, to ensure no increase risk to others result from the site.

5.6.5 In accordance with the LCC , there is a requirement to maintain an easement from existing Ordinary Watercourses and Main Rivers. The EA and LCC both require an 8m easement to be maintained from the Top of Bank of the watercourse into the development area. The easement should provide clear and unimpeded access for future maintenance no fencing, walls or buildings should be present within the designated easement as shown within the proposed planning layout.

Figure 6: Preliminary Proposed Drainage Plan extract (Betts Hydro, 2018)

5.6.6 In accordance with the SuDS Manual (CIRIA 753) and the Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015) all sites should endeavour to achieve as close to pre-development greenfield rates as is viable. Based on the development area, the pre-development greenfield rate (QBar) is calculated to be 84.9l/s using the FEH Statistical Method (see summary in **Appendix J**). The proposals are therefore to restrict surface water run-off to mimic a pre-development greenfield situation. The overall rate of discharge would need to be proportioned between the number of outfalls where necessary. This will be confirmed during detailed design, when the drainage technical detailed are reviewed.

Impermeable Area (2.806ha)	1 In 1 Year	1 In 30 Year	1 In 100 Year + 30% CC
Restricted Run-Off Rate	84.9l/s	84.9l/s	84.9l/s
Estimated Stormwater Storage Volume	117cu.m-290cu.m	515cu.m-853cu.m	1113cu.m-1720cu.m

Table 4: Estimated Stormwater Storage Requirements (Betts Hydro, 2018)

5.6.7 It would be beneficial to implement SuDS features where at all feasible, subject to ground investigation and a detailed levels review. If designed appropriately the SuDS features such as a pond/basin could potentially aid in the attenuation requirements for the proposals (if located appropriately) and provide added benefits in terms of water quality improvements. Detailed design will be required to confirm whether SuDS can be incorporated, at present indicative proposals allow for the inclusion of SuDS, including a pond/basin at multiple outfall points proposed.

5.7 Discharge to Public Sewer Network

5.7.1 UU sewer records identify there to be a public surface water sewer (375mm.dia) which presently crosses the development site from the southern boundary towards Phase 1. Should infiltration not be feasible then the surface water flows generated are proposed to discharge to the existing Ordinary Watercourse crossing the site and not the existing sewer network.

5.8 Climate Change

5.8.1 There are indications that the climate in the UK is changing significantly and it is widely believed that the nature of climate change will vary greatly by region. Current expert opinion indicates the likelihood that future climate change would produce more frequent short duration and high intensity rainfall events with the addition of more frequent periods of long duration rainfall. It is believed that the impact of climate change means there is likely to be a long-term increase in the average sea levels, with an expectation that sea levels will rise gradually. An increase in flood water levels means that future flooding events will occur more frequently and will have a greater impact.

5.8.2 In light of the future uncertainties Climate Change should be accounted for within the design of all new developments. The recently published Environment Agency document '*Adapting to Climate Change: Advice for Flood and Coastal Erosion Risk Management Authorities*' supersedes Defra's policy statement on Flood Risk and Coastal Erosion Risk Management (2009) and should be used for future proposals. Climate change factors have been considered and any increase in the level of flood risk (to the site) from climate change is likely to be related to the increase in rainfall intensity and duration and its impact upon the surface water drainage system.

5.8.3 The site is subject to an existing outline approval (Ref: 3/2014/0764) and the design of Phases 2 & 3 of this development will conform to the criteria already agreed and embedded in the approved planning documentation. The Climate Change factor that has been considered for an increase in rainfall intensity is 30%

6.0 FOUL WATER MANAGEMENT

6.1 Due to the existing land-use onsite, no existing foul water connections to the public sewer network are present. Review of the UU sewer records identifies a foul water pumping station onsite adjacent to the southern boundary. This pumping station has been accounted for within the planning proposals and a public foul water sewer (375mm.dia) associated with the pumping station has been identified onsite adjacent to the southern boundary (see sewer records in **Appendix C**).

6.2 Phase 1 has a separate approved drainage management strategy as detailed in the approved supporting FRA&DMS (REF:HYD068_CHIPPING.LANE_FRA&DMS), which shows foul from this portion of development will outfall into the foul water system located within Inglewhite Road to the south-east of Phase 1 (**Appendix C**).

6.3 Based on the proposals for the construction of up to 184no. residential units for Phase 2 & 3, the approximate peak foul water flows generated by the development are 8.5l/s. This is based on 4000 litres per dwelling per 24 hours; the guidance contained within Sewers for Adoption (SfA).

6.4 The proposals are therefore to connect flows from Phase 2 & 3 to the foul water pumping station within Phase 1 which ultimately connects into the public sewer network within Inglewhite Road. The pumping station within Phase 1 has been designed to also accommodate flows from Phase 2 & 3 however, formal consent is still required from UU approving this connection, discussion with UU shown in **Appendix C**. In addition, a pre-development enquiry has been sent to UU a response is outstanding.

6.3 Detailed design will confirm the full technical details based on the engineering constraints. Consent from UU will be required for works to the public sewer infrastructure. It is recommended that early discussion is undertaken to confirm acceptance of the strategy and identify any additional considerations such as preferred point of connection and capacity constraints. Initial discussion has been carried out to get an agreement in principle at this time.

7.0 SUMMARY AND CONCLUSIONS

7.1 This Flood Risk Assessment and Drainage Management Strategy was commissioned by Barratt Homes referred to hereafter as 'the client'. This report has been prepared to support a full planning application for the construction of a residential development on land to the east of Chipping Lane in Longridge. Phase 1 has planning approval (Ref: 3/2014/0764) and is supported by a separate, approved Flood Risk Assessment and Drainage Management Strategy (HYD068_CHIPPING.LANE_FRA&DMS). This assessment therefore focuses on the residential development proposed as part of Phase 2 & 3 only. Phase 2 & 3 collectively cover 10.66ha, although the proposed development area covers a smaller portion at 6.24ha.

Flood Risk

7.2 The site is located wholly within Flood Zone 1 based on the Environment Agency Flood Map for Planning. The proposals are for a residential-led development, which is considered 'More Vulnerable' in Table 2: Flood Risk Vulnerability Classification within Planning Practice Guidance. This 'More Vulnerable' development is confirmed to be appropriate within Flood Zone 1, providing there is no increase in flood risk elsewhere due to the proposals.

7.3 Consultations with the Environment Agency, Ribble Valley Borough Council, Lancashire County Council and United Utilities have been undertaken and did not identify any historical incidents of flooding to the site or within the neighbouring areas. This assessment has considered all sources of flood risk, this includes the existing Ordinary Watercourse crossing the site which is understood to outfall into Higgin Brook 1km north of the site. As part of Phase 1, hydraulic modelling of the Ordinary Watercourse was undertaken to determine the potential flow risks associated with the proposed culverting the Ordinary Watercourse for vehicular crossing as part of Phase 1. The outcomes of the modelling exercise evidenced the risk to the proposals from the existing Ordinary Watercourse is low. The full Hydraulic Assessment has been appended to this assessment for full details. To summarise the proposed Phase 2 & 3 development area will, following the implementation of mitigation measures remain flood free in all key storm events, including the 1 in 100-year (1% AEP) plus Climate Change event without having any impact on the neighbouring land/properties.

7.4 The site is at 'very low' to 'low' flood risk from the reviewed sources of flooding. The primary source of flood risk is considered to be from surface water where the risk varies across the site from 'very low' to 'high' within the natural low-lying areas of site. The risks post-development from surface water will be effectively managed through implementation of the mitigation measures proposed within this assessment, including appropriate ground levels design and inclusion of a suitable surface water management infrastructure. To minimise flood risk from surface water it would also be recommended that natural drainage routes through the site be maintained within the proposals, including the existing Ordinary Watercourse, crossing the site from the southern boundary to the north.

Drainage Strategy

7.6 To ensure surface water flood risk to others does not increase, it is important to ensure surface water run-off is appropriately managed in accordance with the sustainable drainage hierarchy. Three methods have therefore been reviewed for the appropriate management of surface water run-off. These have been applied in the order of priority being; discharge via infiltration, to a watercourse and finally to public sewerage system.

7.7 Based on the ground conditions identified by the published online datasets, infiltration is not considered to provide a viable drainage solution for the development due to the impermeable strata. A ground investigation report (Ref: STN3505NM-G01) was also undertaken for Phase 1 and identified soakaways were not suitable to be used as a method for managing surface water run-off. As infiltration rates can vary on a site by site basis, the Local Planning Authority may still require onsite Soakaway Testing to be undertaken to evidence this is true for Phase 2 & 3, prior to full commencement of works.

7.8 Assuming infiltration is not feasible, the next method in the drainage hierarchy should be discharge to a watercourse. Most of the site naturally drains to the Ordinary Watercourse crossing the site at present and the proposals are therefore to mimic the existing situation, discharging surface water run-off from the site to the watercourse using the existing onsite features where practical. Detailed design will need to confirm feasibility of a site wide gravity solution, although this is anticipated as most of the site naturally drains in this manner at present. It is assumed that multiple outfalls to the watercourse will be required given the scale of the development and formal consents will be required from Lancashire County Council for any works to the Ordinary Watercourse, including agreement of the proposed discharge rates and points of connection.

7.9 In accordance with the SuDS Manual and the Non-Statutory Technical Standards for Sustainable Drainage Systems, all sites should endeavour to achieve as close to pre-development greenfield rates as viable. The proposals are to therefore discharge to the watercourse crossing the site mimicking pre-development greenfield situation, QBar is calculated to be 84.9l/s and will need to be proportioned between the multiple proposed points of outfall. Restricting the rate of discharge will generate an onsite stormwater storage requirement which will be catered for on the site prior to discharge to the watercourse. It would be beneficial to implement SuDS features including permeable surfaces and bio-filtration where at all feasible (subject to ground investigation and contamination review). Given the scale of development it is proposed that pond/basin features be included onsite near to the proposed outfall location(s). If designed appropriately the SuDS features could potentially aid in the attenuation requirements for the proposals and provide added benefits in terms of water quality. Detailed design will be required to confirm whether SuDS can be incorporated.

7.10 This Flood Risk Assessment and Drainage Management Strategy has been prepared in consultation with the relevant interested parties and incorporates their comments where possible. The report is commensurate with the scale and nature of the development proposals and in summary, the development can be considered appropriate in accordance with the Planning Practice Guidance.

8.0 RECOMMENDATIONS

8.1 For 'more vulnerable' development located within Flood Zone 1, it is typical to set the Finished Floor Levels (FFL) of residential dwellings to a minimum of 150mm above the existing ground levels. By ensuring the FFLs are raised sufficiently above the external levels (following any re-grade) should mitigate any risk of flooding from a variety of sources, including groundwater and surface water run-off risks at the proposed development.

8.2 Any overland flows generated by the proposed development must be controlled, safe avenues directing overland flow away from any existing and proposed buildings are advised. As with any development it is also advised that external levels fall away from property to minimise the flood risk from a variety of sources.

8.3 In accordance with LCC there is a requirement to maintain an easement from the existing Ordinary Watercourse for future maintenance. The LCC typically require an 8m easement to be maintained from the Top of Bank of Ordinary Watercourses into the development area. The easement should provide clear and unimpeded access for future maintenance including no fencing, walls or buildings. Ordinary Watercourses are also required to remain open channel where possible. Culverting of the watercourse for crossing purposes however, is typically accepted by LCC as occurred on Phase 1 of development, providing the culverting is kept to a minimum and follows LCC design requirements. Early discussion with LCC is advised to get approval of any culvert proposals.

8.4 To minimise the flood risk to the neighbouring property and proposed dwellings it is proposed that the surface water run-off generated by the proposals be managed effectively with the peak rates of run-off being restricted to the equivalent of the pre-development situation

8.5 Detailed drainage design will be required to refine the drainage strategy following more in-depth levels and layout review. Early discussion with all relevant parties including the EA, LCC, RVBC and UU is advised for any proposed works. Consents will be required from LCC who are the LLFA and therefore in charge of the Ordinary Watercourses in terms of proposed works. Consent would be required for any new outfall structures on the Ordinary Watercourse, and any culverting (to accommodate crossings shown on the layout). Agreement would also be required to agree the proposed rates of discharge to the Ordinary Watercourse.

8.6 The proposed onsite surface water drainage system will need to be sized to contain the 30yr return period event wholly below ground with overland run-off from storm events up to and including the 1 in 100yr return period storm event with a 40% allowance for climate change being contained onsite.

8.7 It is important that should any drainage systems not be offered for adoption to either the United Utilities or Lancashire County Council then an appropriate maintenance regime should be scheduled with a suitably qualified management company for these private drainage systems.

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APPENDIX A: NPPF & PPG EXTRACTS

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14. Meeting the challenge of climate change, flooding and coastal change

148. The planning system should support the transition to a low carbon future in a changing climate, taking full account of flood risk and coastal change. It should help to: shape places in ways that contribute to radical reductions in greenhouse gas emissions, minimise vulnerability and improve resilience; encourage the reuse of existing resources, including the conversion of existing buildings; and support renewable and low carbon energy and associated infrastructure.

Planning for climate change

149. Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures[48]. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure.

150. New development should be planned for in ways that:

a) avoid increased vulnerability to the range of impacts arising from climate change. When new development is brought forward in areas which are vulnerable, care should be taken to ensure that risks can be managed through suitable adaptation measures, including through the planning of green infrastructure; and

b) can help to reduce greenhouse gas emissions, such as through its location, orientation and design. Any local requirements for the sustainability of buildings should reflect the Government's policy for national technical standards.

151. To help increase the use and supply of renewable and low carbon energy and heat, plans should:

a) provide a positive strategy for energy from these sources, that maximises the potential for suitable development, while ensuring that adverse impacts are addressed satisfactorily (including cumulative landscape and visual impacts);

b) consider identifying suitable areas for renewable and low carbon energy sources, and supporting infrastructure, where this would help secure their development; and

c) identify opportunities for development to draw its energy supply from decentralised, renewable or low carbon energy supply systems and for co-locating potential heat customers and suppliers.

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[48] In line with the objectives and provisions of the Climate Change Act 2008.

152. Local planning authorities should support community-led initiatives for renewable and low carbon energy, including developments outside areas identified in local plans or other strategic policies that are being taken forward through neighbourhood planning.

153. In determining planning applications, local planning authorities should expect new development to:

a) comply with any development plan policies on local requirements for decentralised energy supply unless it can be demonstrated by the applicant, having regard to the type of development involved and its design, that this is not feasible or viable; and

b) take account of landform, layout, building orientation, massing and landscaping to minimise energy consumption.

154. When determining planning applications for renewable and low carbon development, local planning authorities should:

a) not require applicants to demonstrate the overall need for renewable or low carbon energy, and recognise that even small-scale projects provide a valuable contribution to cutting greenhouse gas emissions; and

b) approve the application if its impacts are (or can be made) acceptable[49]. Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas.

Planning and flood risk

155. Inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk (whether existing or future). Where development is necessary in such areas, the development should be made safe for its lifetime without increasing flood risk elsewhere.

156. Strategic policies should be informed by a strategic flood risk assessment, and should manage flood risk from all sources. They should consider cumulative impacts in, or affecting, local areas susceptible to flooding, and take account of advice from the Environment Agency and other relevant flood risk management authorities, such as lead local flood authorities and internal drainage boards.

157. All plans should apply a sequential, risk-based approach to the location of development – taking into account the current and future impacts of climate change

[49] Except for applications for the repowering of existing wind turbines, a proposed wind energy development involving one or more turbines should not be considered acceptable unless it is in an area identified as suitable for wind energy development in the development plan; and, following consultation, it can be demonstrated that the planning impacts identified by the affected local community have been fully addressed and the proposal has their backing.

– so as to avoid, where possible, flood risk to people and property. They should do this, and manage any residual risk, by:

a) applying the sequential test and then, if necessary, the exception test as set out below;

b) safeguarding land from development that is required, or likely to be required, for current or future flood management;

c) using opportunities provided by new development to reduce the causes and impacts of flooding (where appropriate through the use of natural flood management techniques); and

d) where climate change is expected to increase flood risk so that some existing development may not be sustainable in the long-term, seeking opportunities to relocate development, including housing, to more sustainable locations.

158. The aim of the sequential test is to steer new development to areas with the lowest risk of flooding. Development should not be allocated or permitted if there are reasonably available sites appropriate for the proposed development in areas with a lower risk of flooding. The strategic flood risk assessment will provide the basis for applying this test. The sequential approach should be used in areas known to be at risk now or in the future from any form of flooding.

159. If it is not possible for development to be located in zones with a lower risk of flooding (taking into account wider sustainable development objectives), the exception test may have to be applied. The need for the exception test will depend on the potential vulnerability of the site and of the development proposed, in line with the Flood Risk Vulnerability Classification set out in national planning guidance.

160. The application of the exception test should be informed by a strategic or site-specific flood risk assessment, depending on whether it is being applied during plan production or at the application stage. For the exception test to be passed it should be demonstrated that:

a) the development would provide wider sustainability benefits to the community that outweigh the flood risk; and

b) the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

161. Both elements of the exception test should be satisfied for development to be allocated or permitted.

162. Where planning applications come forward on sites allocated in the development plan through the sequential test, applicants need not apply the sequential test again. However, the exception test may need to be reapplied if relevant aspects of the proposal had not been considered when the test was applied at the plan-making stage, or if more recent information about existing or potential flood risk should be taken into account.

163. When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment[50]. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

a) within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;

b) the development is appropriately flood resistant and resilient;

c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;

d) any residual risk can be safely managed; and

e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan.

164. Applications for some minor development and changes of use[51] should not be subject to the sequential or exception tests but should still meet the requirements for site-specific flood risk assessments set out in footnote 50.

165. Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:

a) take account of advice from the lead local flood authority;

b) have appropriate proposed minimum operational standards;

c) have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and

d) where possible, provide multifunctional benefits.

Coastal change

166. In coastal areas, planning policies and decisions should take account of the UK Marine Policy Statement and marine plans. Integrated Coastal Zone Management should be pursued across local authority and land/sea boundaries, to ensure effective alignment of the terrestrial and marine planning regimes.

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[50] A site-specific flood risk assessment should be provided for all development in Flood Zones 2 and 3. In Flood Zone 1, an assessment should accompany all proposals involving: sites of 1 hectare or more; land which has been identified by the Environment Agency as having critical drainage problems; land identified in a strategic flood risk assessment as being at increased flood risk in future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use.

[51] This includes householder development, small non-residential extensions (with a footprint of less than 250m^2) and changes of use; except for changes of use to a caravan, camping or chalet site, or to a mobile home or park home site, where the sequential and exception tests should be applied as appropriate.

167. Plans should reduce risk from coastal change by avoiding inappropriate development in vulnerable areas and not exacerbating the impacts of physical changes to the coast. They should identify as a Coastal Change Management Area any area likely to be affected by physical changes to the coast, and:

a) be clear as to what development will be appropriate in such areas and in what circumstances; and

b) make provision for development and infrastructure that needs to be relocated away from Coastal Change Management Areas.

168. Development in a Coastal Change Management Area will be appropriate only where it is demonstrated that:

a) it will be safe over its planned lifetime and not have an unacceptable impact on coastal change;

b) the character of the coast including designations is not compromised;

c) the development provides wider sustainability benefits; and

d) the development does not hinder the creation and maintenance of a continuous signed and managed route around the coast[52].

169. Local planning authorities should limit the planned lifetime of development in a Coastal Change Management Area through temporary permission and restoration conditions, where this is necessary to reduce a potentially unacceptable level of future risk to people and the development.

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[52] As required by the Marine and Coastal Access Act 2009.

Revision date: 06 03 2014

What should be considered if bringing forward a Neighbourhood Development Order/Community Right to Build Order in an area at risk of flooding?

The general approach and requirements for site-specific flood risk assessments should be applied to developments in areas at risk of flooding to be permitted by Neighbourhood Development/ Community Right to Build Orders. This means that for any development proposals:

- in Flood Zone 2 or 3;
- or of at least 1 hectare;
- or in an area that has critical drainage problems (as notified to the local planning authority by the Environment Agency);
- or that may be subject to other sources of flood risk;

a site-specific flood risk assessment should support the draft Order. The flood risk assessment checklist may be helpful in this respect.

Where the neighbourhood planning area is in Flood Zone 2 or 3, or is in an area with critical drainage problems, advice on the scope of the flood risk assessment required should be sought from the Environment Agency. Where the area may be subject to other sources of flooding, it may be helpful to consult other bodies involved in flood risk management, as appropriate.

Where a Neighbourhood Development/Community Right to Build Order is under consideration for a site/area in Flood Zone 2 or 3, which has not been allocated in the development plan through the Sequential Test, and if necessary the Exception Test, it will be necessary for those proposing the development, in having regard to the National Planning Policy Framework's policies on flood risk, to demonstrate why the development cannot reasonably be located in areas of lower flood risk.

In all cases where new development is proposed, the sequential approach to locating development in areas of lower flood risk should still be applied within a neighbourhood planning area.

Neighbourhood Development/Community Right to Build Orders that propose new development that would be;

- contrary to the flood risk vulnerability and flood zone compatibility table (Table 3), or;
- within areas at risk of flooding where sequential testing shows there to be places at lower flood risk which are suitable and reasonably available for the development proposed,

should not be considered appropriate, having regard to the national policies on development and flood risk.

Paragraph: 064 Reference ID: 7-064-20140306

Revision date: 06 03 2014

Flood Zone and flood risk tables

- Table 1: Flood Zones
- Table 2: Flood risk vulnerability classification
- Table 3: Flood risk vulnerability and flood zone 'compatibility'

Table 1: Flood Zones

These Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences. They are shown on the Environment Agency's Flood Map for Planning (Rivers and Sea (https://flood-map-for-planning.service.gov.uk/)), available on the Environment Agency's web site, as indicated in the table below.

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of sea flooding.(Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water has to flow or be stored in times of flood. Local planning authorities should identify in their Strategic Flood Risk Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

Note: The Flood Zones shown on the Environment Agency's Flood Map for Planning (Rivers and Sea) do not take account of the possible impacts of climate change and consequent changes in the future probability of flooding. Reference should therefore also be made to the Strategic Flood Risk Assessment when considering location and potential future flood risks to developments and land uses.

Paragraph: 065 Reference ID: 7-065-20140306

Revision date: 06 03 2014

Table 2: Flood risk vulnerability classification

Essential infrastructure

- Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk.
- Essential utility infrastructure which has to be located in a flood risk area for operational reasons, including electricity generating power stations and grid and primary substations; and water treatment works that need to remain operational in times of flood.
- Wind turbines.

Highly vulnerable

- Police and ambulance stations; fire stations and command centres; telecommunications installations required to be operational during flooding.
- Emergency dispersal points.
- Basement dwellings.
- Caravans, mobile homes and park homes intended for permanent residential use.
- Installations requiring hazardous substances consent. (Where there is a demonstrable need to locate such installations for bulk storage of materials with port or other similar facilities, or such installations with energy infrastructure or carbon capture and storage installations, that require coastal or water-side locations, or need to be located in other high flood risk areas, in these instances the facilities should be classified as 'Essential Infrastructure').

More vulnerable

- Hospitals
- Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.
- Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.
- Non–residential uses for health services, nurseries and educational establishments.
- Landfill* and sites used for waste management facilities for hazardous waste.
- Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.

Less vulnerable

- Police, ambulance and fire stations which are not required to be operational during flooding.
- Buildings used for shops; financial, professional and other services; restaurants, cafes and hot food takeaways; offices; general industry, storage and distribution; non-residential institutions not included in the 'more vulnerable' class; and assembly and leisure.
- Land and buildings used for agriculture and forestry.
- Waste treatment (except landfill* and hazardous waste facilities).
- Minerals working and processing (except for sand and gravel working).
- Water treatment works which do not need to remain operational during times of flood.
- Sewage treatment works, if adequate measures to control pollution and manage sewage during flooding events are in place.

Water-compatible development

- Flood control infrastructure.
- Water transmission infrastructure and pumping stations.
- Sewage transmission infrastructure and pumping stations.
- Sand and gravel working.
- Docks, marinas and wharves.
- Navigation facilities.
- Ministry of Defence defence installations.
- Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location.
- Water-based recreation (excluding sleeping accommodation).
- Lifeguard and coastguard stations.
- Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms.
- Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.

" * " Landfill is as defined in Schedule 10 of the Environmental Permitting (England and Wales) Regulations 2010 (http://www.legislation.gov.uk/uksi/2010/675/schedule/10/made).

Paragraph: 066 Reference ID: 7-066-20140306

Revision date: 06 03 2014

Table 3: Flood risk vulnerability and flood zone 'compatibility'

Table 3: flood risk vulnerability and flood zone ‘compatibility'
(https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/575184/Table_3_-_Flood_risk_vulnerability_and_flood_zone__compatibility_.pdf) (PDF, 58.1KB, 1 page)

Key:

✓ Development is appropriate

✗ Development should not be permitted.

Notes to table 3:

- This table does not show the application of the Sequential Test which should be applied first to guide development to Flood Zone 1, then Zone 2, and then Zone 3; nor does it reflect the need to avoid flood risk from sources other than rivers and the sea;
- The Sequential and Exception Tests do not need to be applied to minor developments and changes of use, except for a change of use to a caravan, camping or chalet site, or to a mobile home or park home site;
- Some developments may contain different elements of vulnerability and the highest vulnerability category should be used, unless the development is considered in its component parts.

† In Flood Zone 3a essential infrastructure should be designed and constructed to remain operational and safe in times of flood.

” * “ In Flood Zone 3b (functional floodplain) essential infrastructure that has to be there and has passed the Exception Test, and water-compatible uses, should be designed and constructed to:

- remain operational and safe for users in times of flood;
- result in no net loss of floodplain storage;
- not impede water flows and not increase flood risk elsewhere.

Paragraph: 067 Reference ID: 7-067-20140306

Revision date: 06 03 2014

Site-specific flood risk assessment: Checklist

1 - Development site and location

You can use this section to describe the site you are proposing to develop. It would be helpful to include, or make reference to, a location map which clearly indicates the development site.

a. Where is the development site located? (eg postal address or national grid reference)

b. What is the current use of the site? (eg undeveloped land, housing, shops, offices)

c. Which Flood Zone (for river or sea flooding) is the site within? (ie Flood Zone 1, Flood Zone 2, Flood Zone 3). As a first step, you should check the Flood Map for Planning (http://apps.environment-agency.gov.uk/wiyby/37837.aspx) (Rivers and Sea). It is also a good idea to check the Strategic Flood Risk Assessment for the area available from the local planning authority.

2 - Development proposals

APPENDIX B: EA INFORMATION & CORRESPONDENCE

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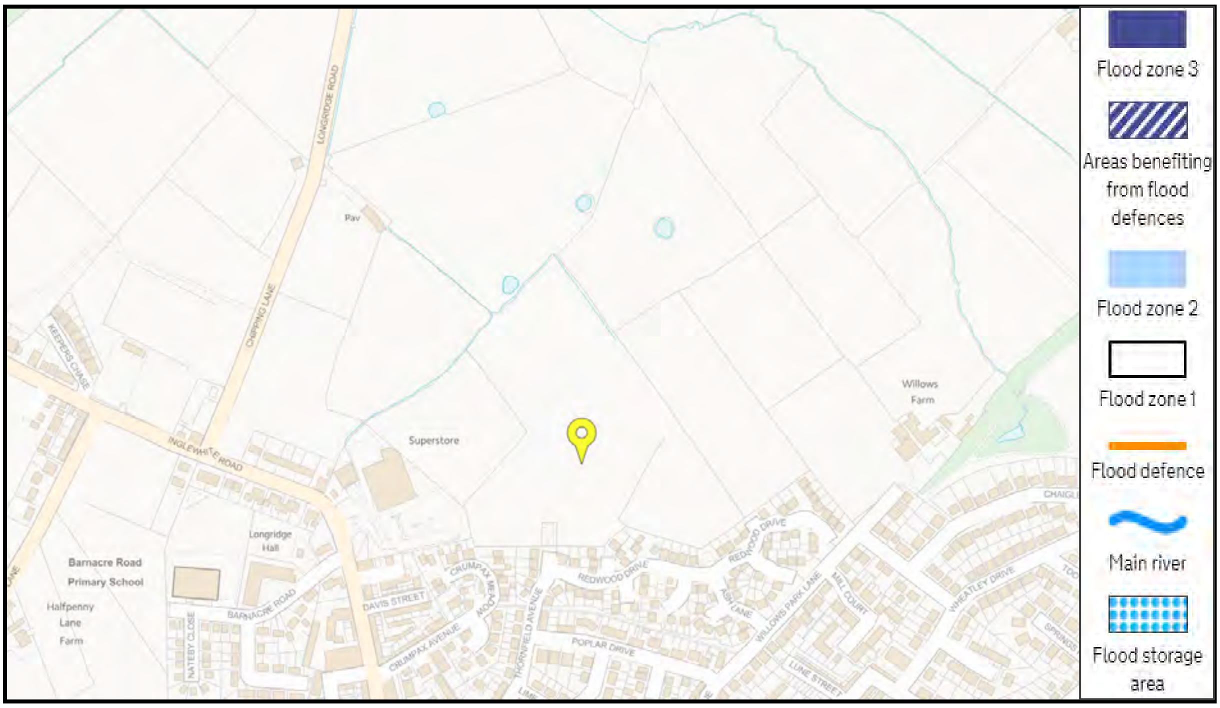
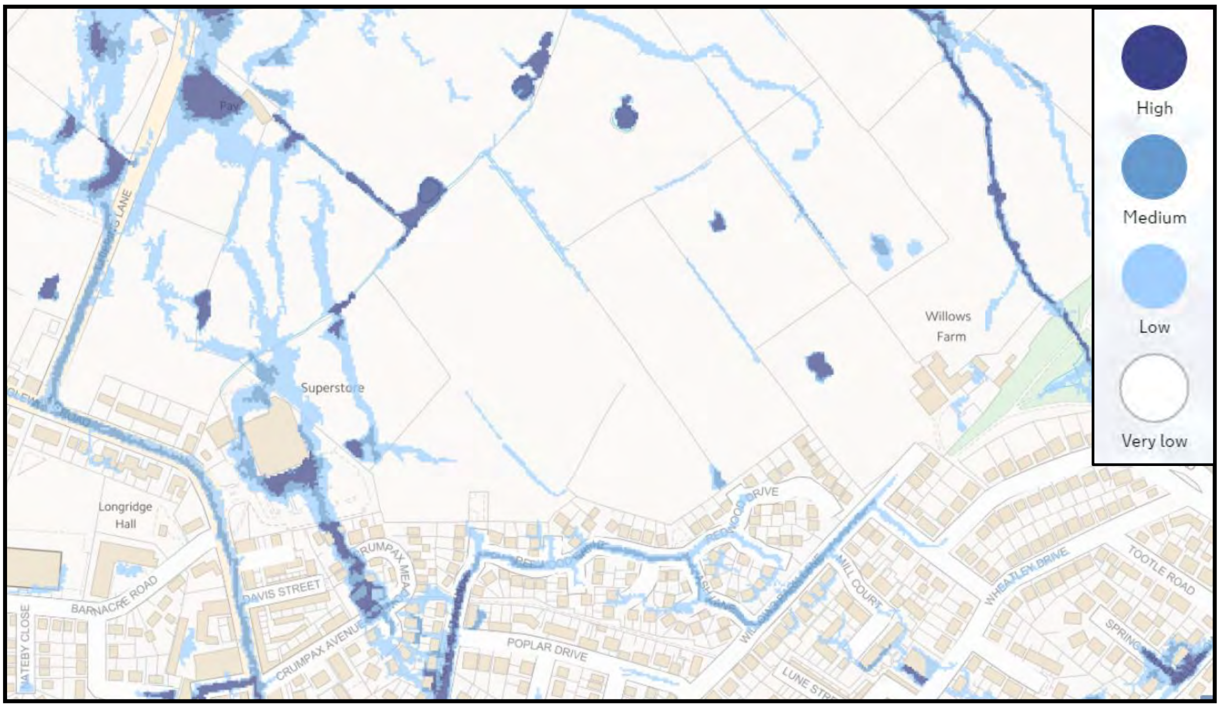
BETTS HYDRO
CONSULTING ENGINEERS

Flood Map for Planning

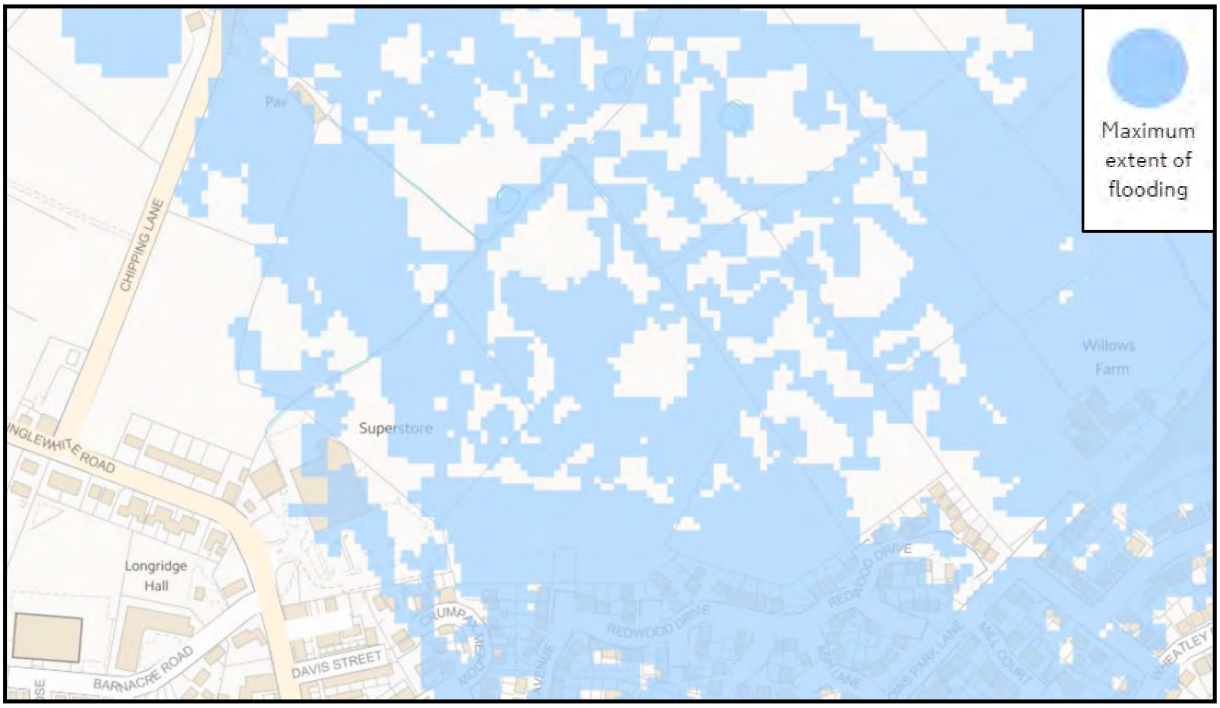


Long Term Flood Risk – Rivers or Sea

Long Term Flood Risk – Surface Water



Long Term Flood Risk - Reservoirs



Megan Berry

From: CMBLNC Info Requests <Inforequests.cmblnc@environment-agency.gov.uk>
Sent: 31 October 2018 11:41
To: Megan Berry
Subject: CL104827HR

Dear Megan

Enquiry regarding product 4 data for Chippings Lane, Longridge.

Thank you for your enquiry received today.

We respond under the Freedom of Information Act 2000 and Environment Regulations 2004.

The area you are looking at does not fall in a flood zone, as such we have no data to provide.

Please get in touch if you have any further queries or contact us within 2 months if you would like us to review the information we have sent.

Kind regards.

Helen Reynolds
Customers and Engagement Officer, Cumbria and Lancashire
Environment Agency | Ghyll Mount, Gillan Way, Penrith 40 Business Park, Penrith, Cumbria, CA11 9BP

From: Megan Berry [mailto:meganberry@betts-associates.co.uk]
Sent: 31 October 2018 11:22

To: CMBLNC Info Requests <Inforequests.cmblnc@environment-agency.gov.uk>
Subject: Historical Flood Information - Product 4

F.A.O Flood Risk, Drainage and/or Planning department

Please forward to the correct department/ office

To whom it may concern,

Chippings Lane, Longridge

Please could you confirm whether you have any information that you feel would be valuable to a Flood Risk Assessment and Drainage Management Strategy for the site above (see location plan attached), including details of historical flooding, predicted flood water levels and current drainage issues; this would be greatly appreciated. If there are any specific requirements that you require in a scope of works for this site please can you advise at this stage so that it can be fully incorporated into the proposals at an early stage.

Please do not hesitate to contact me on the details below to discuss further should you require additional information or clarification.

Kind Regards

Megan Berry BSc(Hons) GradCIWEM
Graduate Flood Risk Analyst

BETTS HYDRO
Specialists in Drainage and Flood Risk
Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire, CH5 2LY

CHESTER OFFICE - 01244 289041

meganberry@betts-associates.co.uk
www.betts-associates.co.uk

CIVIL | STRUCTURAL | GEO-ENVIRONMENTAL | HYDROLOGY | FLOOD RISK MANAGEMENT
SUDS | STRUCTURAL SURVEYS | PARTY WALL DUTIES | INFILTRATION | GEO-TECHNICAL

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APPENDIX C: UU CORRESPONDENCE

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Megan Berry

From: Dodd, Matthew <Matthew.Dodd@uuplc.co.uk>
Sent: 14 November 2018 15:34
To: Megan Berry
Cc: Wastewater Developer Services
Subject: RE: Historical Sewer Flooding Information - GE1835

Good Afternoon

I can confirm that we have no current records of sewer flooding on our DG5 register within the vicinity of the proposed development. The DG5 register is a register of properties that have flooded as a result of hydraulic inadequacy of the public sewer network.

Please note that United Utilities Water Limited (UUW) can only record and check flooding events which are reported to us and we have to comply with our Regulators instructions on the qualification of flooding events to place on the register.

Our response does not include:

- any sewer flooding events caused by blockages or collapses which are the result of third party actions, natural events or other actions over which UUW has no control and not a facet of sewer capacity; or

- any historical sewer flooding events that have been removed from the register as a result of investment in our infrastructure.

As with all development sites, we recommend you liaise with our water and wastewater engineers by contacting our Developer Services team so the details of your development proposal can be considered further. Details can be found at the following link.

https://www.unitedutilities.com/services/builders-developers/

Should you require any further information please do not hesitate to contact me.

Kind regards

Matthew Dodd
Assistant Developer Engineer
Developer Services and Planning
Network Delivery
United Utilities
T: 01925 679369 (internal 79369)
unitedutilities.com

From: Megan Berry [mailto:meganberry@betts-associates.co.uk]
Sent: 31 October 2018 11:23
To: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Subject: Historical Sewer Flooding Information

F.A.O Flood Risk, Drainage and/or Planning department

Please forward to the correct department/ office

To whom it may concern,

Chippings Lane, Longridge

Please could you confirm whether you have any information that you feel would be valuable to a Flood Risk Assessment and Drainage Management Strategy for the site above (see location plan attached), including details of historical flooding, predicted flood water levels and current drainage issues; this would be greatly appreciated. If there are any specific requirements that you require in a scope of works for this site please can you advise at this stage so that it can be fully incorporated into the proposals at an early stage.

Please do not hesitate to contact me on the details below to discuss further should you require additional information or clarification.

Kind Regards

Megan Berry BSc(Hons) GradCIWEM
Graduate Flood Risk Analyst

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Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire, CH5 2LY

CHESTER OFFICE - 01244 289041

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SUDS | STRUCTURAL SURVEYS | PARTY WALL DUTIES | INFILTRATION | GEO-TECHNICAL

Megan Berry

From: Tucker, Sophie <Sophie.Tucker@uuplc.co.uk>
Sent: 10 February 2017 09:36
To: Doyle, Corinne
Cc: SewerAdoptions
Subject: *Ext: HOUSING DEVELOPMENT, CHIPPING LANE, LONGRIDGE, RIBBLE VALLEY – UU Ref 4200014205
Attachments: Pre-start form with Invoice.docx; mg_info.txt

Importance: High

Follow Up Flag: Follow up
Flag Status: Flagged

Dear Corinne,

HOUSING DEVELOPMENT, CHIPPING LANE, LONGRIDGE, RIBBLE VALLEY – UU Ref 4200014205

I refer to your correspondence dated **8th February 2017** and to the plans enclosed therewith, and would inform you that your submission is now satisfactory for incorporating into a Water Industry Act 1991, Section 104 Agreement, providing that the works can be constructed in full accordance with the acceptable drawings numbered as follows:-.

Drainage Layout – 459/ED/02 Rev L
1 in 20 Manholes Details – 459/ED/05 Rev B, 459/ED/09 Rev B, 459/ED/26 Rev C, 459/ED/16 (Flow control)
Long Sections – 459/ED/10 Rev E, 459/ED/11 Rev E, 459/ED/13 Rev B
A3 Land Transfer Plan – 459/ED/01/S104-2
A3 Site Plan - 459/ED/01/S104 Rev D
United Utilities Standard Construction Details (available for download via the following link http://www.unitedutilities.com/documents/developer-services-construction-details.pdf)

(Please note that the following drawings appear to be acceptable, however any works completed to the Pumping Station or Rising Main until the full M&E design is confirmed in writing to be Technically Accepted would be completed at risk. Pumping Station Designers submission now received and request for service to complete a review with UU M&E has been raised).
Pumping Station Civils - 459/ED/15 Rev E
Rising Main Long Section - 459/ED/27 Rev C

To enable the Section 104 Agreement to be completed and inspections to start on site, I would be grateful if you could now provide me with the following:

- **Cheque/payment** for the remainder of the S104 fees **£25,384.00**
- Sign and return the enclosed “Request for approval to commence construction of sewers before signing of agreement form”

Full details of this arrangement are in our ‘Developers Guide’ document a copy of which should already have been provided.

The Developer or his contractor is responsible for verifying all existing service positions and levels on site, including those of the existing public sewerage system, before work commences.

Any costs associated with service diversions required to enable the scheme to be carried in accordance with the acceptable drawings must be borne by the developer.

Where connections are to be made to existing public sewer manholes, the costs for rebuilding the manhole to United Utilities requirements, if deemed necessary by United Utilities, must be borne by the developer. If the works cannot be constructed in accordance with the acceptable plans, the developer must submit revised proposals for appraisal before continuing with the works.

The developer must also obtain specific permission to construct any new manhole or make any connections to the public sewerage system. Please visit our web-site where you will find the S106 Sewer Connection Application form. The form is in two parts but only the second part is required for this scheme which is called **'Request for permission to work on a public sewer'** application form, which the appointed contractor must complete and return to the address on the form. Here is the link to the form: http://www.unitedutilities.com/connecting-public-sewer.aspx

I look forward to receiving the drawings and information requested above at your earliest convenience, but should you require any further information in the meantime, please do not hesitate to contact me.

Regards,
Sophie

Sophie Tucker
Developer Engineer for Adoptions
Developer Services and Planning
Operational Services
United Utilities
T: 01925 679357 (internal 79357)
E: seweradoptions@uuplc.co.uk
unitedutilities.com

BARRATT	Barratt Manchester 4 Brindley Rd City Park Manchester M16 9HQ	Job No	**459**
		Date	**25.10.16**
		Designer	**CD**

Pumping Station Storage Calculations

Project	**Chipping Lane, Longridge - Pump Station with Online Storage Pipe**

Designed to Sewer for Adoption 6th Edition

Input

No. of Dwellings =	513	Units
Max. starts/hour =	15	
Wet Well Diameter =	3.00	m
Lowest Drag Out IL	103.150	m

Incoming Flow

Incoming flow = (4000L/dwelling/day) = 23.75 L/s

Estimate depth of stop/start storage required

Maximum No. of Starts/hour =	15.0	
Duration of Incoming Flow =	4.00	mins
Volume of Incoming Flow /Cycle =	5.700	m^3
Cross-sectional area of wet well =	7.069	m^3
Depth of storage between starts =	0.806	m
Minimum height between start and stop levels =	806	mm
Set height between start/stop levels (duty start) to	**850**	mm

Check number of starts/hour

Volume of storage =	6.008	m^3
Time between starts =	4.22	mins
Number of starts/hour =	14.2	
say	**14**	**starts/hour**

The number of starts is less than permissable, therefore OK

BARRATT

Barratt Manchester
4 Brindley Rd
City Park
Manchester
M16 9HQ

Job No	**459**
Date	**25.10.16**
Designer	**CD**

Pumping Station Storage Calculations

Project	**Chipping Lane, Longridge - Pump Station with Online Storage Pipe**

Volume & Depth of Emergency Storage required

Storage volume required based on 160L/dwelling = 82.08 m^3

Storage of Pipes Foul system upstream of wet well = 35.30 m^3

Length of 150dia pipe=	275.39
Length of 225dia pipe=	98.15
Length of 750dia pipe=	60.06

Manhole	F31	F32
Invert Lvl	102.524	102.12
Dia	1200	1200
Volume	0.708	1.165

Manhole	F29	F34	F30	F15	F16	F17	F18
Invert Lvl	102.017	102.581	101.918	101.688	101.585	101.503	101.373
Dia	1200	1200	1200	1350	1350	1200	1500
Volume	1.281	0.644	1.393	2.093	2.240	1.863	3.140

Manhole	F36	F37	F38	F39	F43	F19	Wet Well (HL alarm)
Invert Lvl	103.029	102.770	102.390	101.800	101.723	101.302	100.765
Dia	1200	1200	1350	1200	2100	2400	3000
Volume	0.137	0.430	1.088	1.527	4.943	8.360	16.858
Total							47.2

Total Volume provided = 82.46 m^3

The total storage provided is greater than storage required therefore OK

Sum of dists upto HL Alarm= 1.350

Sump level of wet well = 99.415

Cover level of wet well = 105.80

Depth of wet well = 6.385

Megan Berry

From: Megan Berry
Sent: 20 November 2018 11:08
To: 'Wastewater Developer Services'
Subject: UU Pre-Development Enquiry - Land off Chipping Lane, Longridge
Attachments: HYD371 Surface Water Run-off Calcs.pdf; Preliminary Drainage Situation for UU .pdf; UU-Wastewater_predevelopment_enquiry.pdf; LOCATION PLAN.pdf

UU PREDEVELOPMENT ENQUIRY. Pro-forma attached.

To Whom It May Concern,

We are currently preparing a Flood Risk Management Assessment and Drainage Management Strategy to support a residential planning application on land off Chipping Lane in Longridge. As part of the preparation, a drainage management strategy has been devised and at this stage we are seeking to begin discussions with UU with regards to the proposed foul water: attached is the pre-application advice form with supporting information as required.

Surface Water: The primary method of discharging surface water in accordance with the national drainage hierarchy should ideally be though infiltration; however Soakaway Testing has been recommended to confirm onsite characteristics. Assuming infiltration does not work on the site, the next approach would be to discharge to the nearest watercourse which has been located crossing site (see drainage strategy attached). Detailed design will be required and full consents to be obtained as the application progresses.

Foul Water: Foul water flows generated by the development are proposed to connect to nearest the public foul water sewer. Review of the UU sewer records identify there to be a foul water pumping station onsite adjacent to the southern boundary. This pumping station has been accounted for within the planning proposals and a public foul water sewer (375mm.dia) associated with the pumping station has been identified onsite adjacent to the southern boundary. Due to the existing land-use onsite, no existing foul water connections to the public sewer network are present. Based on the proposals for the construction of up to 184no. residential units for Phase 2 & 3, the approximate peak foul water flows generated by the development are 8.5l/s. This is based on 4000 litres per dwelling per 24 hours; the guidance contained within Sewers for Adoption (SfA).

Phase 1 has a separate drainage management strategy as detailed in the approved supporting FRA&DMS (REF: 3/2014/0764), which shows foul from this portion of development will outfall into the foul water system located within Inglewhite Road to the south-east of Phase 1. The proposals are therefore to connect into the nearest public foul water sewer onsite adjacent to the southern boundary or divert flows from Phase 2 & 3 towards the pumping station within Phase 1, subject to confirmation of capacity within this existing infrastructure, which ultimately connects into the public sewer network within Inglewhite Road. Detailed design will be required to confirm feasibility based on the topographic levels following further detailed investigation. At this stage however it is understood that a pumped solution may be required based on the existing topographic levels onsite.

We are ultimately seeking to identify United Utilities preferred points of connection(s) and to confirm any constraints. It is acknowledged that considerable offsite work will likely be required to achieve connection to the public sewer network. Hopefully the summary above and the attached are of assistance and allow agreement in principle to be given, do not hesitate to contact me on the details below should you require any further assistance.

Kind Regards

Megan Berry BSc(Hons) GradCIWEM
Graduate Flood Risk Analyst

BETTS HYDRO
Specialists in Drainage and Flood Risk
Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire, CH5 2LY

APPENDIX D: LPA/LLFA CORRESPONDENCE

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Megan Berry

From: Freedom of Information <CSSGFreedom@lancashire.gov.uk>
Sent: 02 November 2018 15:15
To: Megan Berry
Subject: Request for Information (945.1747)PH Acknowledgement

Dear Ms Berry

Request for Information Under the Freedom of Information Act (2000) We are writing to acknowledge receipt of your enquiry of 31st October 2018, in which you request the disclosure of information.
We can confirm that your enquiry will now be assigned to an officer who will commence a search for the information you require and they will respond in due course. The deadline date for issuing you with a full response is 28th November 2018. We will endeavour to provide a response well in advance of this date, however, should we envisage any delays, or require more details from you, we will contact you immediately.

If you have any queries about the above, please do not hesitate to contact us, quoting ref. 945.1747.

Yours sincerely,

On Behalf of the Information Governance Team Lancashire County Council PO Box 78 County Hall Preston PR1 8XJ

From: Suds
Sent: 02 November 2018 10:29
To: Freedom of Information <CSSGFreedom@lancashire.gov.uk>
Subject: Historical Flood Information - Freedom of Information

Good morning,

Please see below a request for flooding information under the Freedom of Information Act.

We will start investigating the query but will await your response before we reply. I have logged the query on HAMS under CRNo136238 but have had to log it as Chipping Road as Chipping Lane is not showing on HAMS.

Regards

Helen Lord
Flood Risk Technical Support Officer
Community Services
Lancashire County Council
T: 01772 536275
W: www.lancashire.gov.uk

From: Megan Berry [mailto:meganberry@betts-associates.co.uk]
Sent: 31 October 2018 11:22
To: Suds <suds@lancashire.gov.uk>
Subject: Historical Flood Information - Freedom of Information

F.A.O Flood Risk, Drainage and/or Planning department

Please forward to the correct department/ office

To whom it may concern,

Chippings Lane, Longridge

Please could you confirm whether you have any information that you feel would be valuable to a Flood Risk Assessment and Drainage Management Strategy for the site above (see location plan attached), including details of historical flooding, predicted flood water levels and current drainage issues; this would be greatly appreciated. If there are any specific requirements that you require in a scope of works for this site please can you advise at this stage so that it can be fully incorporated into the proposals at an early stage.

Please do not hesitate to contact me on the details below to discuss further should you require additional information or clarification.

Kind Regards

Megan Berry BSc(Hons) GradCIWEM
Graduate Flood Risk Analyst

BETTS HYDRO
Specialists in Drainage and Flood Risk
Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire, CH5 2LY

CHESTER OFFICE - 01244 289041

meganberry@betts-associates.co.uk
www.betts-associates.co.uk

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SUDS | STRUCTURAL SURVEYS | PARTY WALL DUTIES | INFILTRATION | GEO-TECHNICAL

Megan Berry

From: Megan Berry
Sent: 31 October 2018 11:22
To: 'contact@ribblevalley.gov.uk'
Subject: Historical Flooding Information - Freedom of Information
Attachments: LOCATION PLAN.pdf

F.A.O Flood Risk, Drainage and/or Planning department

Please forward to the correct department/ office

To whom it may concern,

Chippings Lane, Longridge

Please could you confirm whether you have any information that you feel would be valuable to a Flood Risk Assessment and Drainage Management Strategy for the site above (see location plan attached), including details of historical flooding, predicted flood water levels and current drainage issues; this would be greatly appreciated. If there are any specific requirements that you require in a scope of works for this site please can you advise at this stage so that it can be fully incorporated into the proposals at an early stage.

Please do not hesitate to contact me on the details below to discuss further should you require additional information or clarification.

Kind Regards

Megan Berry BSc(Hons) GradCIWEM
Graduate Flood Risk Analyst

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Specialists in Drainage and Flood Risk
Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire, CH5 2LY

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CIVIL | STRUCTURAL | GEO-ENVIRONMENTAL | HYDROLOGY | FLOOD RISK MANAGEMENT
SUDS | STRUCTURAL SURVEYS | PARTY WALL DUTIES | INFILTRATION | GEO-TECHNICAL

APPENDIX E: LOCATION PLAN

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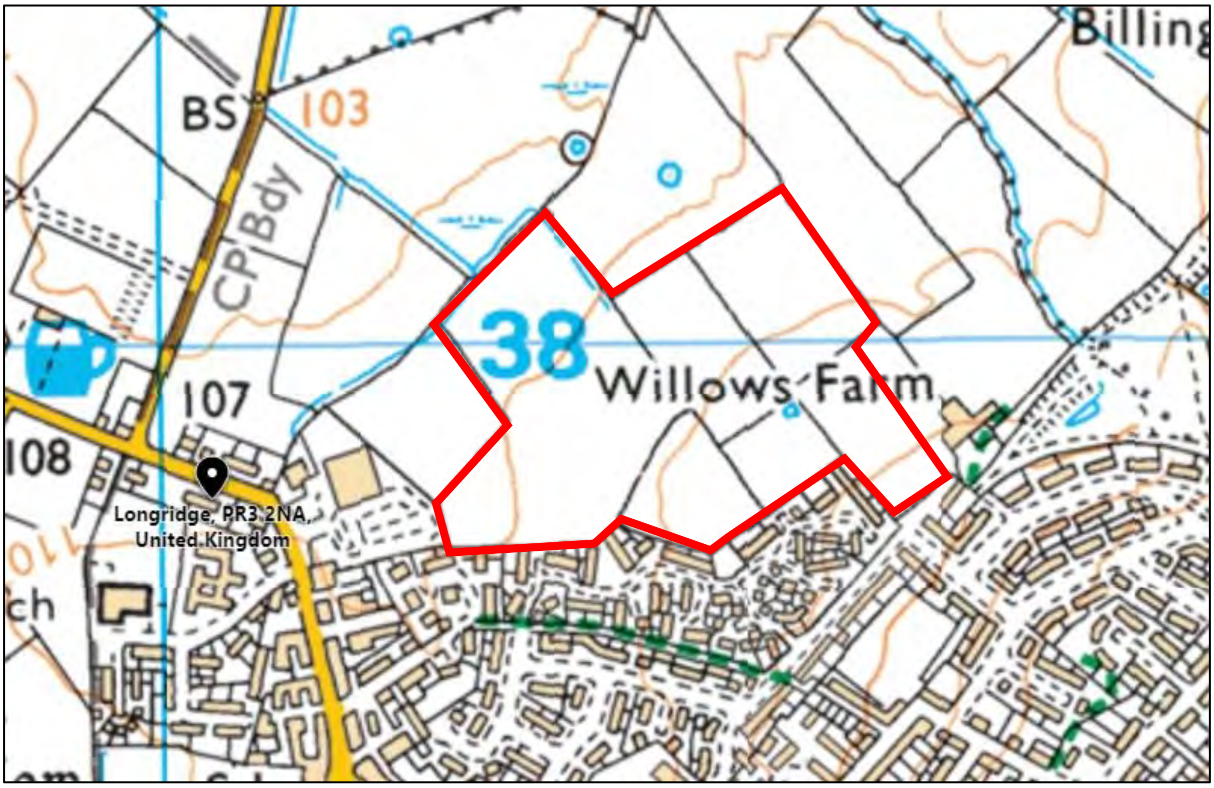
LOCATION PLAN

Chipping Lane, Longridge



OS X (Eastings)	360405
OS Y (Northings)	437794
Nearest Post Code	PR3 3HB
Lat (WGS84)	N53:50:06 (53.834883)
Long (WGS84)	W2:36:11 (-2.603137)
Lat,Long	53.834883,-2.603137
Nat Grid	SD604377 / SD6040537794
mX	-289779
mY	7104425

APPENDIX F: TOPOGRAPHIC SURVEY

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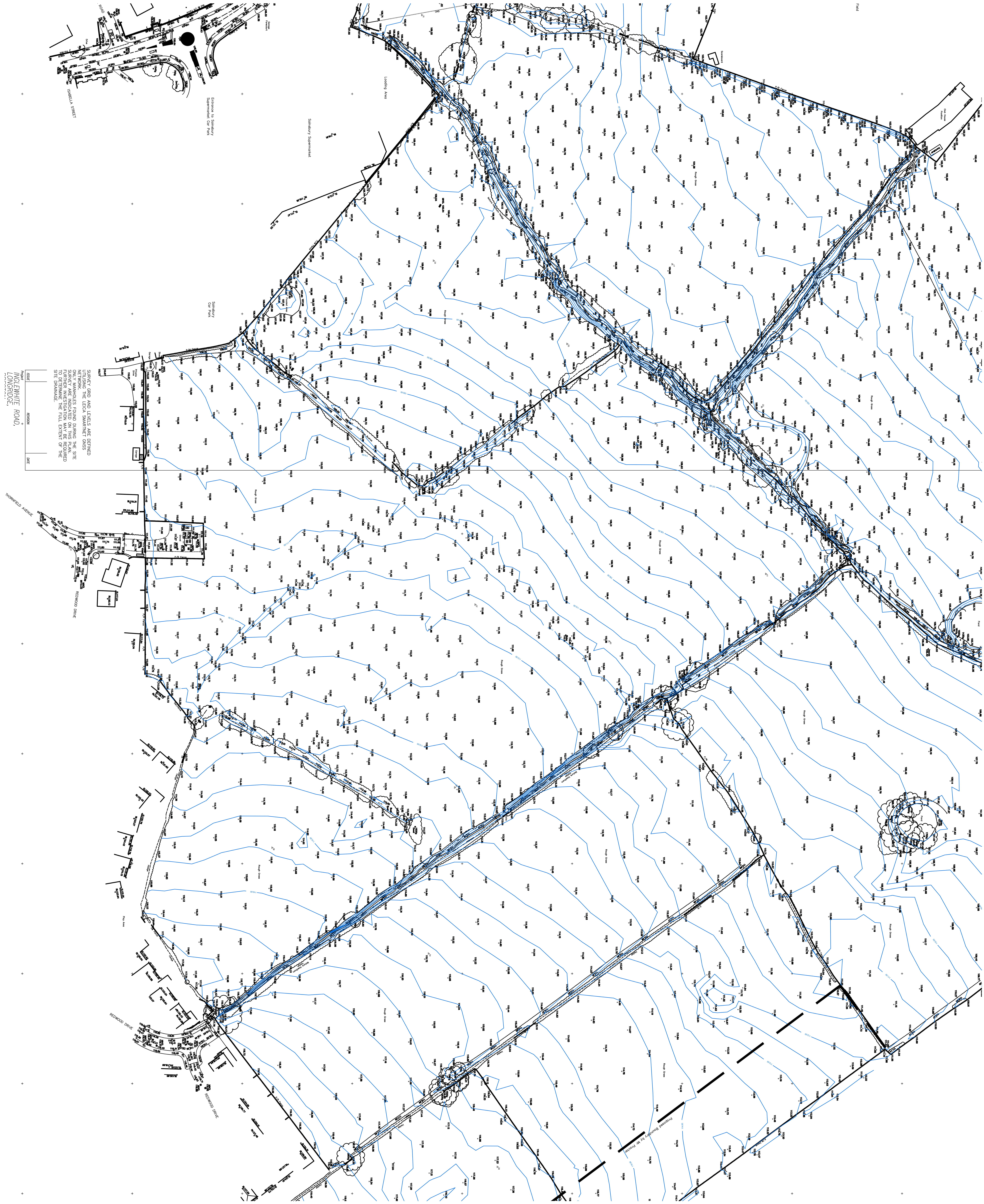

SURVEY GRID AND LEVELS ARE DEFINED UTILISING THE LEICA SMARTNET GNSS NETWORK.
ONLY MANHOLES FOUND DURING THE SITE SURVEY ARE INDICATED ON THIS PLAN. FURTHER INVESTIGATION MAY BE REQUIRED TO DETERMINE THE FULL EXTENT OF THE SITE DRAINAGE.
ISSUE
REVISION
DATE
Project
INGLEWHITE ROAD,
LONGRIDGE,
THORNFIELD AVENUE
REDWOOD DRIVE
Sainsbury Supermarket
Entrance to Sainsbury Supermarket Car Park
Sainsbury Car Park
Loading Area
Field

APPENDIX G: PROPOSED PLANNING LAYOUT

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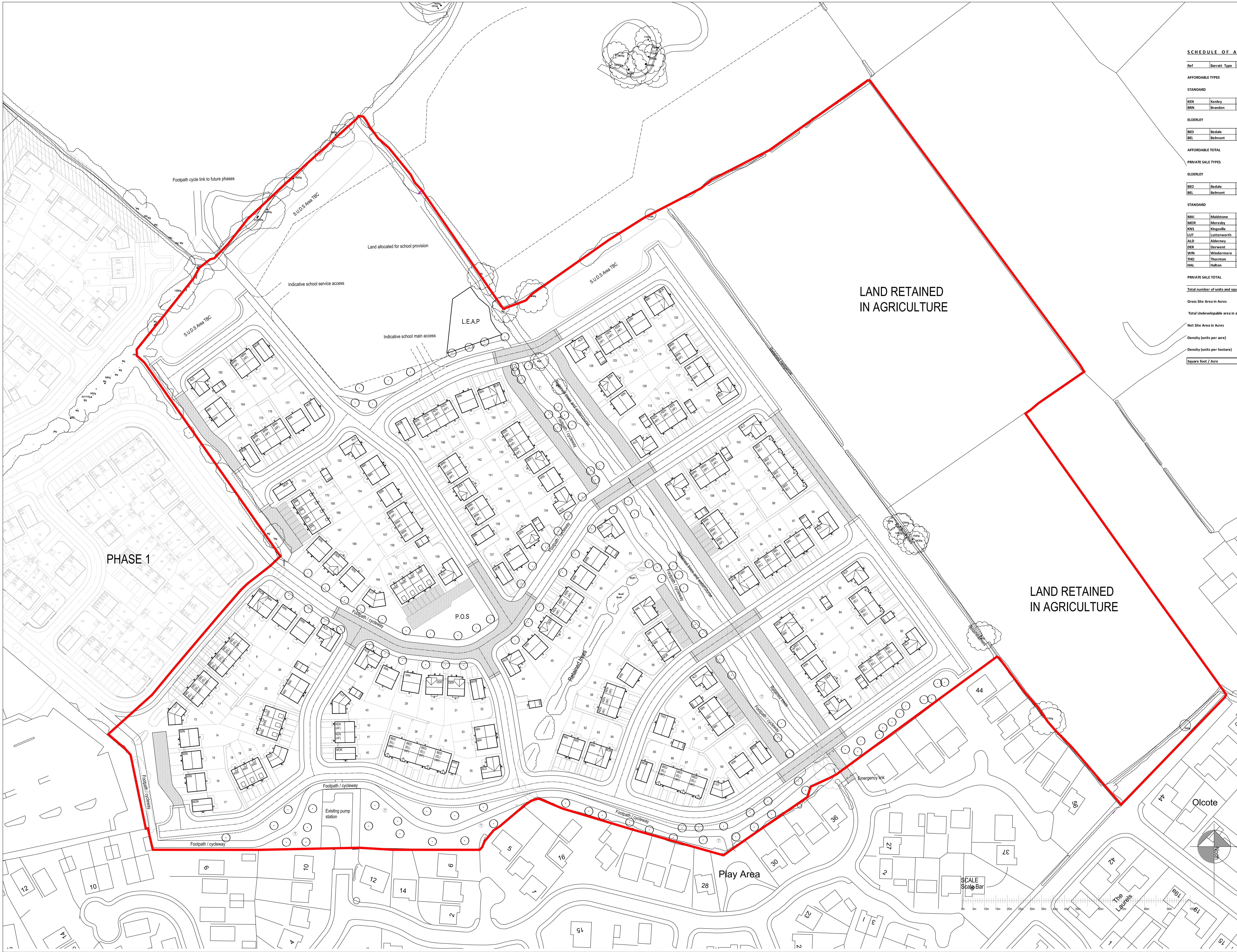

WARNING TO HOUSE PURCHASERS
Property Misdescriptions Act 1991

Buyers are warned that this is a working drawing and is not intended to be treated as descriptive material describing, in relation to any particular property or development, any of the specified matters prescribed by any Order made under the above act. The contents of this drawing may be subject to change at any time, and alterations and variations can occur during the progress of the works without revisions of the drawing. Consequently the layout, form, content and dimensions of the finished construction may differ materially from those shown. Nor do the contents of this drawing constitute a contract, part of any contract, or warranty.

SCHEDULE OF ACCOMMODATION

Ref	Barratt Type	House Type	Sqft	No	Total Sqft
AFFORDABLE TYPES					
STANDARD					
KEN	Kenley	2 Bedroom affordable mews	624	21	13104
BRN	Brandon	3 Bedroom affordable mews	706	20	14120
ELDERLEY					
BED	Bedale	2 Bed LTH Bungalow	594	7	4158
BEL	Belmont	2 Bed LTH House	731	7	5117
AFFORDABLE TOTAL				55	36499
PRIVATE SALE TYPES					
ELDERLEY					
BED	Bedale	2 Bed LTH Bungalow	594	7	4158
BEL	Belmont	2 Bed LTH House	731	7	5117
STANDARD					
MAI	Maidstone	3 Bed semi-detached house	830	26	21580
MOR	Moresby	3 Bed dual aspect semi-detached house	854	18	15372
KNS	Kingsville	3 bed townhouse	1072	14	15008
LUT	Lutterworth	3 bed detached house	1001	5	5005
ALD	Alderney	4 bed dual aspect detached house	1225	19	23275
DER	Derwent	3 bed detached house	920	9	8280
WIN	Windermere	4 bed detached house	1073	22	23606
THO	Thornton	4 bed detached house	1202	1	1202
HAL	Halton	4 bed detached house		1	1267
PRIVATE SALE TOTAL				129	123870
Total number of units and square footage				184	160369
Gross Site Area in Acres					26.11
Total Undevelopable area in acres					14.15
Net Site Area in Acres					11.96
Density (units per acre)					15
Density (units per hectare)					38
Square foot / Acre					13,409

DRAWING KEY

- (AF) AFFORDABLE DWELLINGS
- (EL) DWELLING FOR THE ELDERLY
- (T) PROPOSED TRIM TRAIL ITEM
- TREE/ HEDGE TO BE REMOVED
- TREE/ HEDGE TO BE RETAINED
- BLOCK PAVIORS (RED)
- PROPOSED INDICATIVE TREE PLANTING
- 1800mm TIMBER GATE

Rev	Description	Date	Drawn	Chk'd
02	Tree adjacent to emergency link shown as removed	15-10-18	AA	
01	Schedule amended	12-10-18	AA	

BARRATT HOMES
MANCHESTER

Barratt Homes Manchester
(A division of BDW Trading Ltd)
4 Brindley Road
City Park
Manchester
M16 9HQ
Tel: 0161 872 0161
Fax: 0161 855 2828

Job: CHIPPING LANE LONGRIDGE			
Title: PHASE 2 / 3 PLANNING LAYOUT			
Design By: AA	Date: 10-10-18	Drawing Number: 459-PL04	Rev: 02
Drawn By: AA	Scale @ A1: 1:500		

APPENDIX H: HYDRAULIC ASSESSMENT

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LAND AT CHIPPING LANE, LONGRIDGE

HYDRAULIC ASSESSMENT

For
Barratt Homes Manchester
4 Brindley Road,
City Park,
Manchester,
M16 9HQ.

July 2016

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BETTS HYDRO
CONSULTING ENGINEERS

**LAND AT CHIPPING LANE,
LONGRIDGE**

HYDRAULIC ASSESSMENT

Document Tracking Sheet

Document Reference:	HYD068_CHIPPINGLANE_HYDRAULIC_ASSESSMENT
Revision:	1.0
Date of Issue:	8th July 2016
Report Status:	FINAL

Prepared by:
Dominic Kearney BEng (Hons), MSc, PhD
Principal Hydraulic Analyst

Checked by:
Richard Nicholas BEng (Hons) MBA
Director

Authorised by:
Rob Ankers
Director

Revision History:

Rev.:	**Date:**	**Status:**	**Prepared by:**	**Checked by:**	**Issued by:**
1.0	04/07/16	Final	DK	RN	DK

Old Marsh Farm Barns
Welsh Road, Sealand
Flintshire CH5 2LY
Telephone: 01244 289 041

Betts Hydro Ltd trading as Betts Hydro. Registered in England and Wales No. 09663830
Head Office Betts Associates Ltd

www.betts-associates.co.uk

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CONTENTS

Figures & Tables

Specialist Software

- Flood Estimation Handbook FEH CD-ROM (v.3.0) – Determination of Catchment Descriptors and depths of rainfall.

- ISIS (3.7) – 2013 - 1D Hydraulic Model

Abbreviations & Acronyms

AEP	Annual Exceedance Probability	mAOD	Metres Above Ordnance Datum
BGL	Below Ground Level	NGR	National Grid Reference
CC	Climate Change	NPPF	National Planning Policy Framework
EA	Environment Agency	OS	Ordnance Survey
FEH	Flood Estimation Handbook	PFRA	Preliminary Flood Risk Assessment
FRA	Flood Risk Assessment	PPS	Planning Policy Statement
FZ	Flood Zone	SFRA	Strategic Flood Risk Assessment
Ha	Hectare	LCC	Lancashire County Council
LLFA	Lead Local Flood Authority	TWL	Top Water Level
LPA	Local Planning Authority	UU	United Utilities

1.0 EXISTING SITE SITUATION

1.1 The proposed development site is located on land at Chipping Lane, Longridge and is directly accessed off Chipping Lane. The Ordnance Survey National Grid Reference (OS NGR) for the site is Eastings 360073, Northings 437980 and the nearest postcode is PR3 2NA.

1.2 The proposed development area is edged in red Figure 1 (below). A location plan is included Appendix A.

Figure 1: Aerial Photograph of site (proposed development area edged in red)

1.3 Two small watercourses enter the site from the south east and south west and flow in a north westerly direction, leaving the site via 600mm diameter culvert outfall by Chipping Lane north of the site.

1.4 The Environment Agency flood zone maps indicated that the site is entirely within Flood Zone 1, implying that the site is at low risk of fluvial flooding.

1.6 From a flood risk perspective it was considered prudent to undertake a hydraulic assessment of the watercourse to assess the peak water levels in the watercourse in both the existing and the post development scenarios.

2.0 DEVELOPMENT PROPOSALS

2.1 The initial proposals are a residential development within the red edge boundary indicated in Figure 2 and in Appendix B.

Figure 2: Indicative Planning Proposals

3.0 CATCHMENT DESCRIPTORS

3.1 The Flood Estimation Handbook (FEH) CD-ROM provided catchment descriptors for Higgin Brook upstream of a point north of the development site. Three smaller sub-catchments (Sub A, Sub B and Sub C) upstream of the 600mm culvert were identified using LiDAR data.

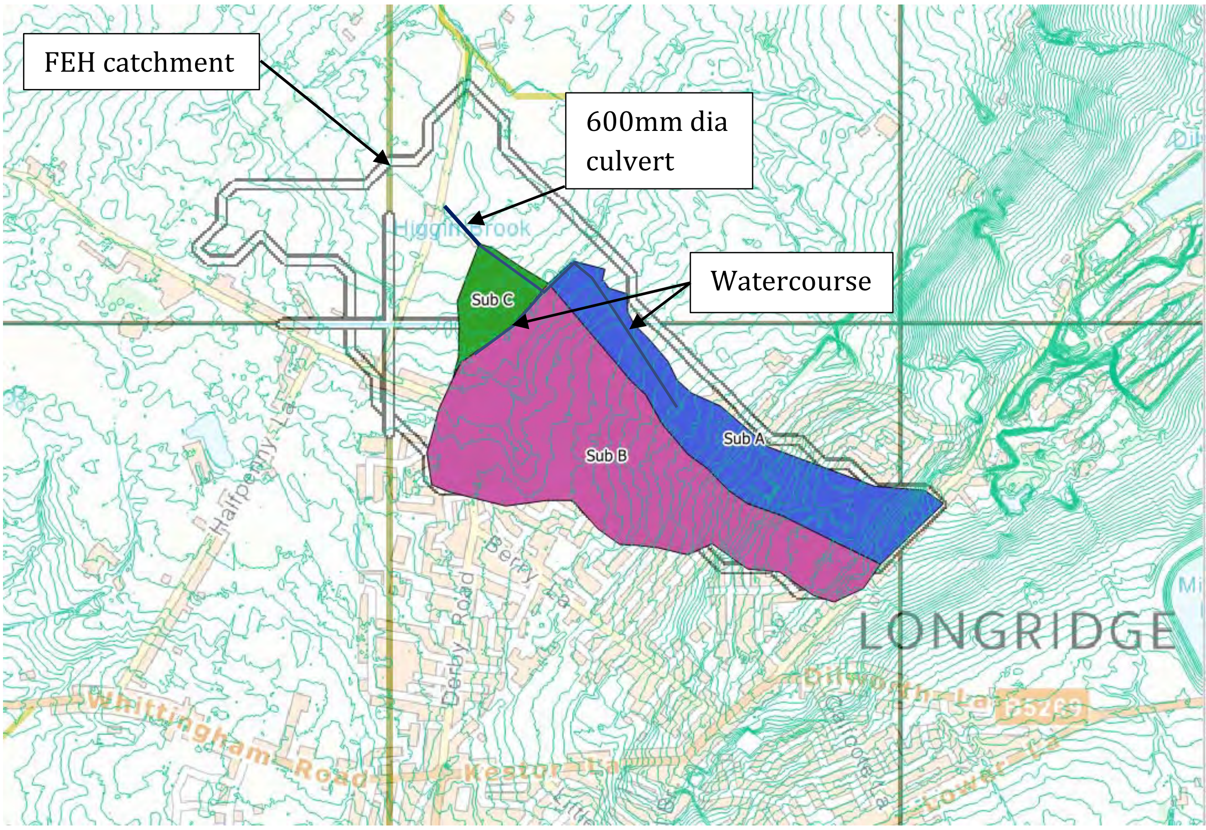

Figure 3: Upstream Sub-catchments

3.2 The FEH Catchment descriptors are summarised below and included in full in Appendix C.

Important Catchment Descriptors: All sub-catchments

DPSBAR (m/km)	22.3	Mean slope between nodes (m/km)
SAAR (mm)	1200	Standard annual average rainfall – 1961-1990
FARL	1.00	Flood attenuation due to reservoirs/lakes (no attenuation)
BFIHOST	0.417	Baseflow index from Hydrology of Soil Types
SPRHOST	35.03	Standard percentage runoff from soil types
PROPWET	0.51	Proportion of time catchment is wet
URBEXT1990	0.1643	Urban extent in 1990 (essentially rural)

3.3 The areas for the sub-catchments were calculated using GIS and mean drainage path length (DPLBAR) was calculated using formula 7.1 from the FEH Volume 5: Catchment Descriptors as follows: $DPLBAR = AREA^{0.548}$. The sub-catchment areas and DPLBAR values are shown in Table 1.

Sub-catchment	Area (km^2)	DPLBAR (km)
Sub A	0.093	0.272
Sub B	0.200	0.414
Sub C	0.022	0.123

Table 1: Sub-catchment specific characteristics

4.0 HYDROLOGY

4.1 The Revitalised Flood Hydrograph (ReFH) method was applied for each sub-catchment based on catchment descriptors. The $URBEXT_{1990}$ <0.5 and BFIHOST<0.65 for all sub-catchments, therefore the use of the ReFH method is appropriate.

4.2 This study has considered the 1 in 5 year (20% AEP), 1 in 30 year (3.3% AEP), 1 in 100 year (1% AEP) and the 1 in 100 year (1% AEP) plus climate change (CC) return period flows in the watercourses.

4.3 These are considered to represent conservative flow estimates (i.e. adopts the precautionary approach). The site is considered to be predominantly greenfield and the catchment characteristics from the FEH CD-ROM were utilised. The peak flow estimates are shown in Table 2 below. Full details are shown in Appendix D.

Sub-Catchment	20% AEP	3.3% AEP	1% AEP	1% AEP + CC
Sub A	0.11	0.18	0.24	0.29
Sub B	0.20	0.32	0.45	0.54
Sub C	0.03	0.06	0.08	0.10

Table 2: ReFH Peak Flow Estimates

4.4 The critical storm duration for the largest sub-catchment (Sub B) was 1.065 hours. It was assumed that the same storm would occur in all sub-catchments, as they are adjacent to one another.

4.5 The full hydrographs for all sub-catchments in all return periods are shown in Figures D.1 to D.10 in Appendix D.

5.0 HYDRAULIC MODELLING

Model Details

5.1 An unsteady state 1D model of the watercourse was developed using ISIS for the existing and the proposed development scenarios.

5.2 A topographical survey of the site and watercourse was undertaken and a 3D ground model was generated. Cross sections through the watercourse were generated from the ground model at locations shown in the model schematics shown in Figure 4. The cross sections (Figures E.1 to E.30) and watercourse profile (Figure E.15) are included in Appendix E.

5.3 The watercourse was modelled in the existing scenario for the 20%, 3.3%, 1% and 1% plus climate change AEP events.

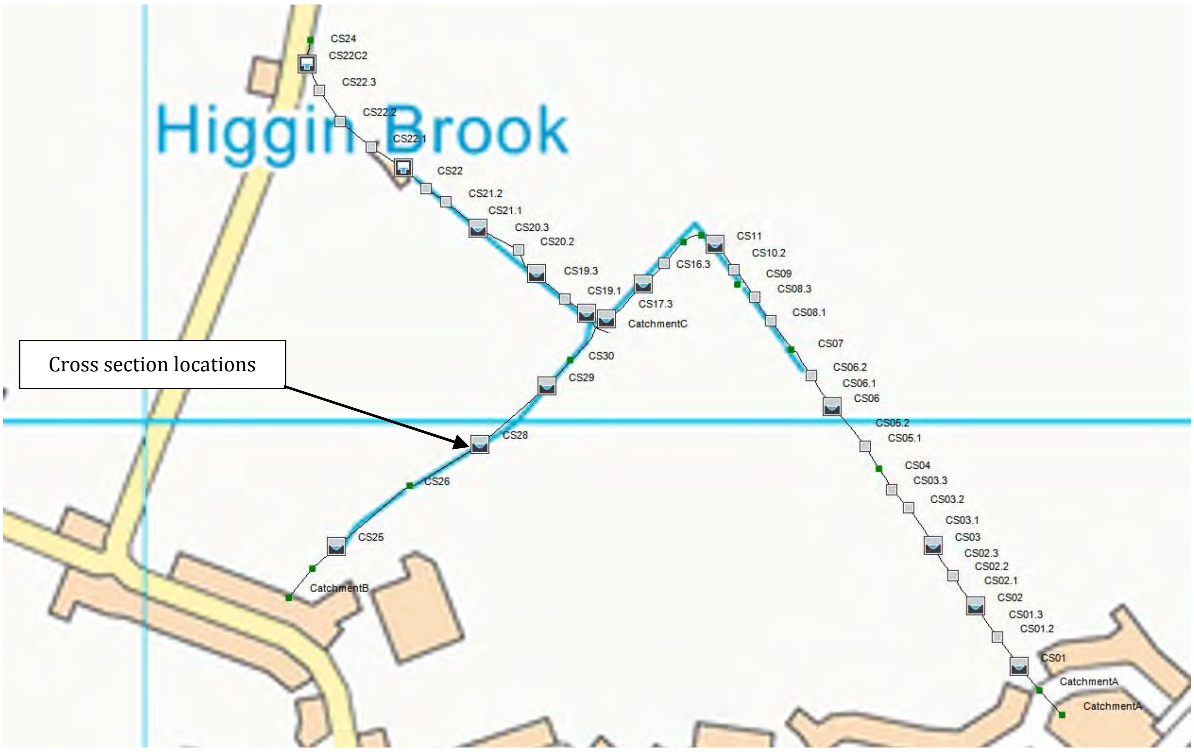

Figure 4: ISIS Model Schematic

5.4 Roughness coefficient allocation was based on aerial imagery. The watercourse channel is straight with some vegetation and as such the channel was assigned a roughness Manning's n value of 0.04 (refer to photographs in Appendix H).

5.5 There are seven structures within the modelled reach of the watercourse:

- 4 no. 300mm diameter pipes;
- 1 no. 525mm diameter pipe;
- 1 no. 575mm diameter pipe;

- 1 no. 600mm diameter pipe.

5.6 Overtopping of the bridges has been modelled in 1-D using a spill unit.

Model Assumptions

5.7 The cross sections were generated from a 3D ground model and so the profile of the channel may not be as true as if cross sections had been specifically surveyed. In some cases, the top water level on the date of the survey may have been used as the bed level. This approach is, however, conservative.

5.8 The diameters of pipes at cross sections 4, 9 and 15 have been assumed to be 300mm due to surveyed information not being available.

Model Results

Existing Scenario

5.7 The hydraulic modelling results including longitudinal profile and cross sections (including peak water levels) are included in Appendix E. Peak water levels for the 20%, 3.3%, 1% AEP and 1% AEP plus climate change events for the existing scenario are shown in Table 3.

5.8 The results show that water levels remain in bank for most of the reach in all AEPs. The peak water level is out of bank at the inlet to the 600mm diameter culvert.

Proposed Scenario

5.9 A 600mm diameter pipe, approximately 26m long, was inserted upstream of cross section number 26 to simulate a proposed crossing. The location of the new crossing is shown in Figure 5.

5.10 The hydraulic modelling results including longitudinal profiles and cross sections (including peak water levels) are included in Appendix F. Peak water levels for the 20%, 3.3%, 1% AEP and 1% AEP plus climate change events for the existing scenario are shown in Table 4.

5.11 Comparison of the existing and post development levels in the 1% AEP plus climate change event shows that peak levels remain largely unchanged, although with some small increases in places. The largest increase is of 27mm at cross section 26/26A, upstream of the proposed new culvert. There is also an increase of 25mm at cross section 25. These increases are relatively small and do not increase flood risk or the likelihood of surcharging of surface water outfalls.

Sensitivity Testing

5.12 Sensitivity testing was carried out on certain key model parameters to determine the effects on the simulated flows and water levels due to controlled changes in accordance with best practice.

5.15 The flow rate was increased by 20% and Manning's n values (channel roughness) were increased and decreased by 20%. These were all undertaken on the 1% AEP flow event (refer to Appendix G for the full sensitivity analysis results).

5.16 The increase in Manning's roughness coefficient, n, resulted in a mean increase in level of 0.022m and a maximum increase of 0.043m, occurring at cross section CS32 at the confluence of sub-catchments A and B. Reducing roughness coefficient by 20% had the effect of maximum decrease in water level of 0.057m. The mean effect was to reduce peak water levels by 0.021m.

5.17 Increasing flow by 20% resulted in a mean increase in peak water level of 0.073m and a maximum of 0.323m occurring at cross section CS07.

5.19 The sensitivity analysis has shown that water levels are not particularly sensitive to changes in channel roughness, with all mean and maximum changes within +/- 0.057m. When the 1% flow was increased by 20%, there were some isolated relatively large increases in water level, the maximum being 0.323m. The mean change was 0.073m and the change throughout most of the modelled reach was less than 0.100m.

5.20 The sensitivity due to these parameters should be taken into account when setting design levels.

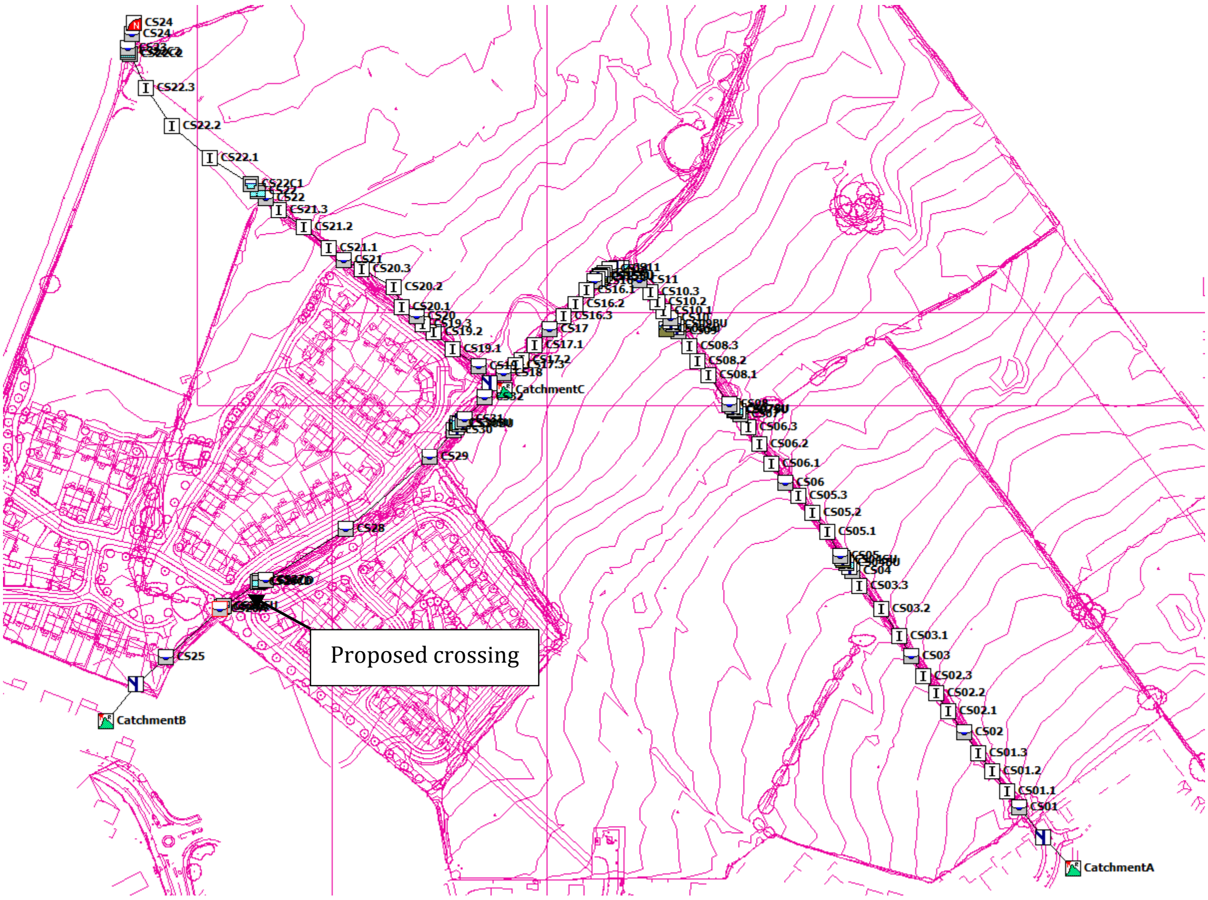

Figure 5: Proposed ISIS model schematic with new crossing

Cross Section	20% AEP (mAOD)	3.3% AEP (mAOD)	1% AEP level (mAOD)	0.1% AEP level (mAOD)
CS01	115.96	116.02	116.06	116.10
CS02	114.79	114.85	114.89	114.92
CS03	113.39	113.45	113.51	113.53
CS04	112.38	112.66	112.88	112.92
CS05	111.36	111.40	111.44	111.47
CS06	109.89	109.92	109.97	110.00
CS07	108.37	108.65	109.08	109.40
CS08	107.86	107.91	107.95	107.97
CS09	107.26	107.51	107.59	107.62
CS10	106.88	106.92	106.97	106.99
CS11	106.39	106.44	106.49	106.51
CS14	105.60	105.85	106.15	106.23
CS15	105.58	105.84	106.15	106.23
CS16	105.14	105.19	105.22	105.25
CS17	103.91	103.92	103.94	103.95
CS18	103.40	103.45	103.50	103.52
CS19	103.40	103.45	103.50	103.52
CS20	102.81	102.88	102.93	103.14
CS21	102.52	102.63	102.84	103.14
CS22	102.40	102.58	102.83	103.14
CS23	101.30	101.39	101.44	101.45
CS24	101.22	101.31	101.35	101.36
CS25	105.85	105.93	106.03	106.13
CS26	105.61	105.76	105.91	106.06
CS27	105.09	105.19	105.27	105.31
CS28	104.81	104.85	104.89	104.92
CS29	104.14	104.23	104.34	104.40
CS30	103.99	104.14	104.27	104.35
CS31	103.63	103.72	103.81	103.85
CS32	103.40	103.45	103.50	103.52

Table 3: Peak 20%, 3.3%, 1% and 0.1% AEP existing water levels

Cross Section	20% AEP (mAOD)	3.3% AEP (mAOD)	1% AEP level (mAOD)	0.1% AEP level (mAOD)
CS01	115.96	116.02	116.06	116.10
CS02	114.79	114.85	114.89	114.92
CS03	113.39	113.45	113.51	113.53
CS04	112.38	112.66	112.88	112.92
CS05	111.35	111.40	111.45	111.47
CS06	109.89	109.92	109.97	110.00
CS07	108.37	108.65	109.08	109.40
CS08	107.86	107.91	107.95	107.97
CS09	107.26	107.50	107.59	107.62
CS10	106.88	106.92	106.97	106.99
CS11	106.39	106.44	106.49	106.51
CS14	105.60	105.85	106.15	106.23
CS15	105.58	105.84	106.15	106.23
CS16	105.14	105.19	105.22	105.25
CS17	103.91	103.92	103.94	103.95
CS18	103.40	103.45	103.50	103.53
CS19	103.40	103.45	103.50	103.53
CS20	102.81	102.88	102.93	103.15
CS21	102.52	102.63	102.84	103.14
CS22	102.41	102.58	102.83	103.14
CS23	101.30	101.39	101.44	101.45
CS24	101.22	101.31	101.35	101.36
CS25	105.86	105.95	106.06	106.15
CS26A	105.67	105.81	105.97	106.09
CS27	105.09	105.19	105.28	105.31
CS28	104.81	104.85	104.89	104.92
CS29	104.14	104.24	104.34	104.41
CS30	103.99	104.14	104.28	104.36
CS31	103.63	103.72	103.81	103.86
CS32	103.40	103.45	103.50	103.53

Table 4: Peak 20%, 3.3%, 1% and 0.1% AEP proposed water levels

6.0 LOW FLOW ANALYSIS

6.1 In order to determine a typical water level above which to set the levels of the surface water outfalls, a low flow analysis was undertaken in accordance with the Institute of Hydrology Report number 108 (IH 108). The analysis included the soil HOST classification, the UK Hydrometric Register and the Flood Estimation Handbook (FEH) CD-ROM.

6.2 An extract from the soil HOST maps is shown in Figure 6, indicating that the soil classification for the catchment is 711m.

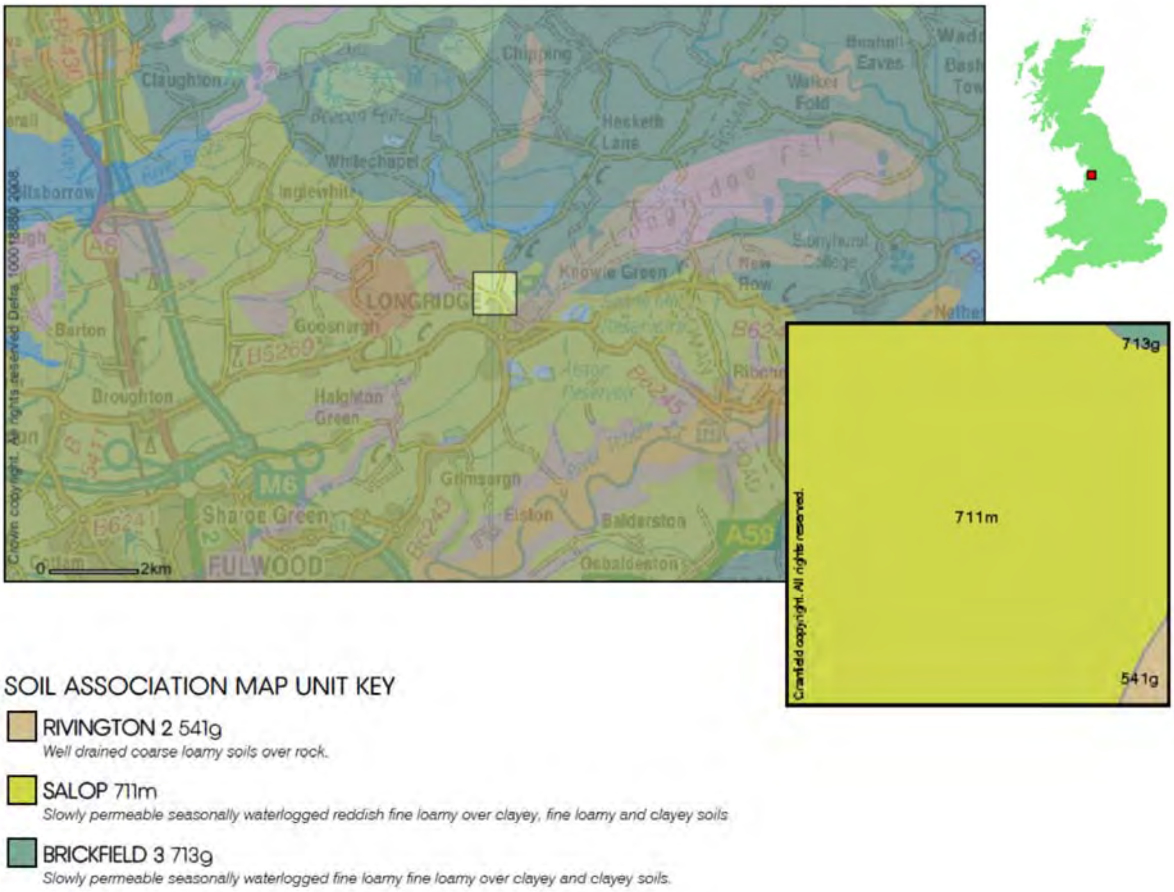

Figure 6: Soil HOST map classification

6.3 The FEH CD-ROM gives the Catchment Area = 0.52km² and standard average annual rainfall, SAAR = 1200mm. The FEH catchment is shown in Figure 7.

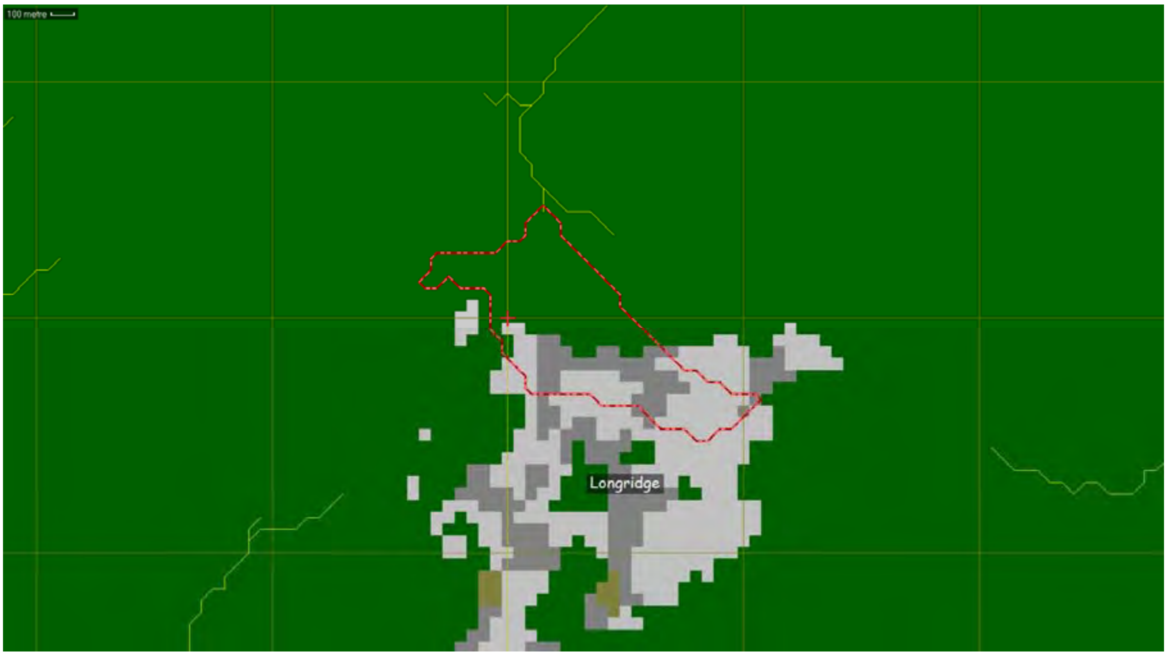

Figure 7: FEH CD-ROM catchment

6.4 From UK Hydrometric Register River Hodder @ Hodder Place (Station Number 71008):

Potential evaporation, PE = 600mm

6.5 From Institute of Hydrology (IH) report 108, section 7.3.2:

Annual Average Runoff Depth (AARD) = SAAR – Losses
Losses = r x PE where r=1 for SAAR>= 850mm

AARD = 1200 – 600
AARD = 600mm

Convert AARD to Mean Flow (MF)

MF = AARD x AREA x (3.17×10^{-5})
MF = 600 x 0.52 x 3.17×10^{-5}
MF = 0.0099 m^3/s

6.6 From IH 108 Appendix 4

Soil type 711m gives the 95 percentile 1-day flow, Q95(1), of 10.7% of mean flow, therefore

Q95(1) = MF x 10.7/100
Q95(1) = 0.0011 m^3/s

6.7 From IH 108 Table 7.1:

Curve 10: Q95(1) percentage of 10.0% is closest to Q95(1) of 10.7% given by soil

Percentile	% Mean Flow	Flow (m^3/s)
2	428.96	0.0425
5	303.93	0.0301
50	52.46	0.0052
80	21.25	0.0021
90	13.75	0.0014
95	10.00	0.0010
99	5.89	0.0006

Table 5: Flow duration

6.8 Flow duration curve is shown in Figure 8.

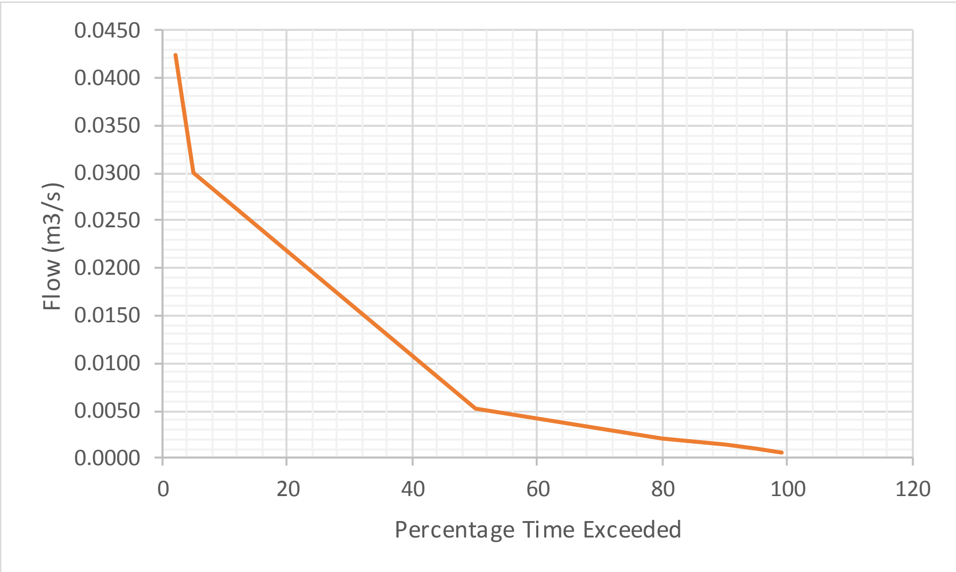

Figure 8: Flow Duration Curve

6.9 The Q95(1) flow of 0.001 m^3/s is too low to be run in the hydraulic model, and so a Manning's equation calculation has been undertaken on a typical cross section to determine the typical water level. The typical cross section is shown in Figure 9.

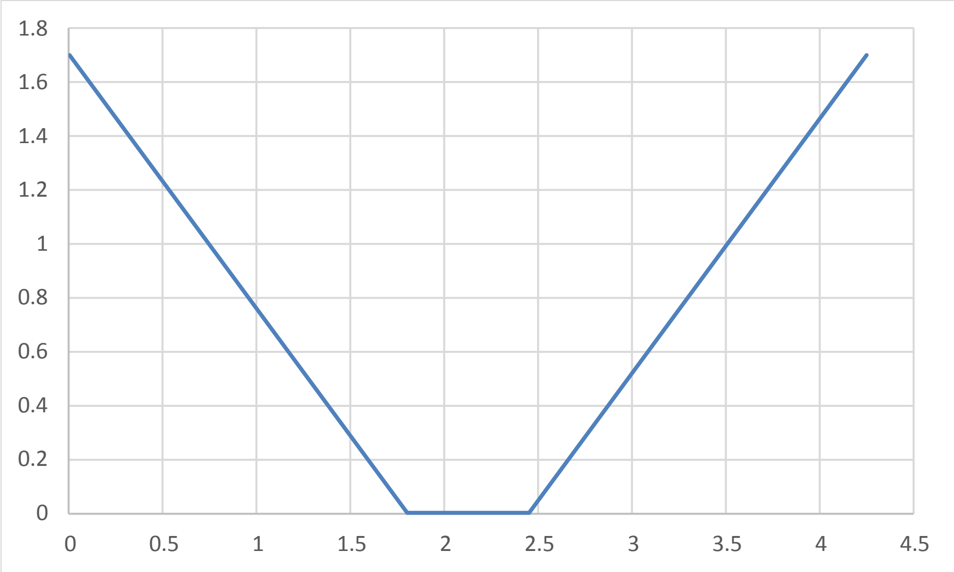

Figure 9: Typical cross section

6.10 Manning's equation is as follows:

$$Q = \frac{AR^{2/3}\sqrt{S}}{n}$$

where Q is flow, A is area of flow, R is hydraulic radius and S is gradient.

6.11 Using the average gradient of 0.025 and a Manning's roughness coefficient of 0.06, Manning's equation yields:

$$A = \frac{Qn}{R^{2/3}\sqrt{S}}$$

$$A = \frac{0.01 \times 0.06}{0.011^{2/3}\sqrt{0.025}}$$

$$A = 0.008\ m^3$$

6.12 The flow area of 0.008m^3 corresponds to a depth in the typical channel cross section of 0.012m. It is therefore recommended that the invert levels of surface water outfalls be set at 300mm above this level.

7.0 CONCLUSIONS

6.1 The hydraulic assessment has indicated that peak water levels in the watercourses remain largely within banks for events up to the 1% AEP plus climate change.

6.2 A thorough sensitivity analysis of key parameters has been undertaken and has shown that the model results are not significantly affected by changes in those parameters.

6.3 A low flow analysis was undertaken to determine the Q95(1) flow. The Q95(1) flow was calculated to be $0.001m^3/s$.

6.4 A Manning's equation calculation provided a typical depth in the channel of 0.012m. It is recommended that the invert levels of the surface water outfalls be set at 300mm above the Q95(1) water level.

BIBLIOGRAPHY & REFERENCES

National Planning Policy Framework, CLG (2012).
Planning Practice Guidance, CLG (2014)
Institute of Hydrology Report No. 108 (1992)

Web-based References

Bingmaps – http://www.bing.com/Maps/
British Geological Survey – http://www.bgs.ac.uk/opengeoscience/home.html
Chronology of British Hydrological Events – www.dundee.ac.uk/
CIRIA – http://www.ciria.org/
Cranfield University – http://www.landis.org.uk/soilscapes/
Environment Agency – www.environment-agency.gov.uk/
FloodProBE – http://www.floodprobe.eu/
Flood Forum – http://www.floodforum.org.uk/
Flood London – http://www.floodlondon.com/
Flood Resilience Group – http://www.floodresiliencegroup.org/frg/
Fylde Borough Council– http://www.fylde.gov.uk/
Google Maps – http://maps.google.co.uk/
Lancashire County Council- http://www.lancashire.gov.uk/home/2010/classic/index.asp
Streetmap – http://www.streetmap.co.uk/
United Utilities - http://www.unitedutilities.com/default.aspx

APPENDIX A: LOCATION PLAN

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OS X (Eastings) 360073
OS Y (Northings) 437980
Nearest Post Code PR3 2NA
Lat (WGS84) N53:50:12 (53.836529)
Long (WGS84) W2:36:30 (-2.608205)
Lat,Long 53.836529,-2.608205
Nat Grid SD600379 / SD6007337980

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APPENDIX B: INDICATIVE PLANNING LAYOUT

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WARNING TO HOUSE PURCHASERS
Property Misdescriptions Act 1991

Buyers are warned that this is a working drawing and is not intended to be treated as descriptive material describing, in relation to any particular property or development, any of the specified matters prescribed by any Order made under the above act. The contents of this drawing may be subject to change at any time, and alterations and variations can occur during the progress of the works without revisions of the drawing. Consequently the layout, form, content and dimensions of the finished construction may differ materially from those shown. Nor do the contents of this drawing constitute a contract, part of any contract, or warranty.

SCHEDULE OF ACCOMMODATION

Abb	House Type	Range	Description	Sqft	No	Total Sqft	Percentage
AFFORDABLE TYPES							
ASH	Ashford	CLASSIC	2 bedroom traditional house	634	15	9510	13
BAM	Bampton	CLASSIC	3 bedroom traditional house	737	12	8844	10
BEA	Beadle	CLASSIC	2 Bedroom LTH bungalow	594	5	2970	4
FOX	Foxton	CLASSIC	1 bedroom elderly apartment	653	2	1306	2
FOX	Foxton 1st	CLASSIC	1 bedroom elderly apartment	665	2	1330	2
AFFORDABLE TOTAL					36	23960	31
PRIVATE SALE TYPES							
FOX	Foxton	CLASSIC	1 bedroom elderly apartment	653	2	1306	2
FOX	Foxton 1st	CLASSIC	1 bedroom elderly apartment	665	2	1330	2
BEA	Beadle	CLASSIC	2 Bedroom LTH bungalow	594	5	2970	4
ASH	Ashford	CLASSIC	2 bedroom traditional house	634	3	1902	3
BAR	Barwick	CLASSIC	3 bed traditional house	831	10	8310	8
MOR	Morpeth	CLASSIC	3 bed dual aspect house	956	16	15296	14
CHE	Cheadle	CLASSIC	3 bed detached house	939	6	5634	5
DEWS	Dewsbury	CLASSIC	3 bedroom traditional house	795	2	1590	2
HELMS	Helmsley	CLASSIC	4 bed 2.5 storey townhouse	1108	9	9972	8
SOM	Somerton	CLASSIC	4 bed detached house	1159	7	8113	6
THO	Thornbury	CLASSIC	4 bed detached house	1203	2	2406	2
KEN	Kennington	CLASSIC	4 bed detached house	1270	6	7620	5
FAR	Farringdon	CLASSIC	3 bed detached house	1082	2	2164	2
LIN	Lincoln	CLASSIC	4 bed dual aspect corner house	1243	10	12430	8
TOTAL					82	81043	69
GRAND TOTAL					118	105003	100

PHASE 1 SITE GROSS AREA: 13.22 ACRES
NON DEVELOPABLE AREA 7.13 ACRES
NET DEVELOPABLE AREA 6.09 ACRES
DENSITY 17242 Sq.ft/acre

Rev	Description	Date	Drawn	Chk'd

BARRATT HOMES MANCHESTER

Barratt Homes Manchester
(A division of BDW Trading Ltd)
4 Brindley Road
City Park
Manchester
M16 9HQ
Tel: 0161 872 0161
Fax: 0161 855 2828

Job: CHIPPING LANE LONGRIDGE

Title: PHASE 1 PLANNING LAYOUT

Design By	Date	Drawing Number	Rev
AA	25/11/15	459-PL01	
Drawn By	Scale @ A1		
AA	1:500		

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APPENDIX C: FEH CATCHMENT DATA & DESCRIPTIONS

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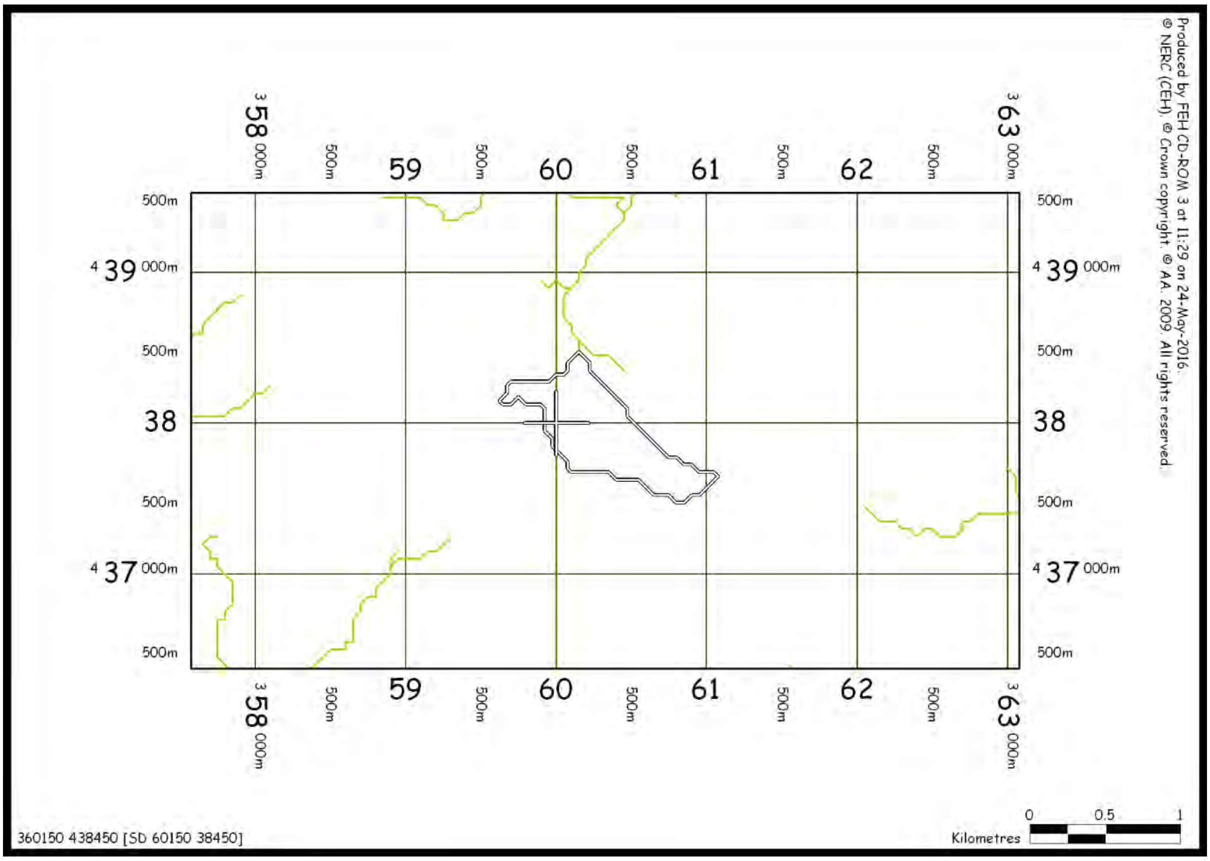
Higgin Brook catchment and catchment characteristics



AREA	0.52	URBLOC1990	1.515
ALTBAR	115	C	-0.025
ASPBAR	325	D1	0.40671
ASPVAR	0.65	D2	0.33211
BFIHOST	0.417	D3	0.41529
DPLBAR	0.77	E	0.29629
DPSBAR	22.3	F	2.45864
FARL	1	C(1 km)	-0.025
LDP	1.58	D1(1 km)	0.404
PROPWET	0.51	D2(1 km)	0.33
RMED-1H	10.5	D3(1 km)	0.417
RMED-1D	39.7	E(1 km)	0.296
RMED-2D	51.6	F(1 km)	2.453
SAAR	1200		
SAAR4170	1137		
SPRHOST	35.03		
URBCONC1990	0.964		
URBEXT1990	0.1643		

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APPENDIX D: REVITALISED FLOOD HYDROGRAPH METHOD OUTPUTS [PEAK FLOW ESTIMATES]

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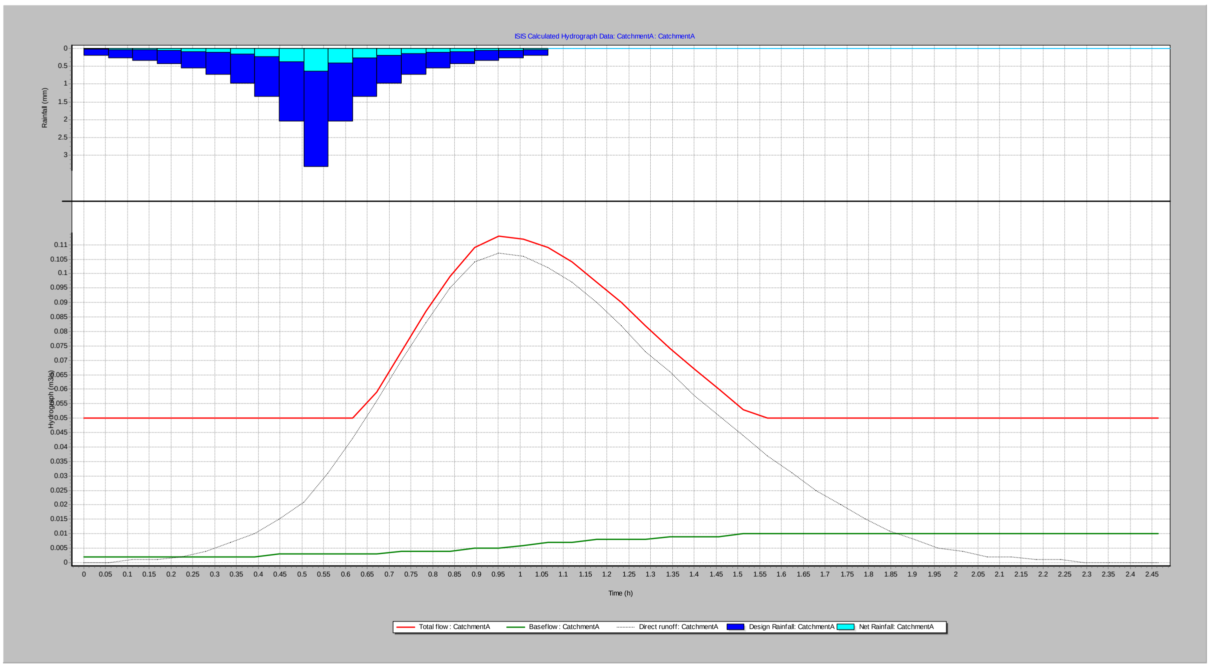

Figure D.1 Sub-catchment A 1 in 5 year (20% AEP) flow hydrograph

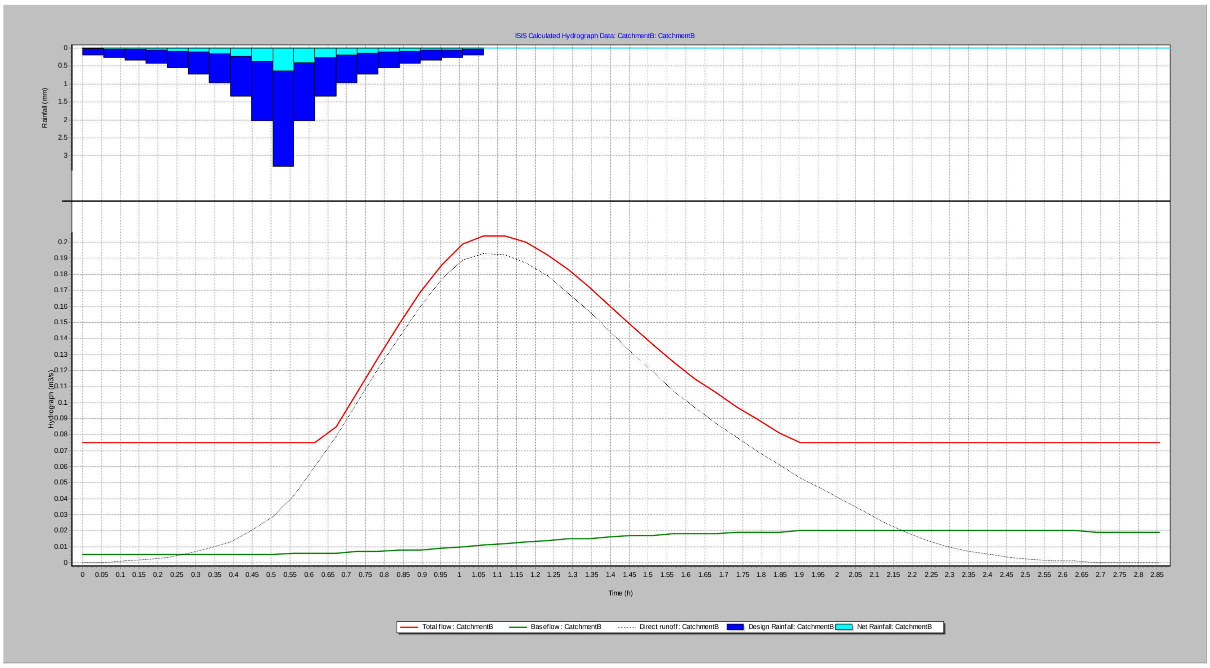

Figure D.2 Sub-catchment B 1 in 5 year (20% AEP) flow hydrograph

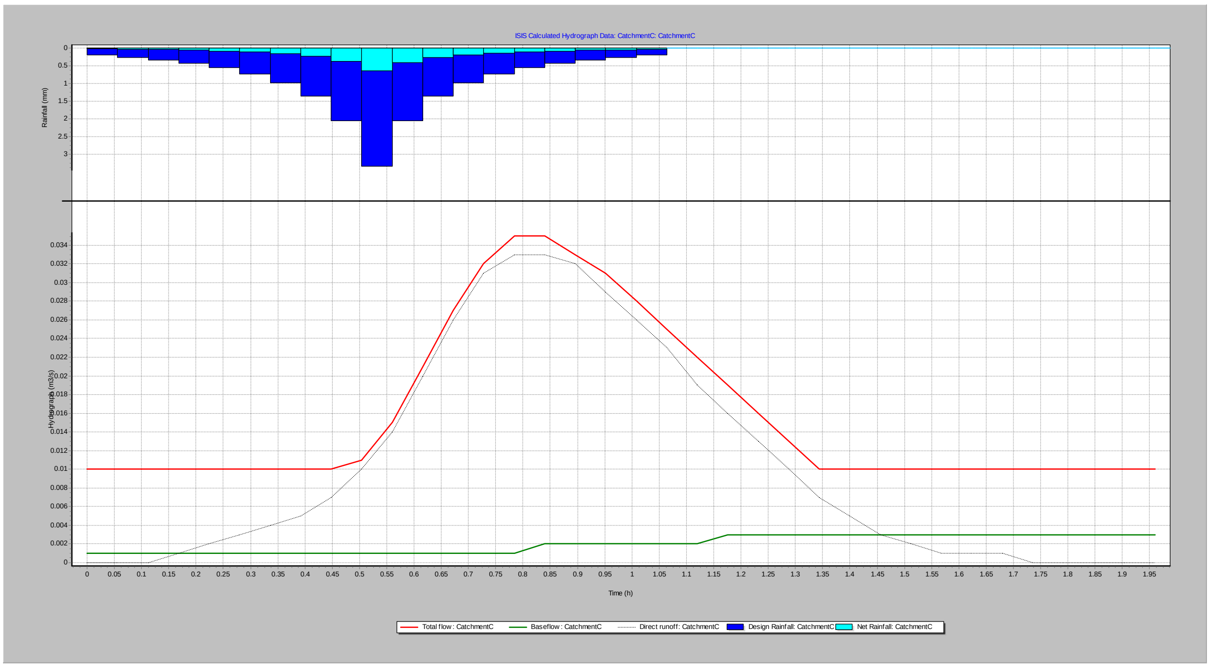

Figure D.3 Sub-catchment C 1 in 5 year (20% AEP) flow hydrograph

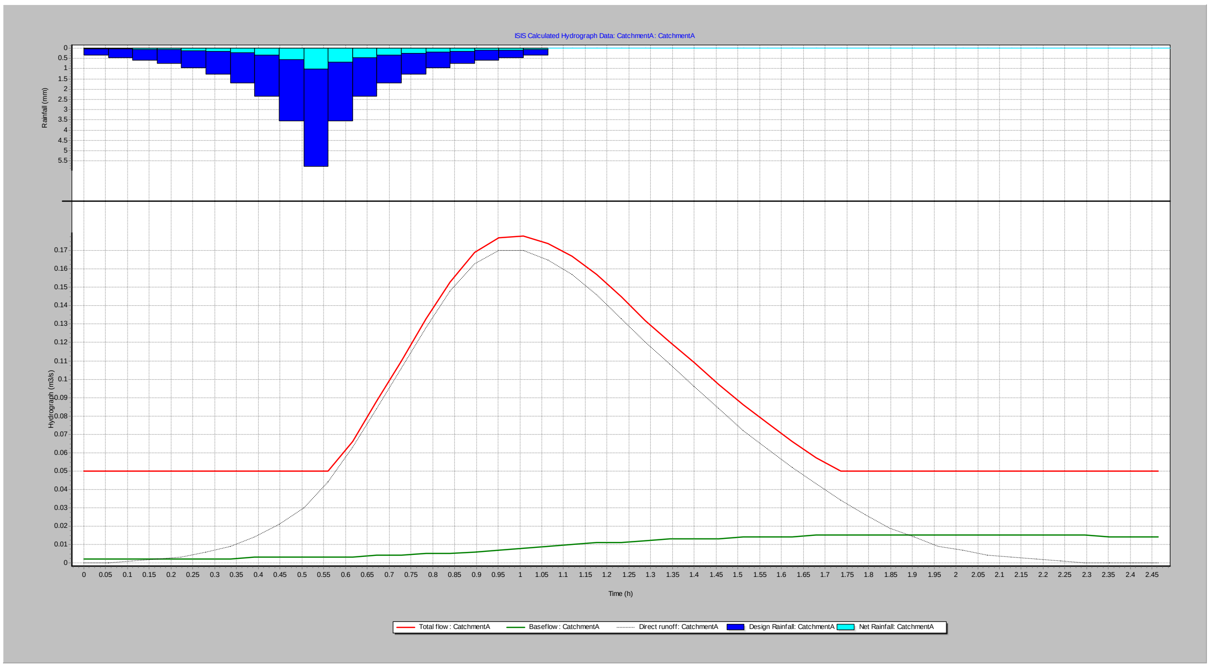

Figure D.4 Sub-catchment A 1 in 30 year (3.3% AEP) flow hydrograph

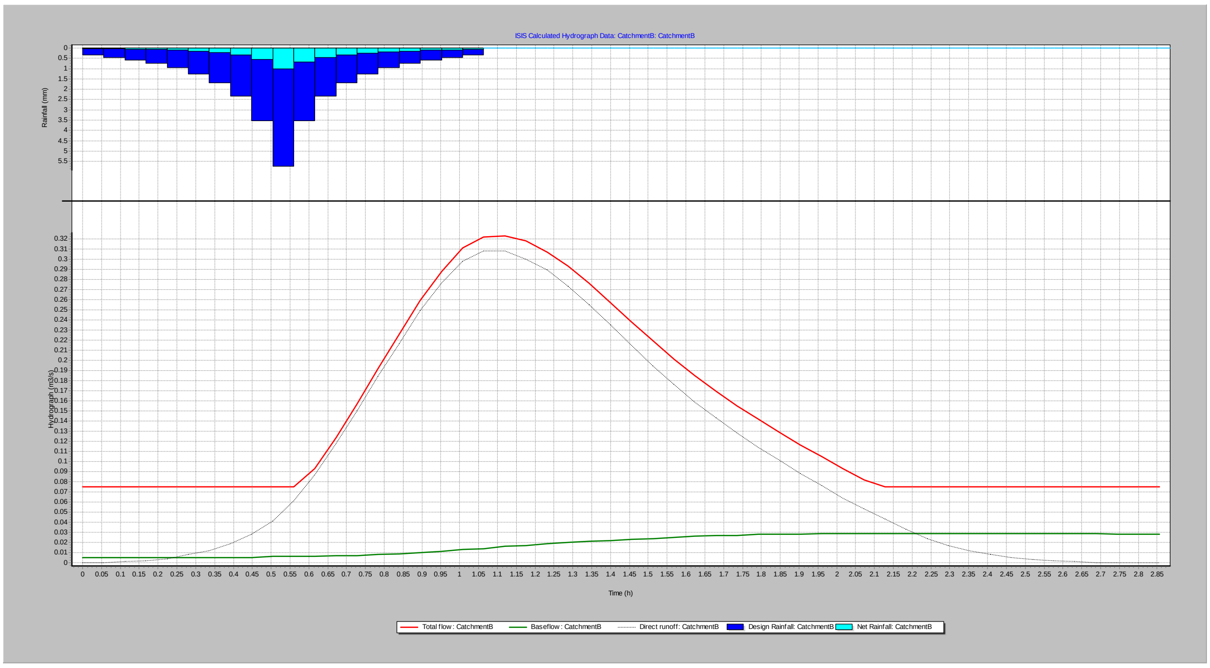

Figure D.5 Sub-catchment B 1 in 30 year (3.3% AEP) flow hydrograph

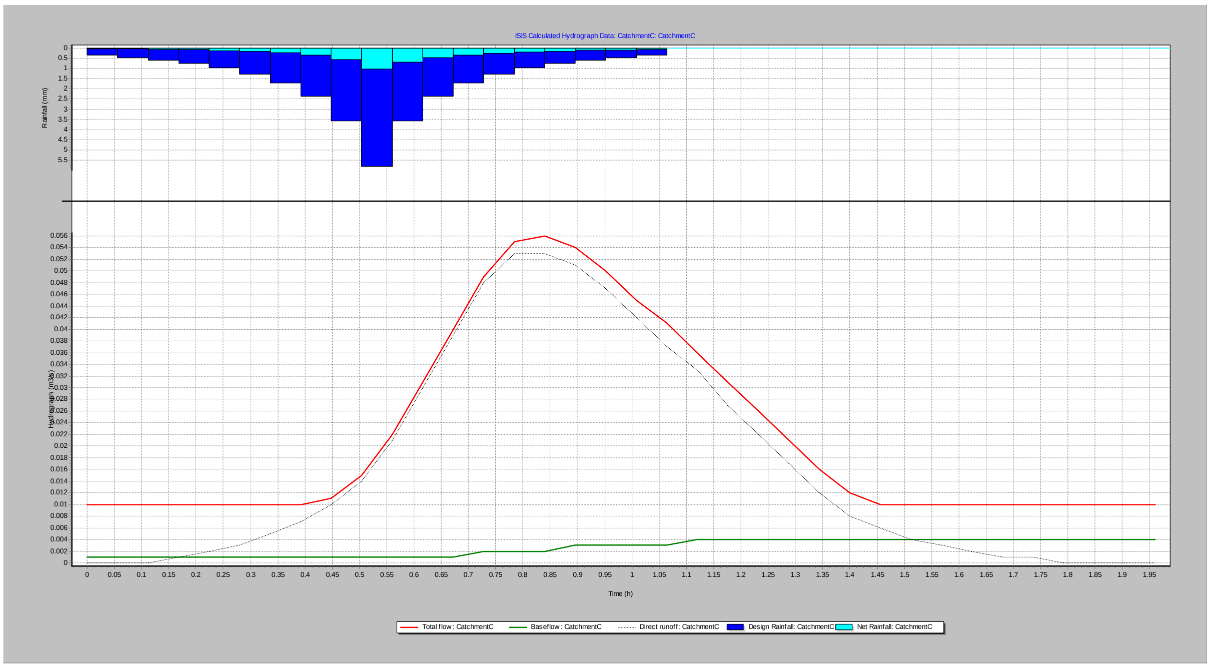

Figure D.6 Sub-catchment C 1 in 30 year (3.3% AEP) flow hydrograph

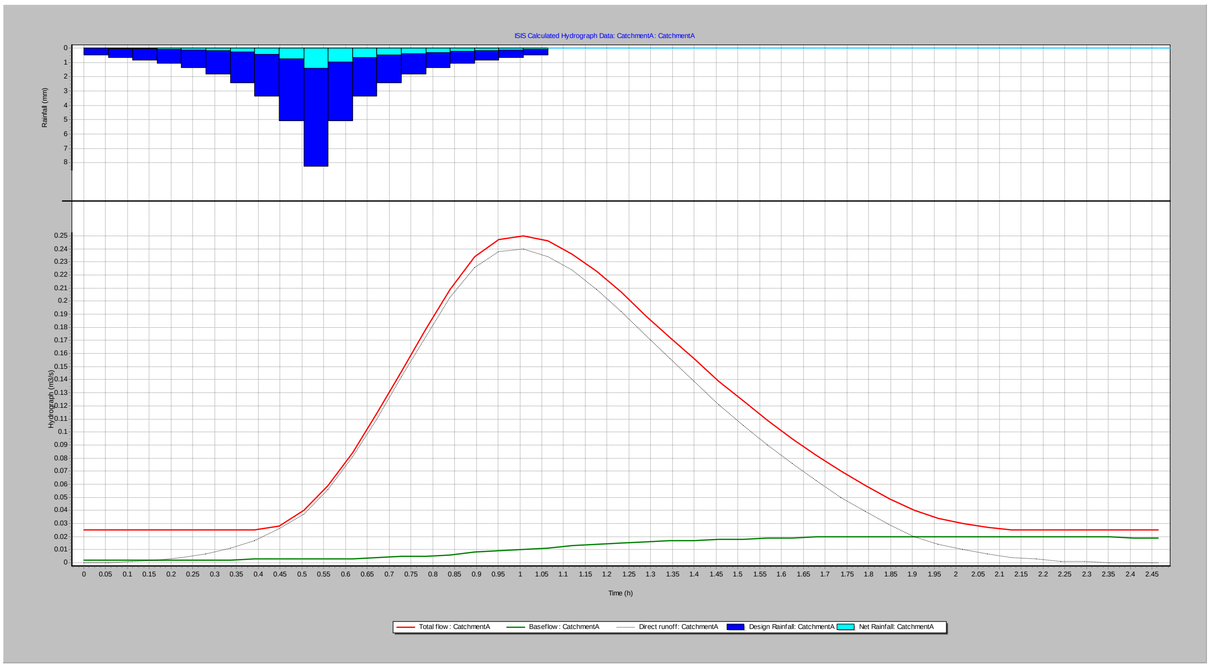

Figure D.7 Sub-catchment A 1 in 100 year (1% AEP) flow hydrograph

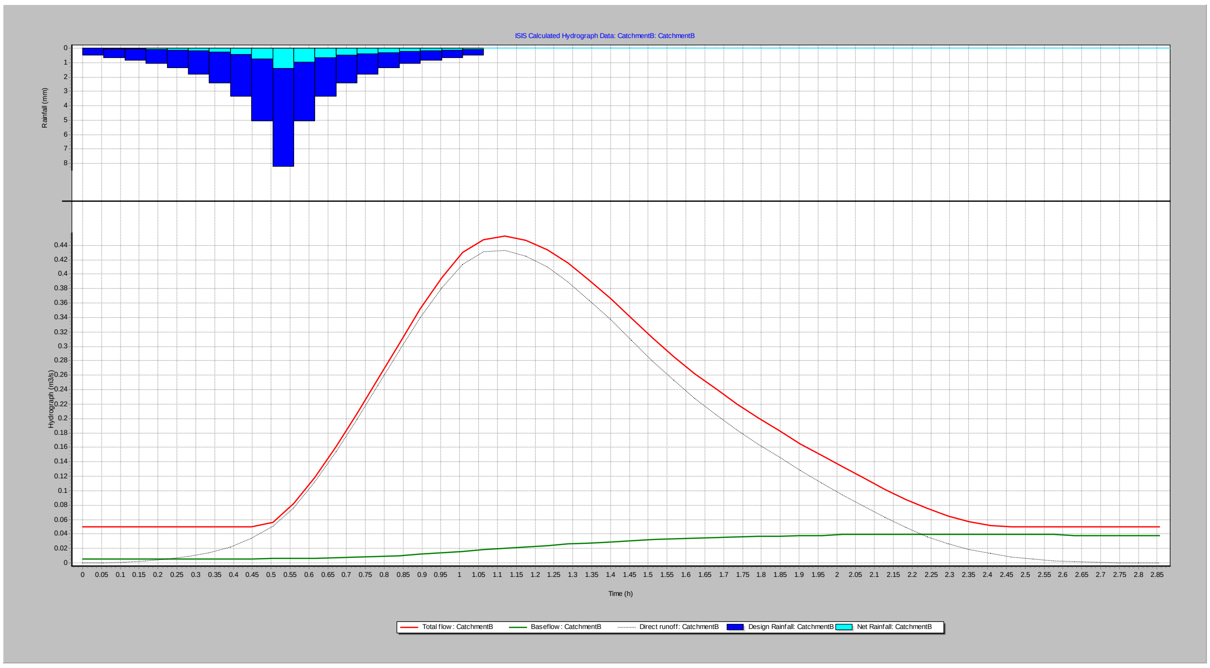

Figure D.8 Sub-catchment B 1 in 100 year (1% AEP) flow hydrograph

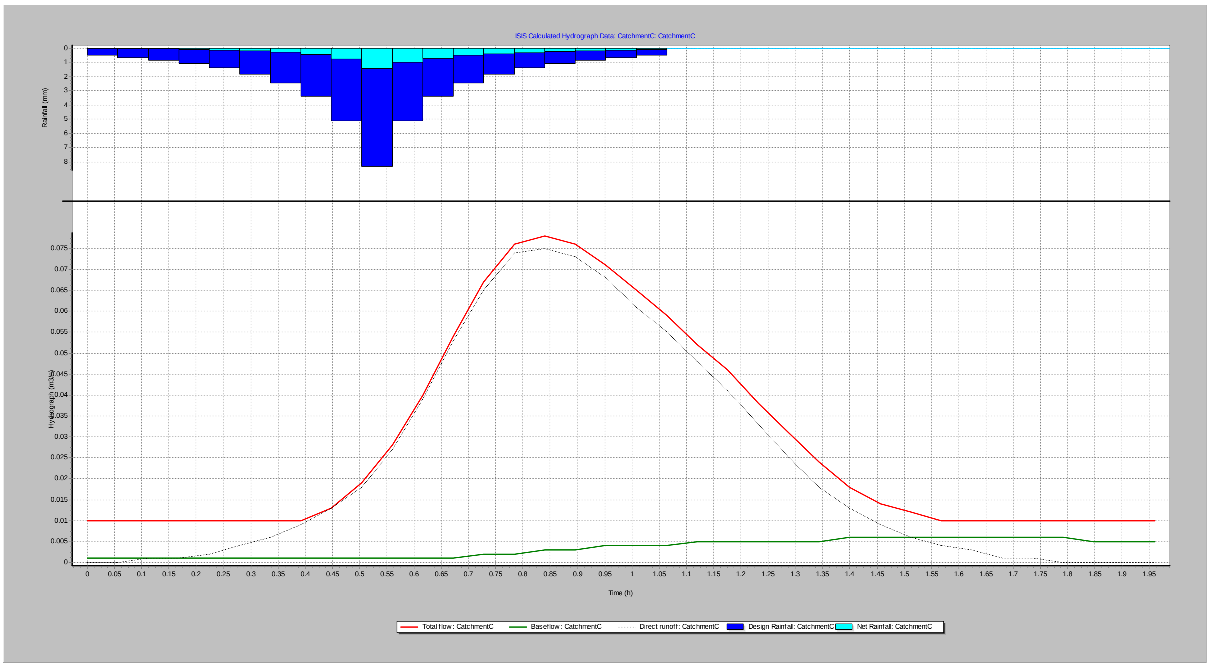

Figure D.9 Sub-catchment C 1 in 100 year (1% AEP) flow hydrograph

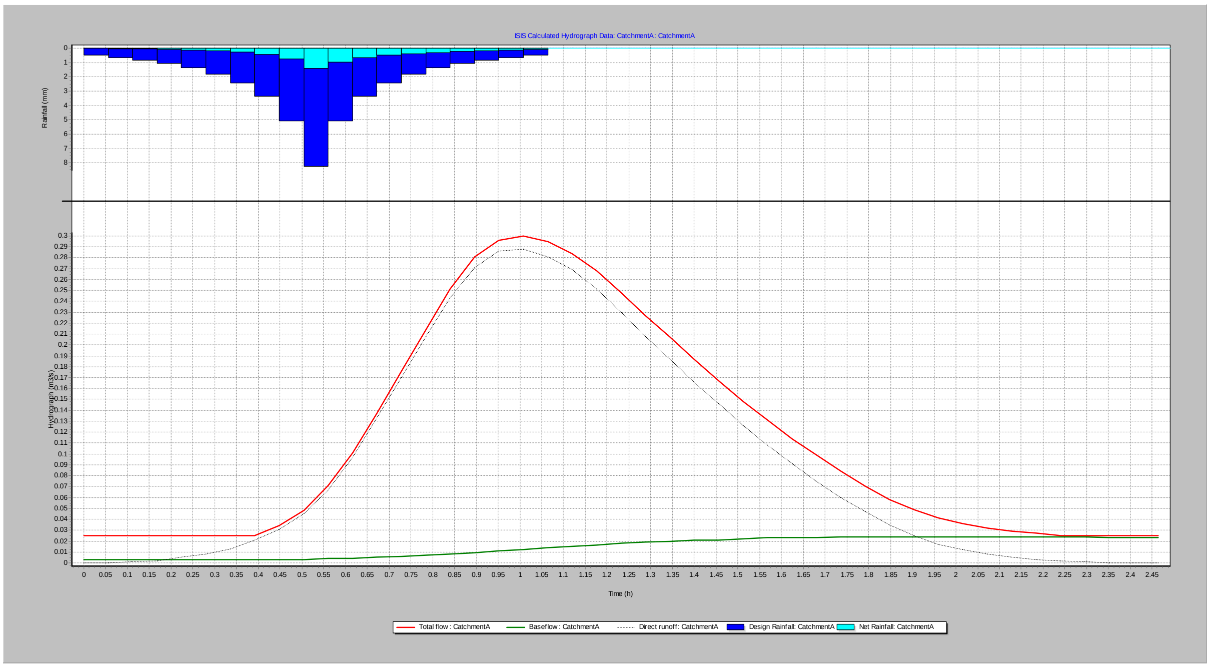

Figure D.9 Sub-catchment A 1 in 100 year (1% AEP) plus climate change flow hydrograph

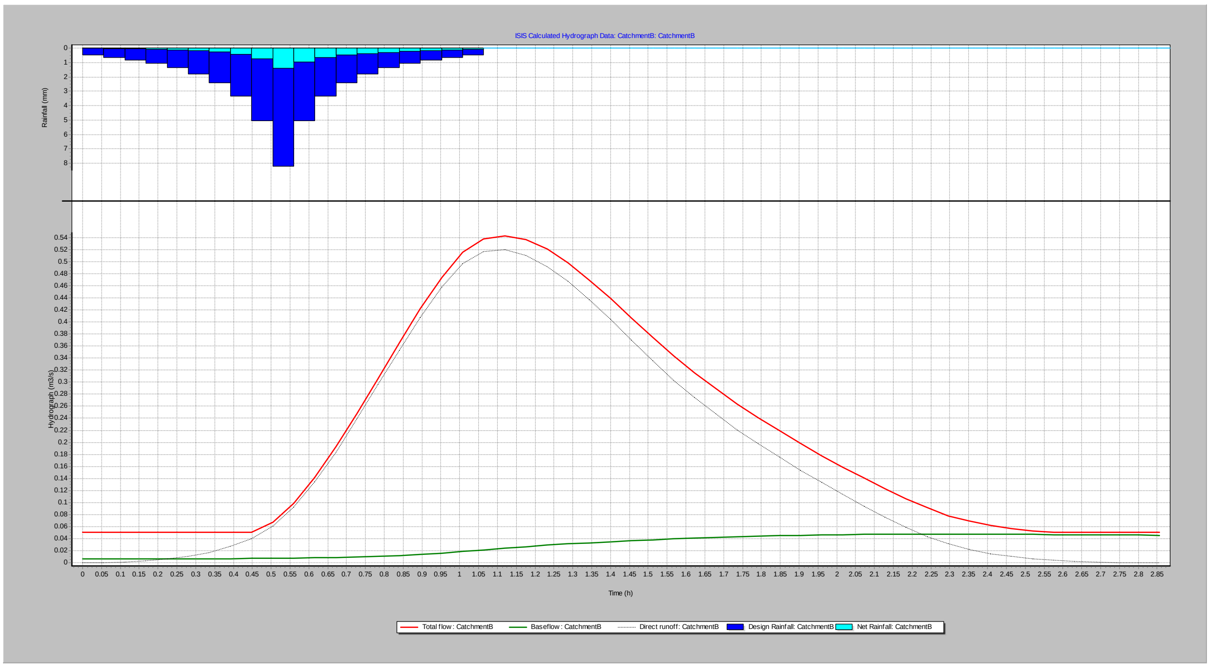

Figure D.9 Sub-catchment B 1 in 100 year (1% AEP) plus climate change flow hydrograph

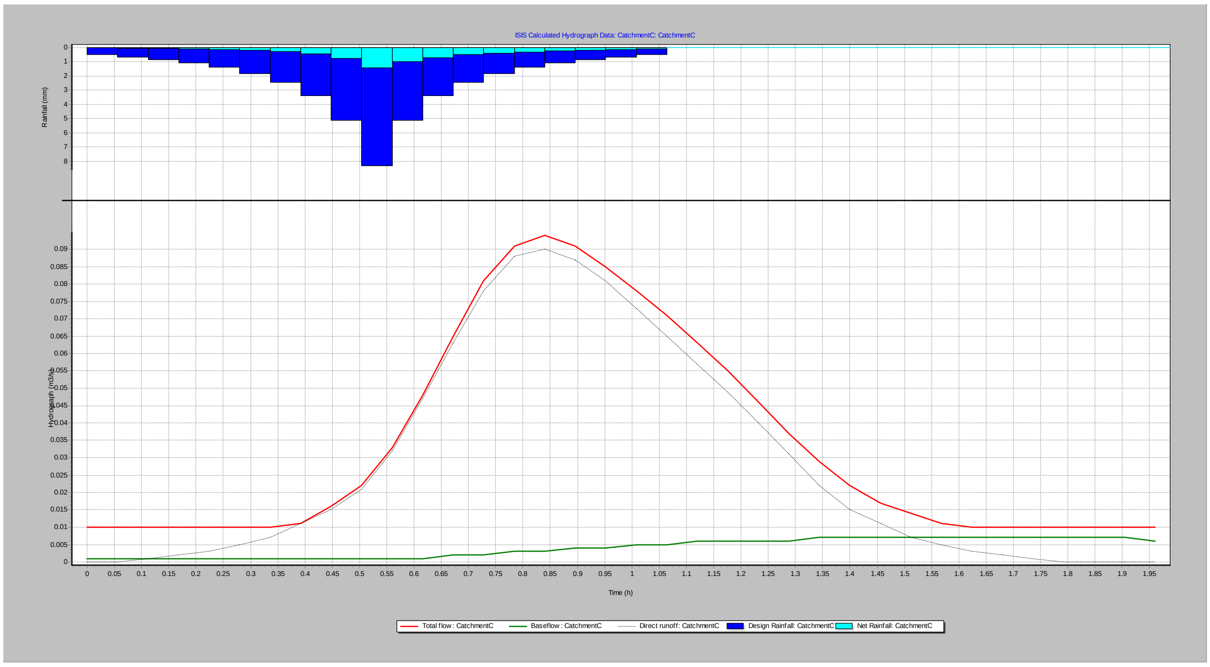

Figure D.10 Sub-catchment C 1 in 100 year (1% AEP) plus climate change flow hydrograph

APPENDIX E: ISIS OUTPUTS: EXISTING SCENARIO SCHEMATIC, LONG-SECTION AND CROSS-SECTIONS

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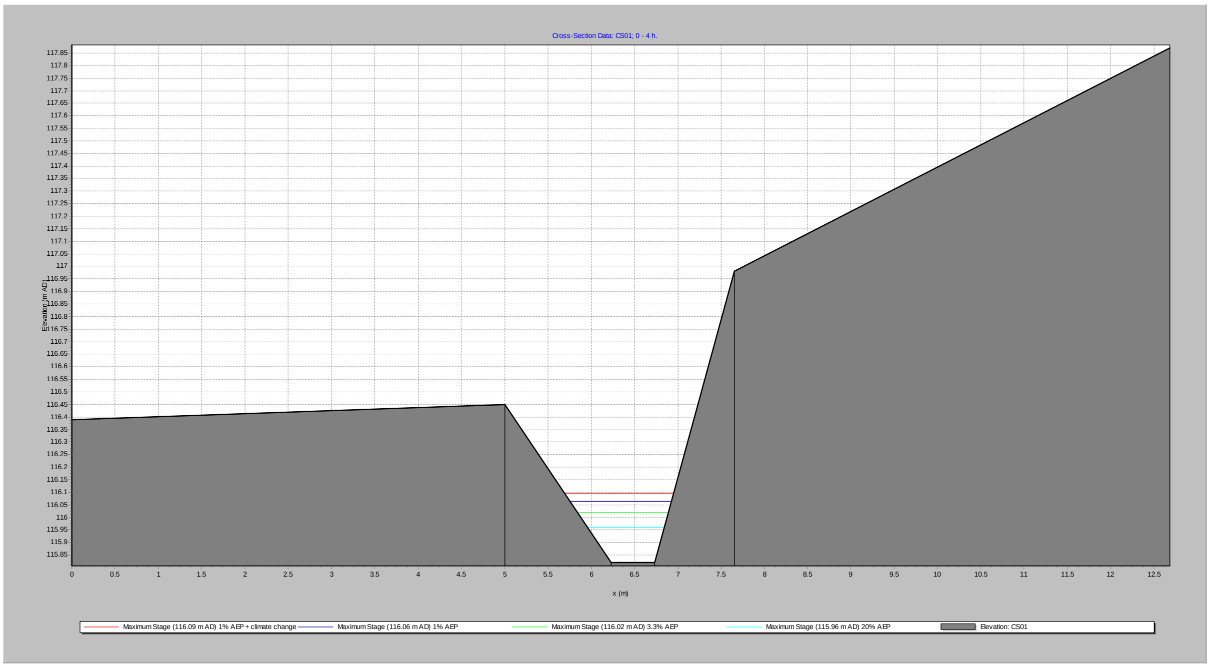

Figure E.1 Peak levels at cross section CS01

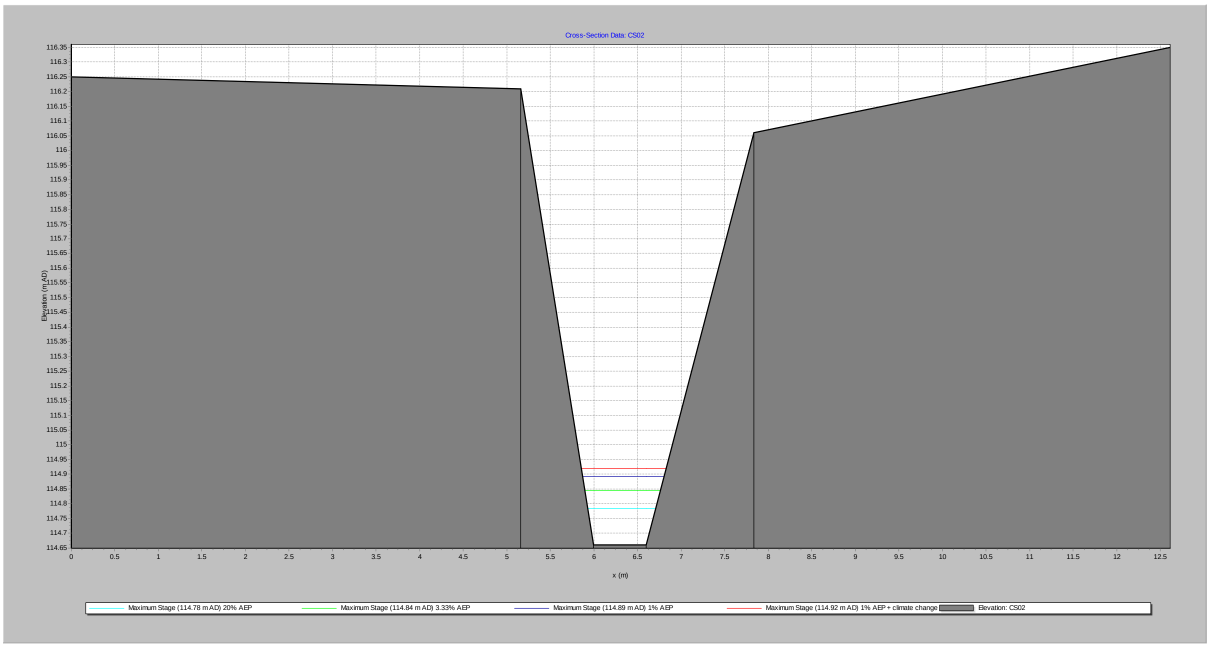

Figure E.2 Peak levels at cross section CS02

Figure E.3 Peak levels at cross section CS03

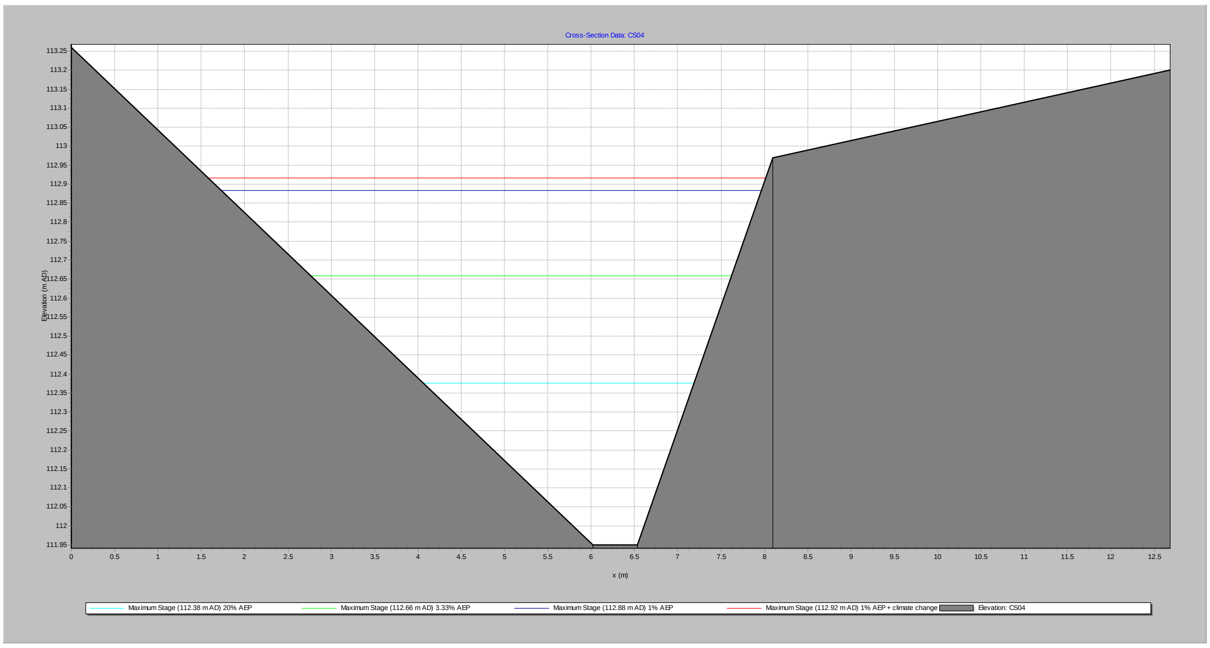

Figure E.4 Peak levels at cross section CS04

Figure E.5 Peak levels at cross section CS05

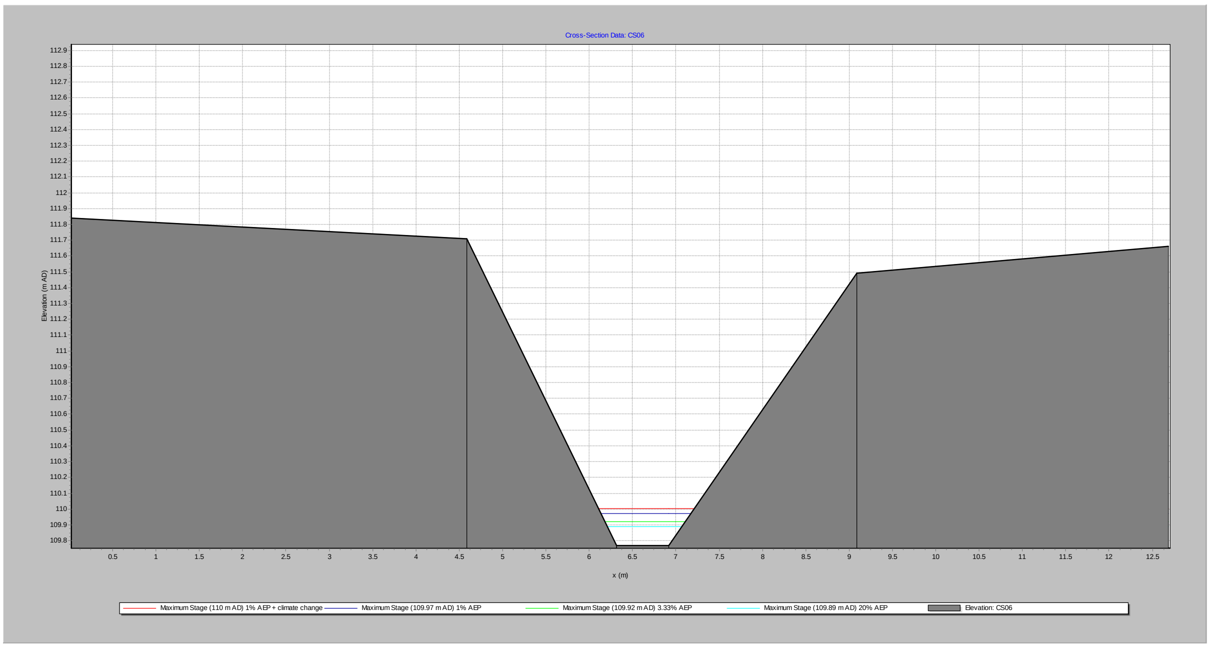

Figure E.6 Peak levels at cross section CS06

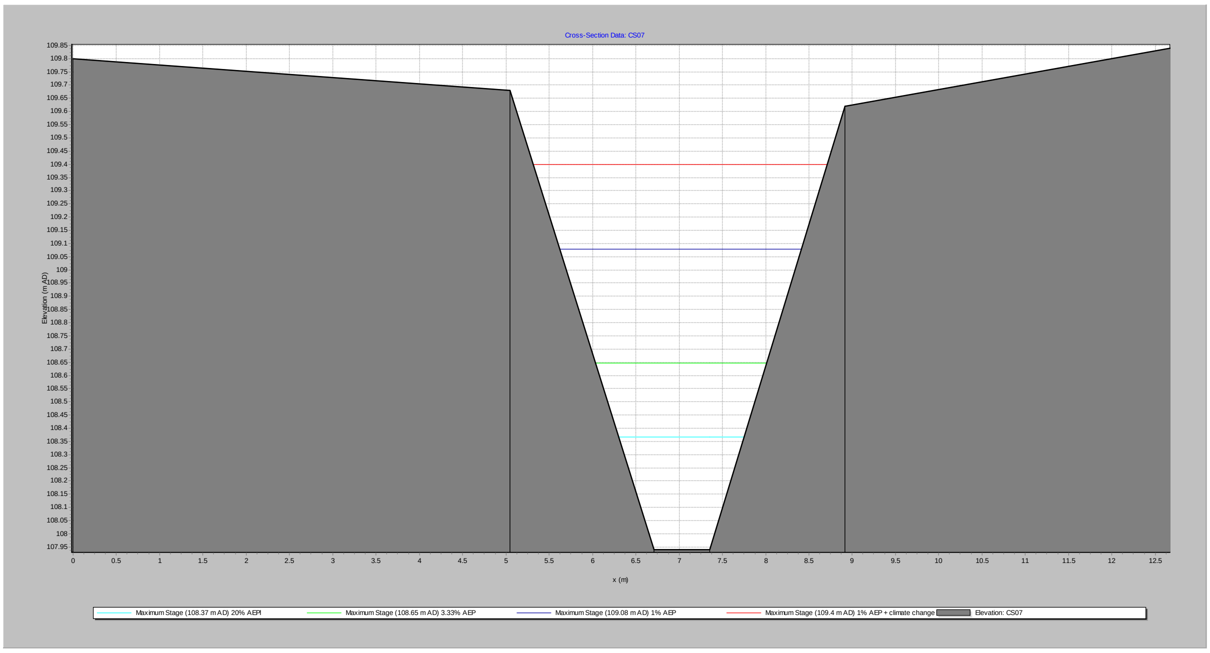

Figure E.7 Peak levels at cross section CS07

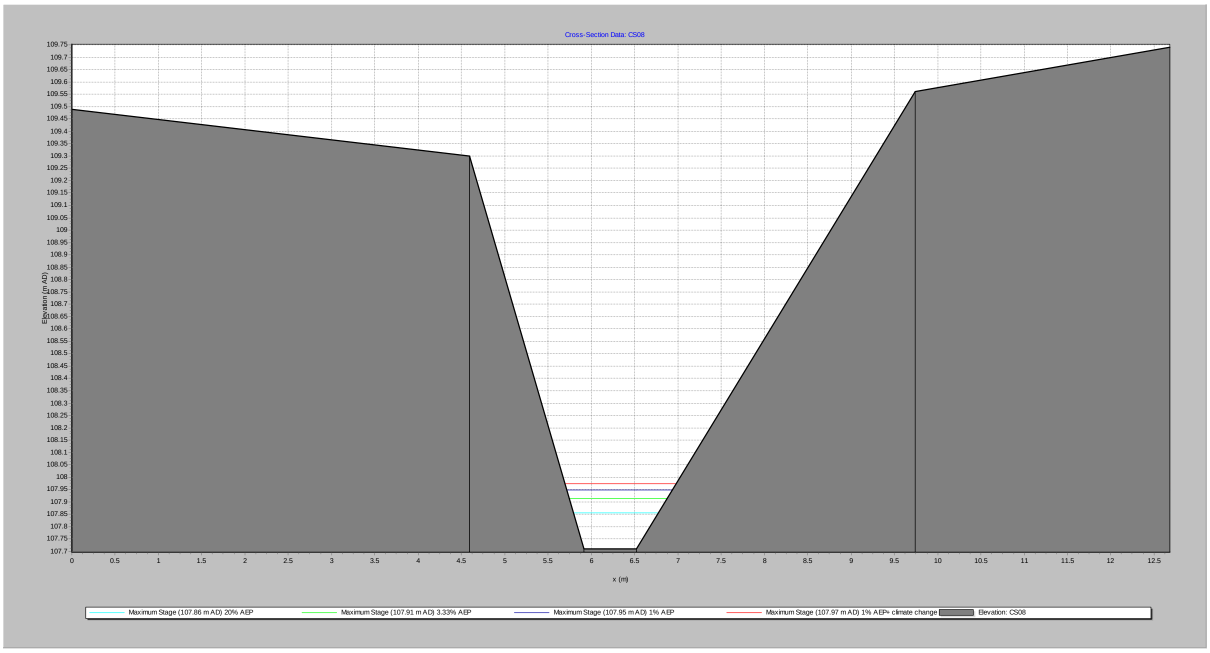

Figure E.8 Peak levels at cross section CS08

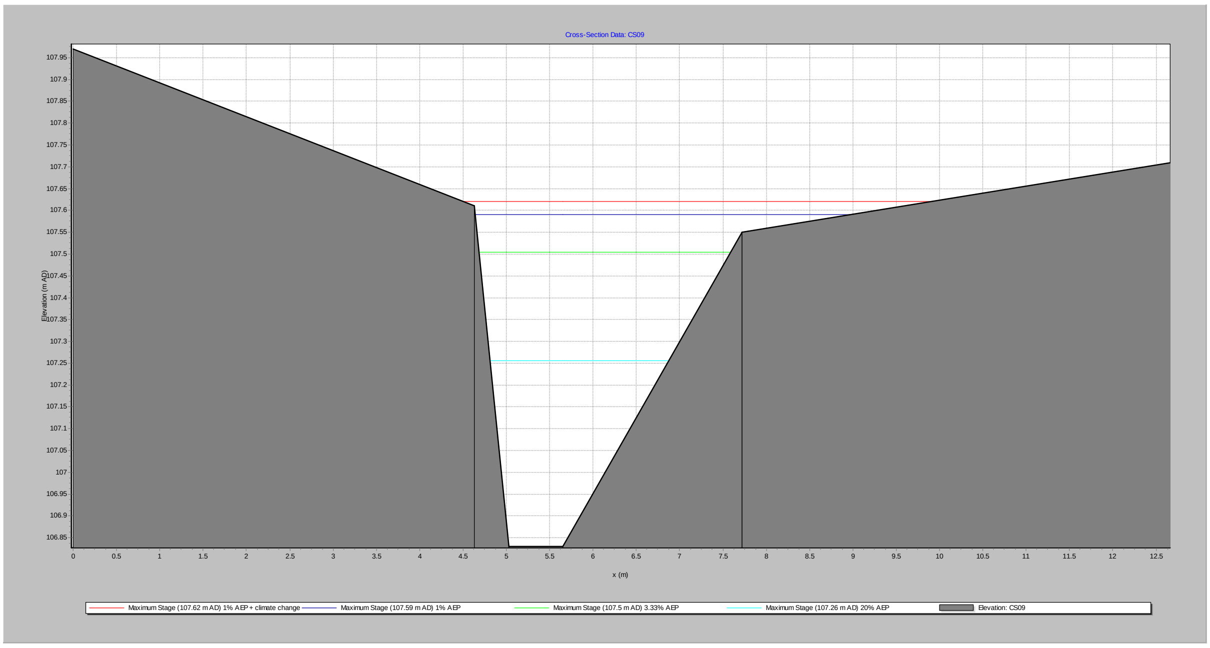

Figure E.9 Peak levels at cross section CS09

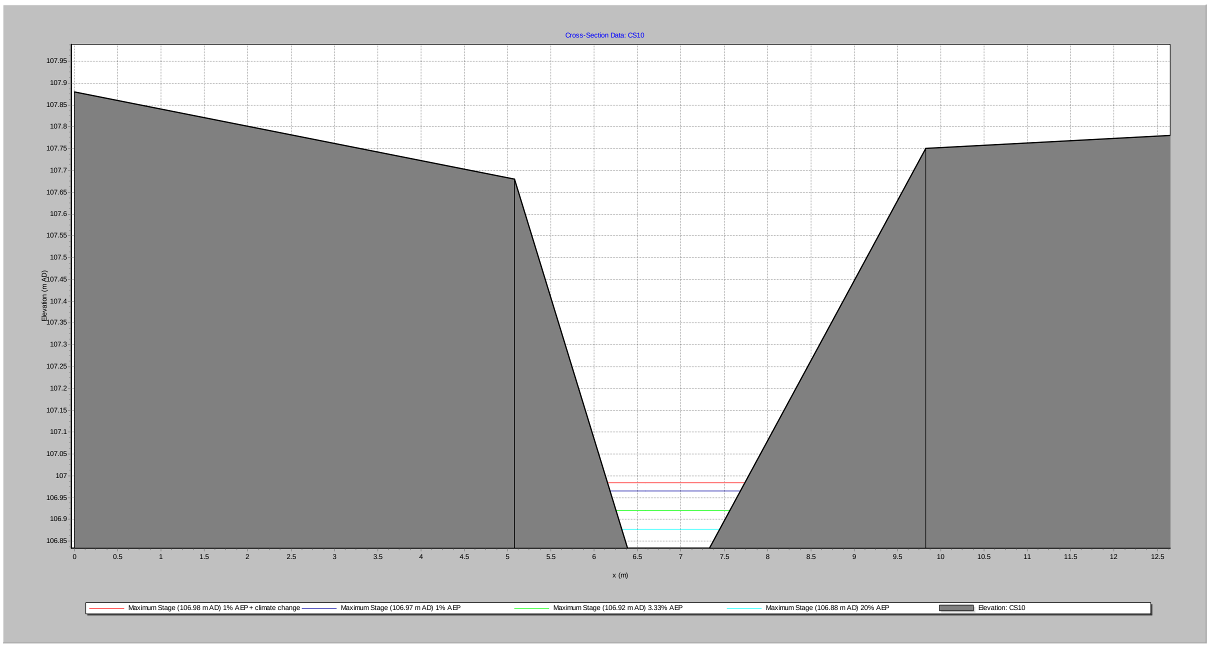

Figure E.10 Peak levels at cross section CS10

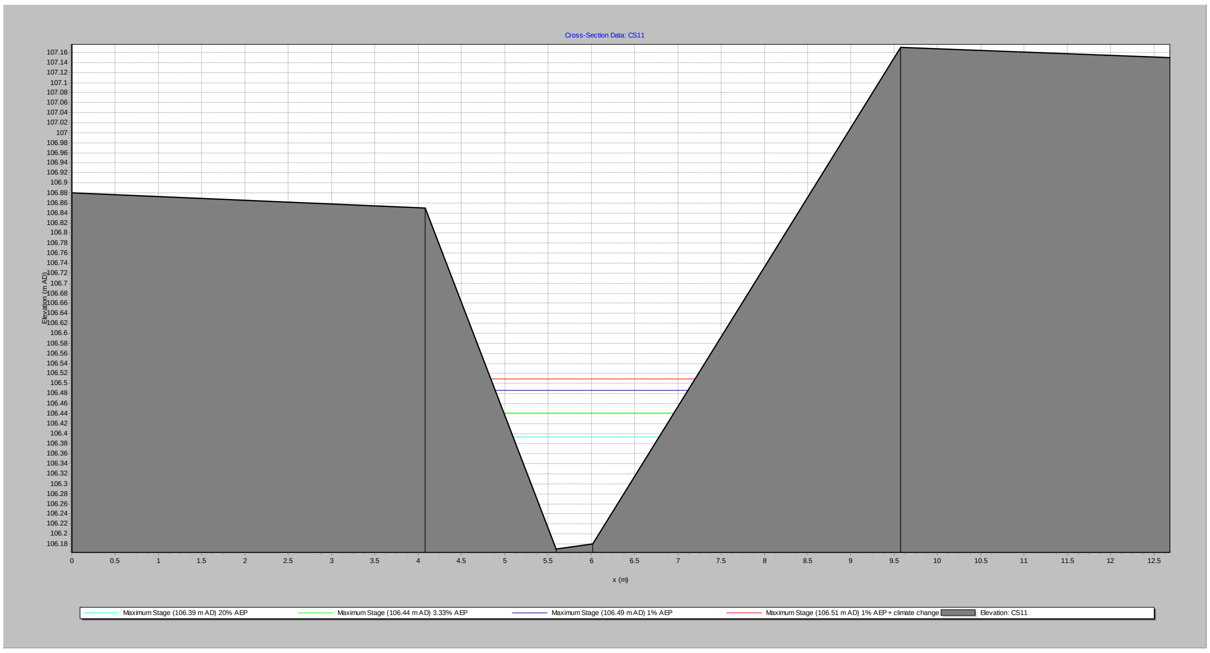

Figure E.11 Peak levels at cross section CS11

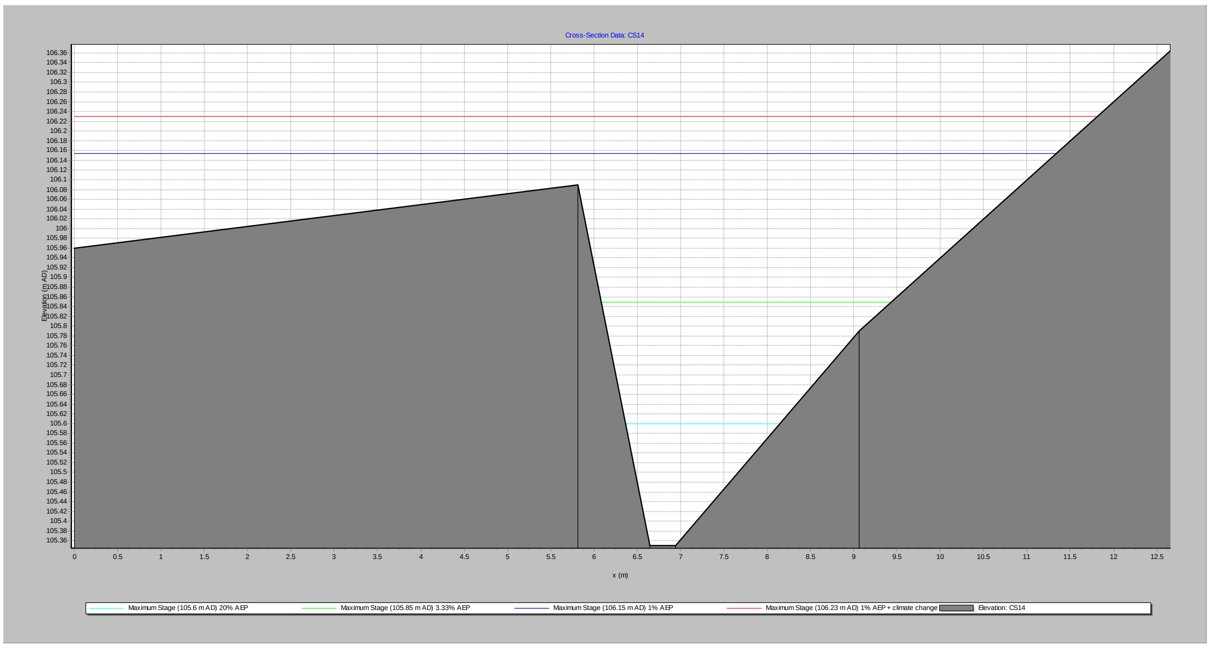

Figure E.12 Peak levels at cross section CS14

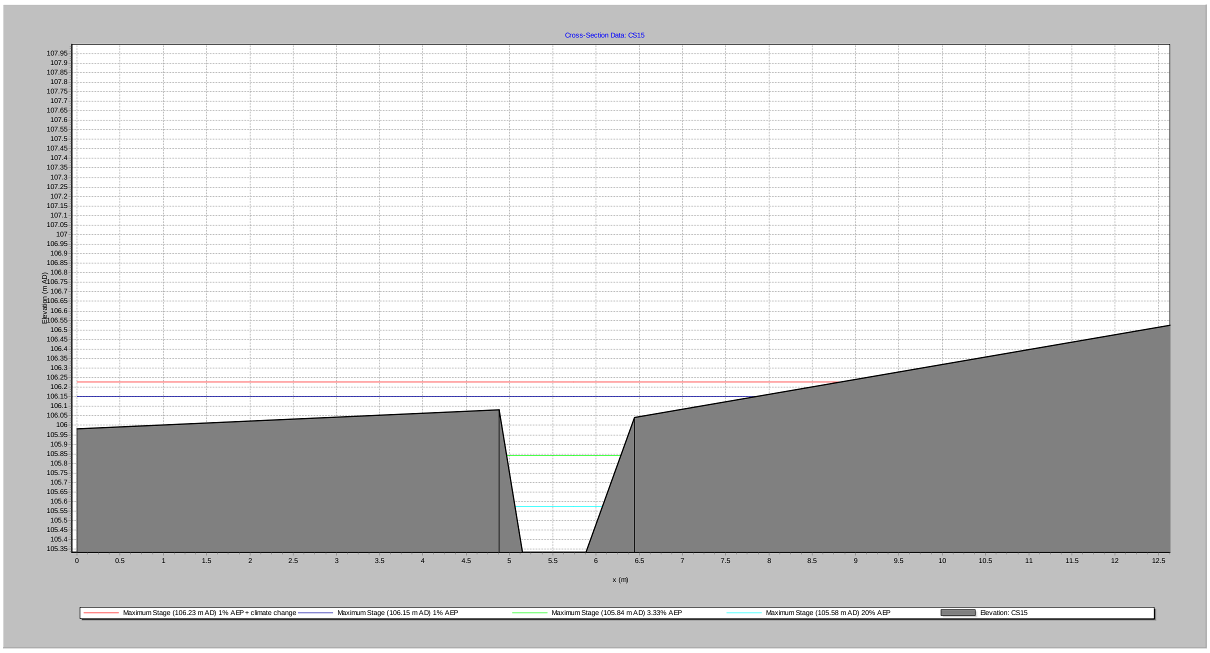

Figure E.13 Peak levels at cross section CS15

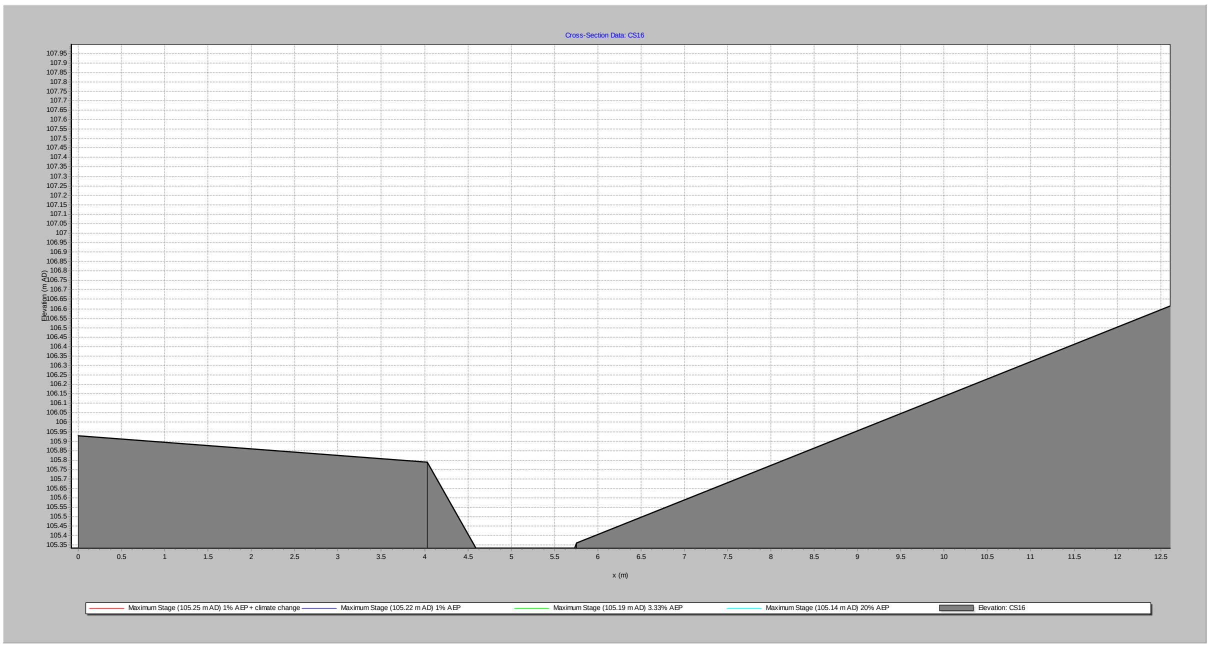

Figure E.14 Peak levels at cross section CS16

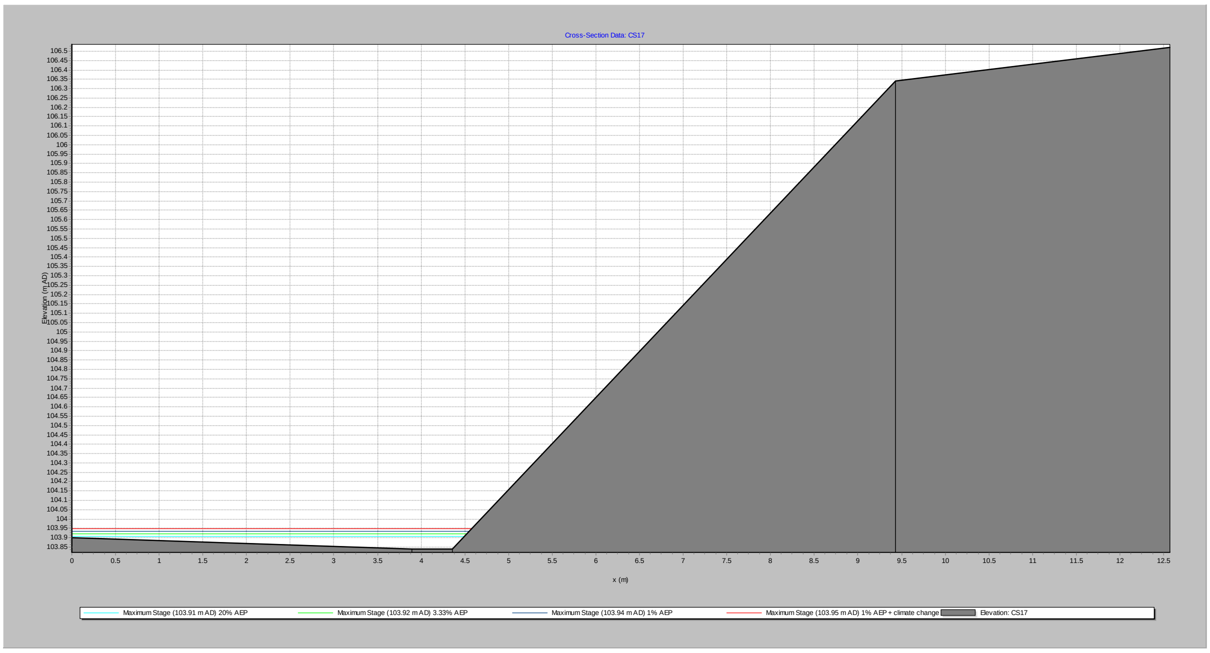

Figure E.15 Peak levels at cross section CS17

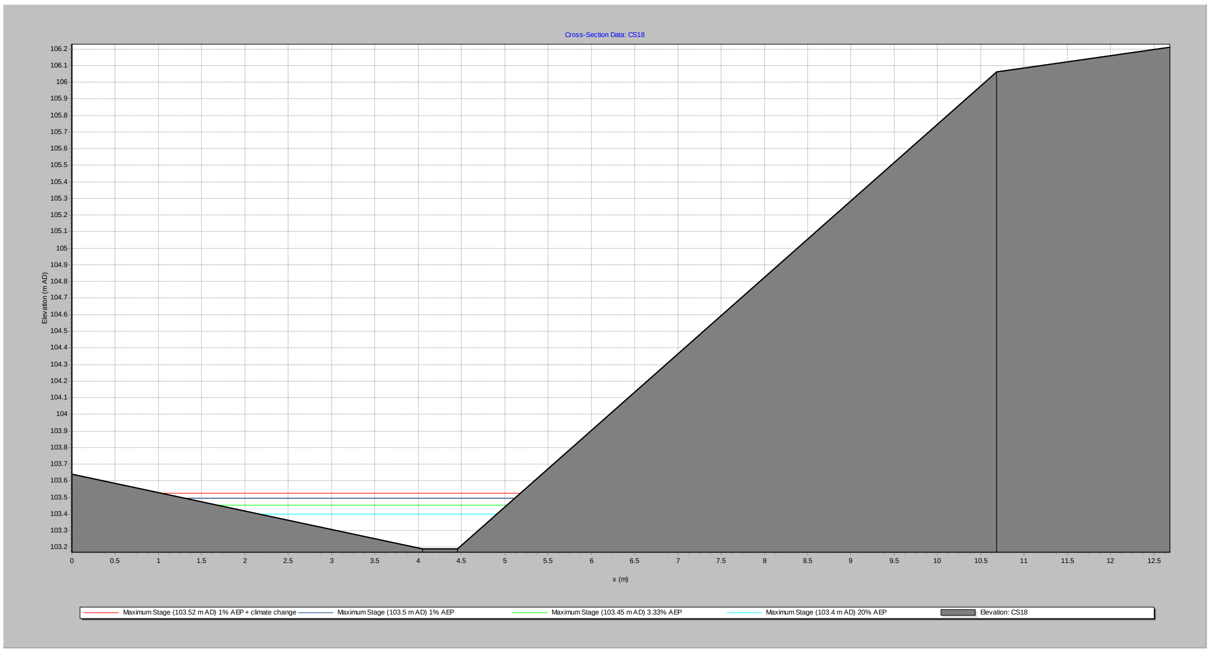

Figure E.16 Peak levels at cross section CS18

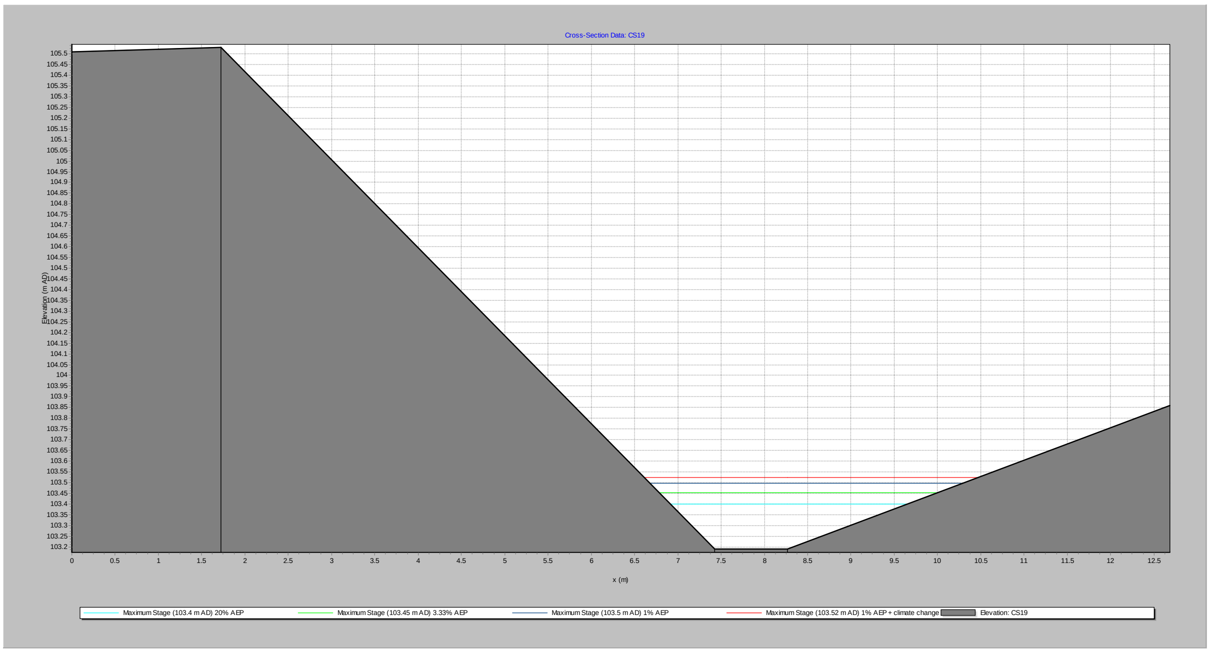

Figure E.17 Peak levels at cross section CS19

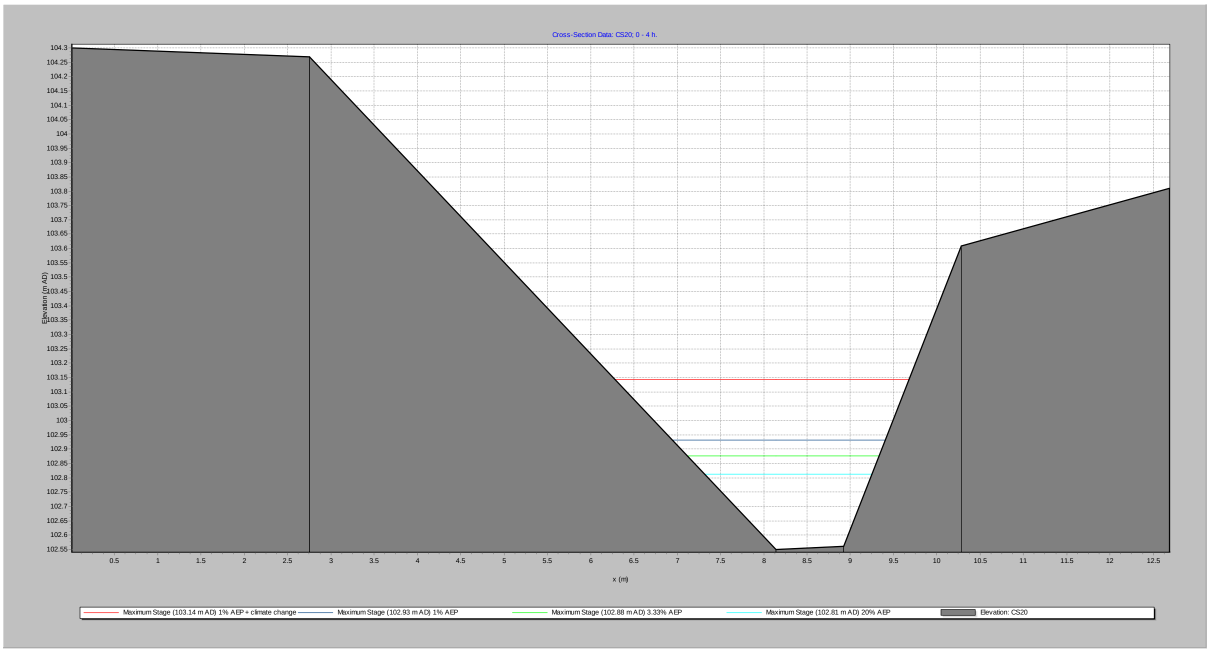

Figure E.18 Peak levels at cross section CS20

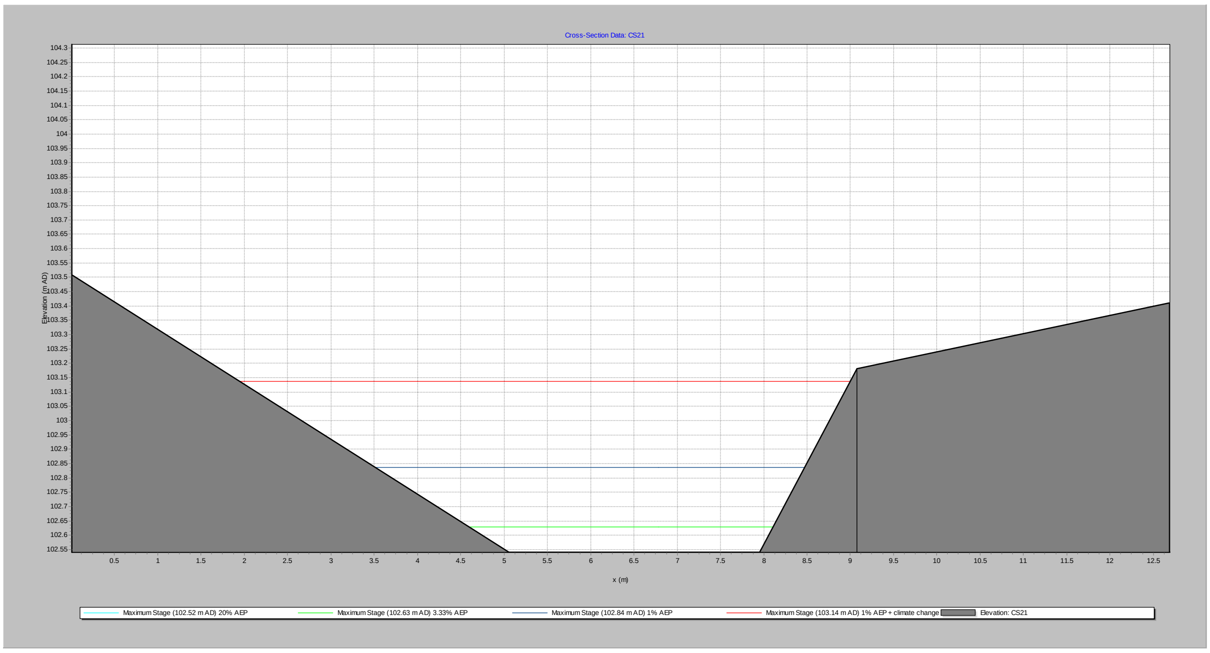

Figure E.19 Peak levels at cross section CS21

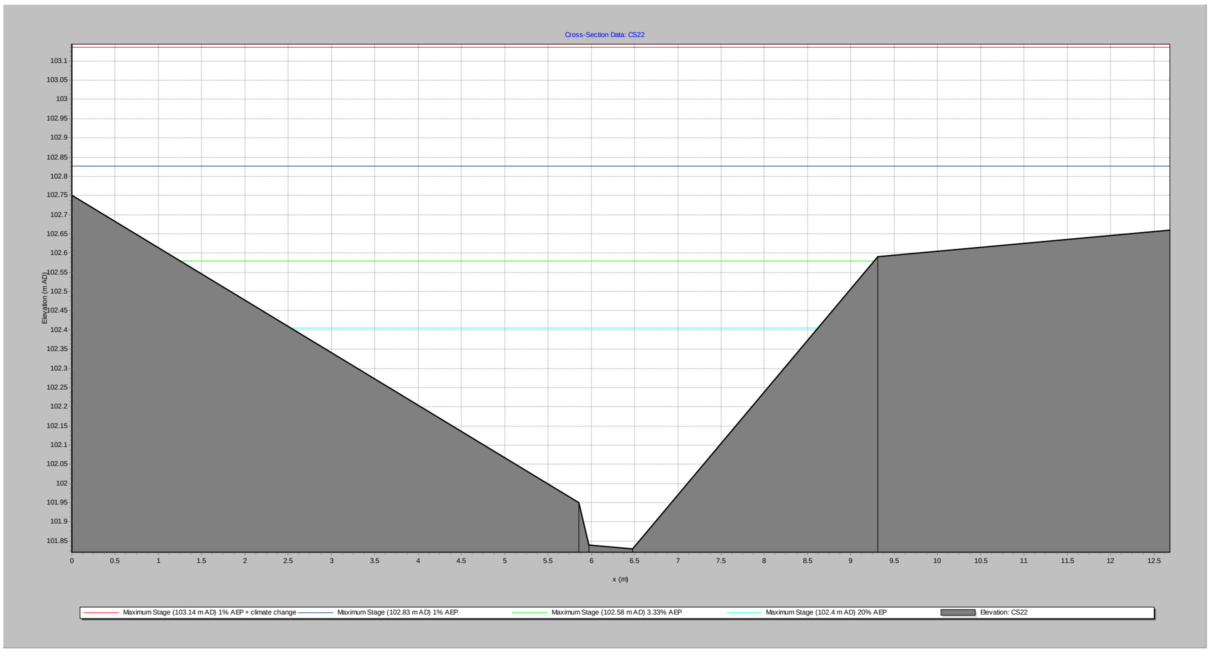

Figure E.20 Peak levels at cross section CS22

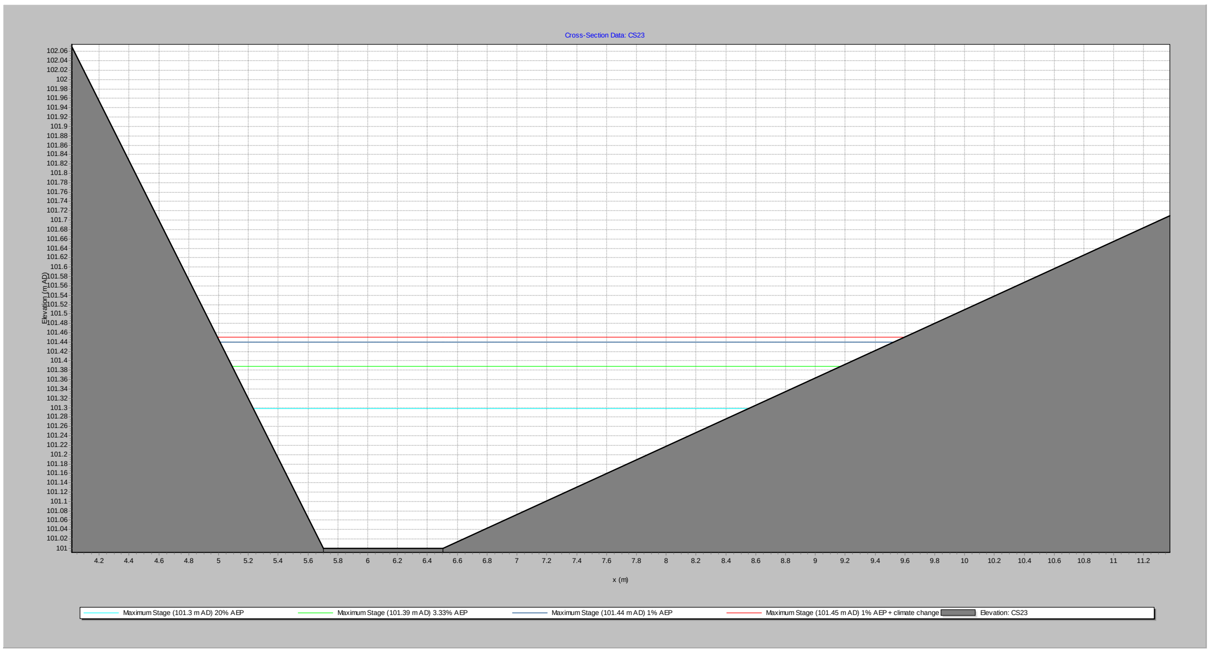

Figure E.21 Peak levels at cross section CS23

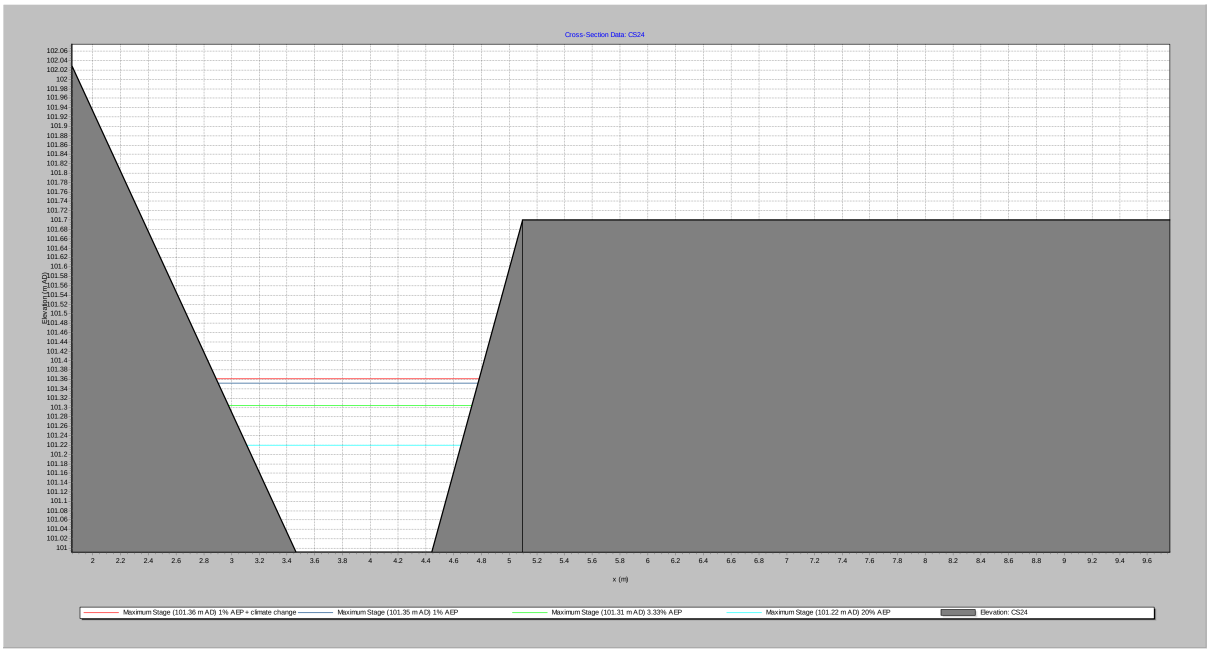

Figure E.22 Peak levels at cross section CS24

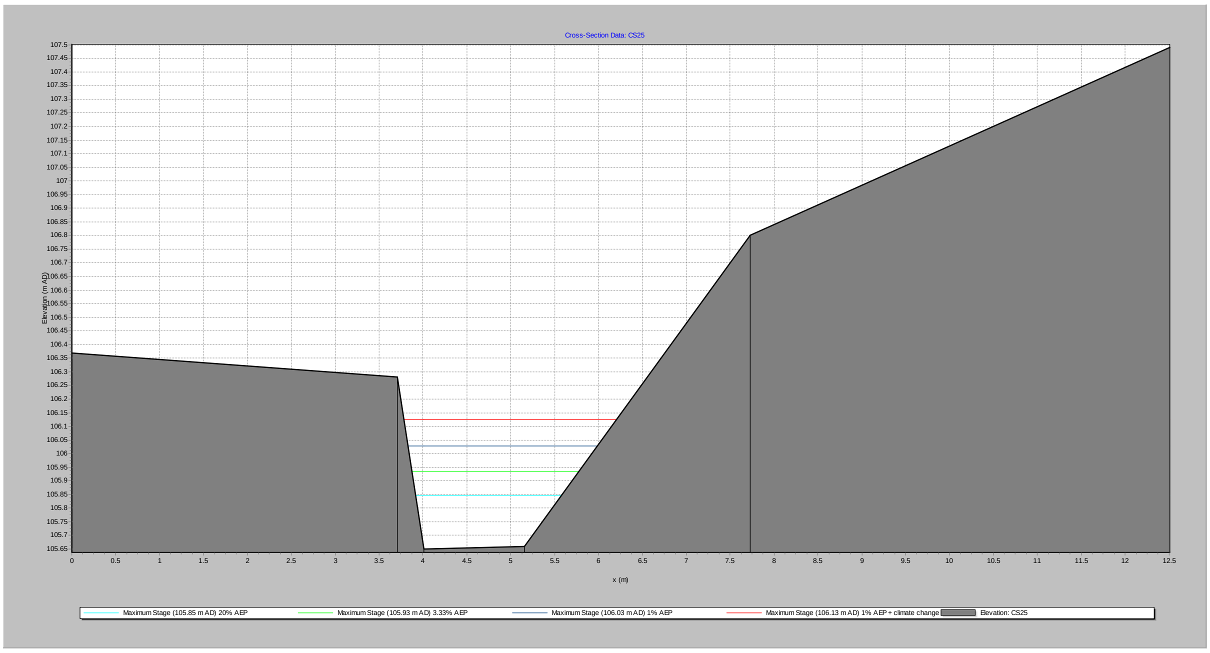

Figure E.23 Peak levels at cross section CS25

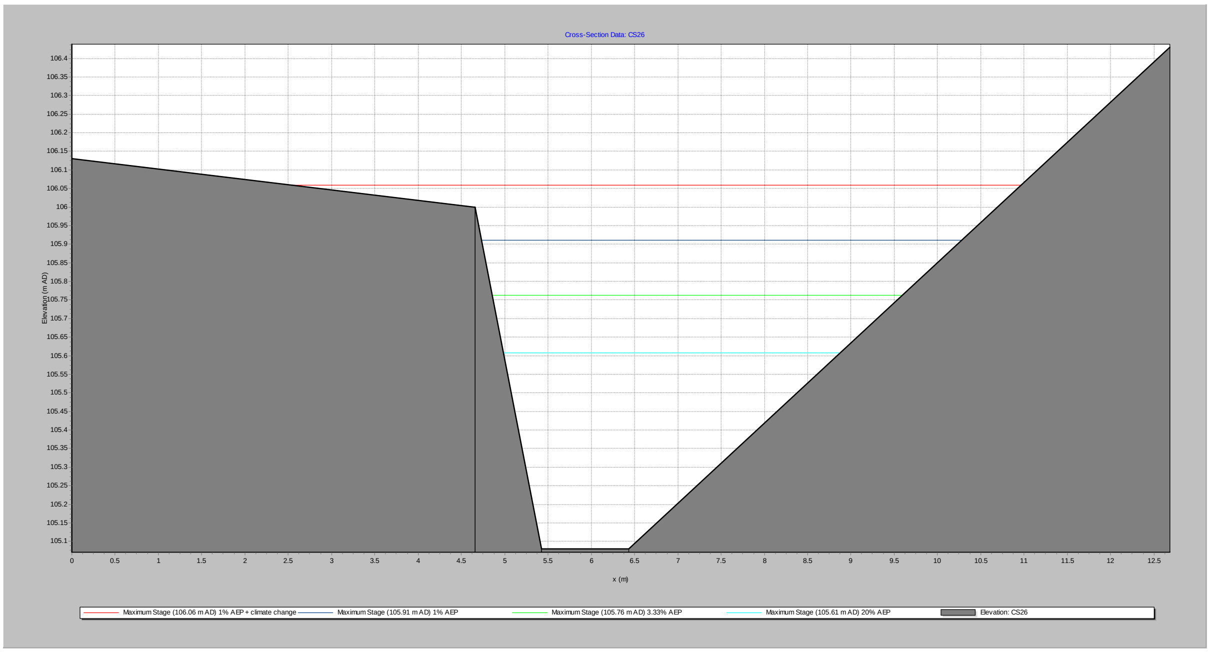

Figure E.24 Peak levels at cross section CS26

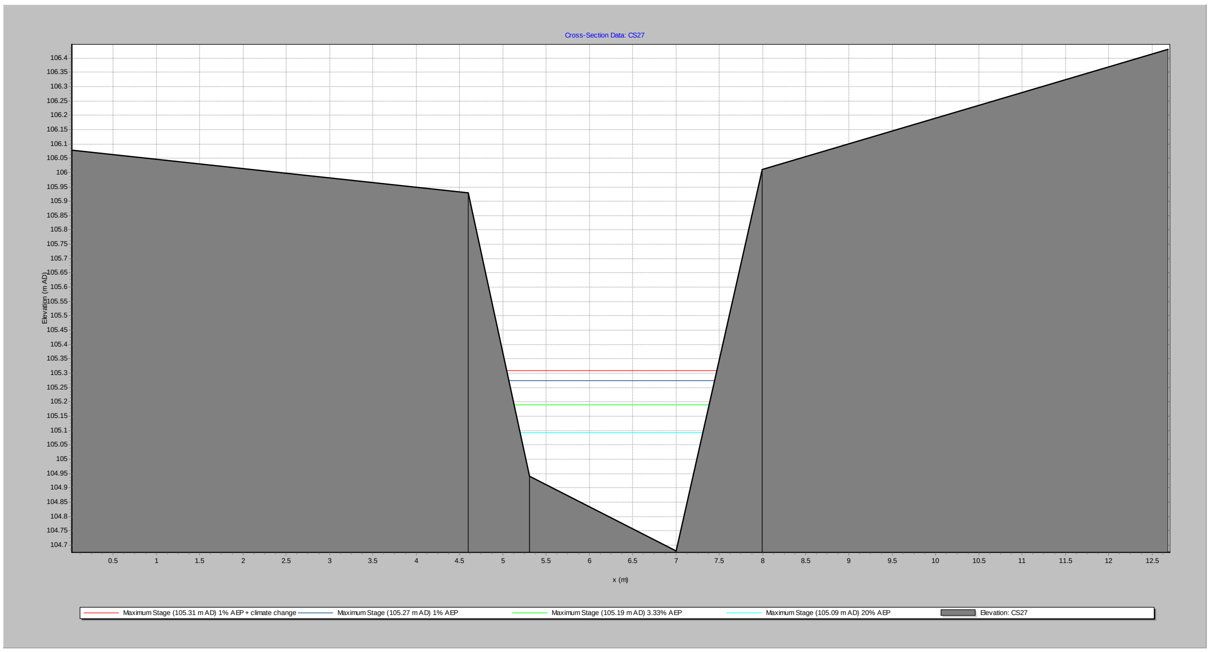

Figure E.25 Peak levels at cross section CS27

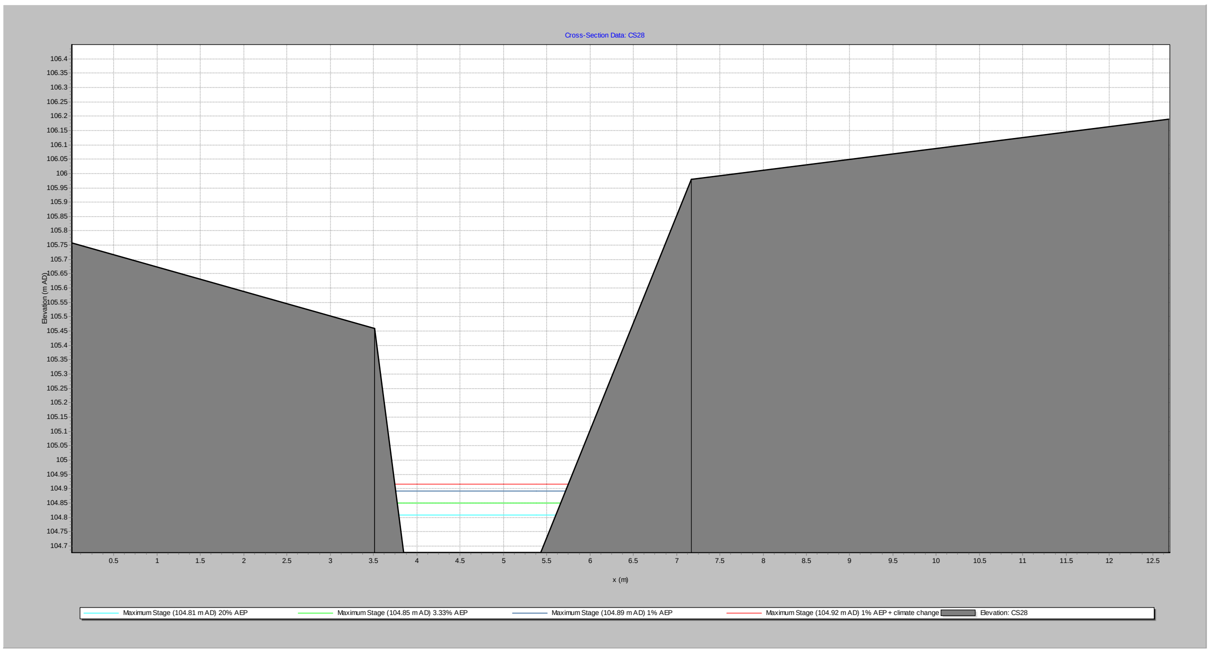

Figure E.26 Peak levels at cross section CS28

Figure E.27 Peak levels at cross section CS29

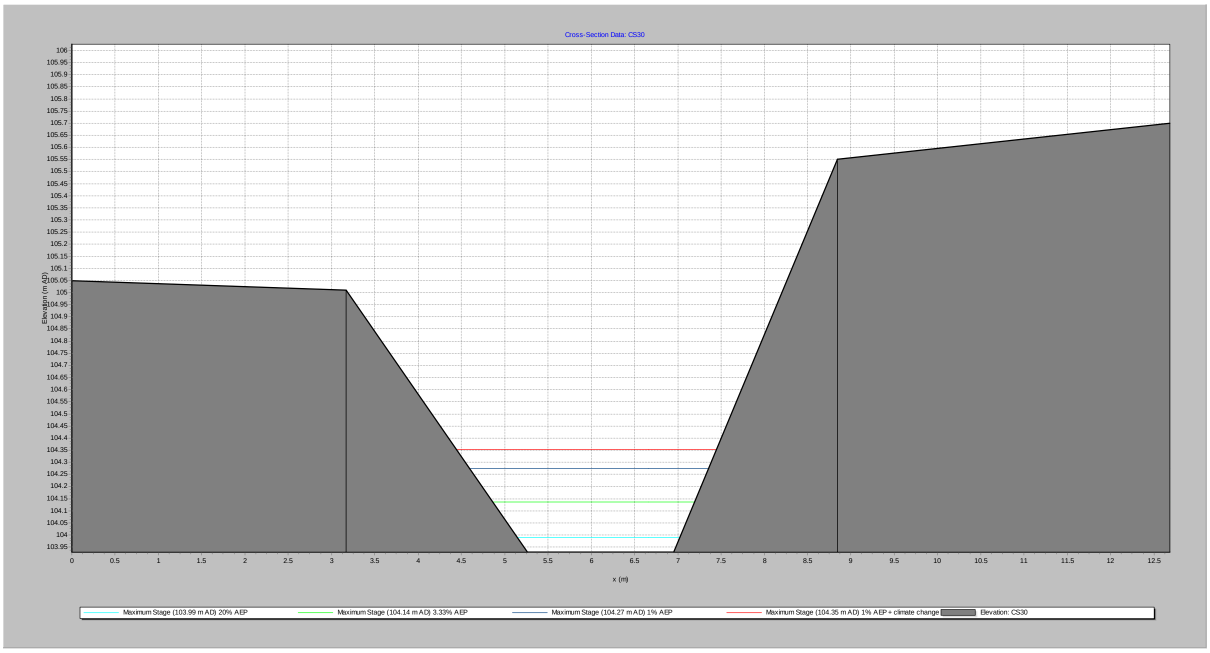

Figure E.28 Peak levels at cross section CS30

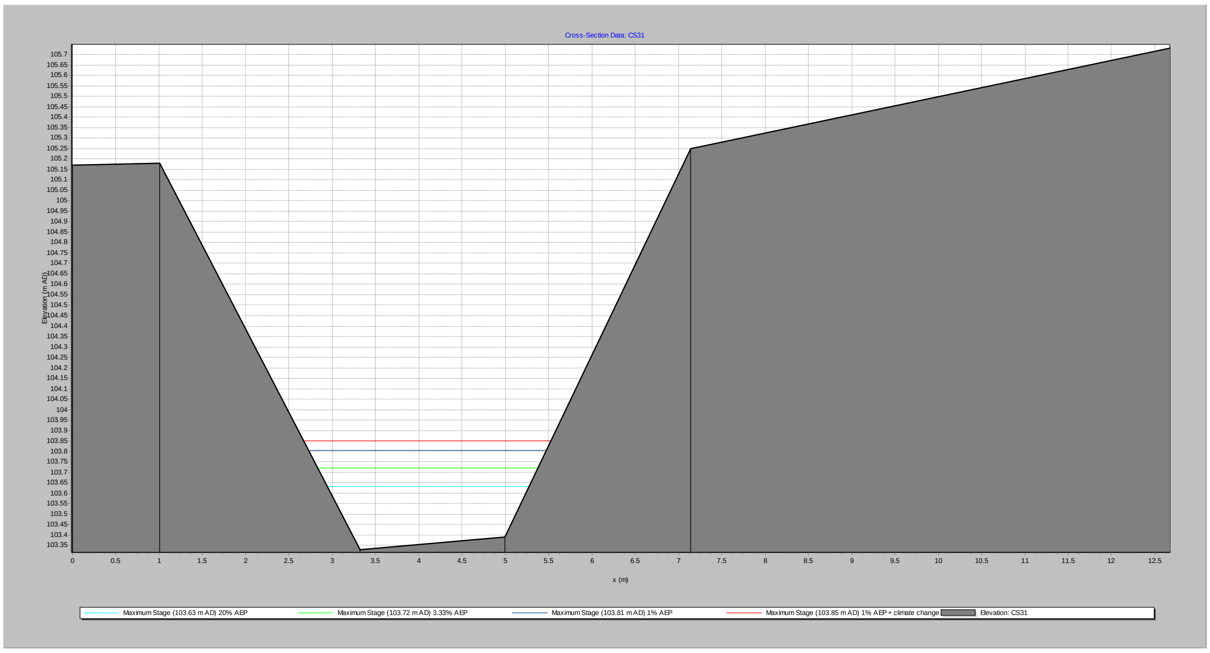

Figure E.29 Peak levels at cross section CS31

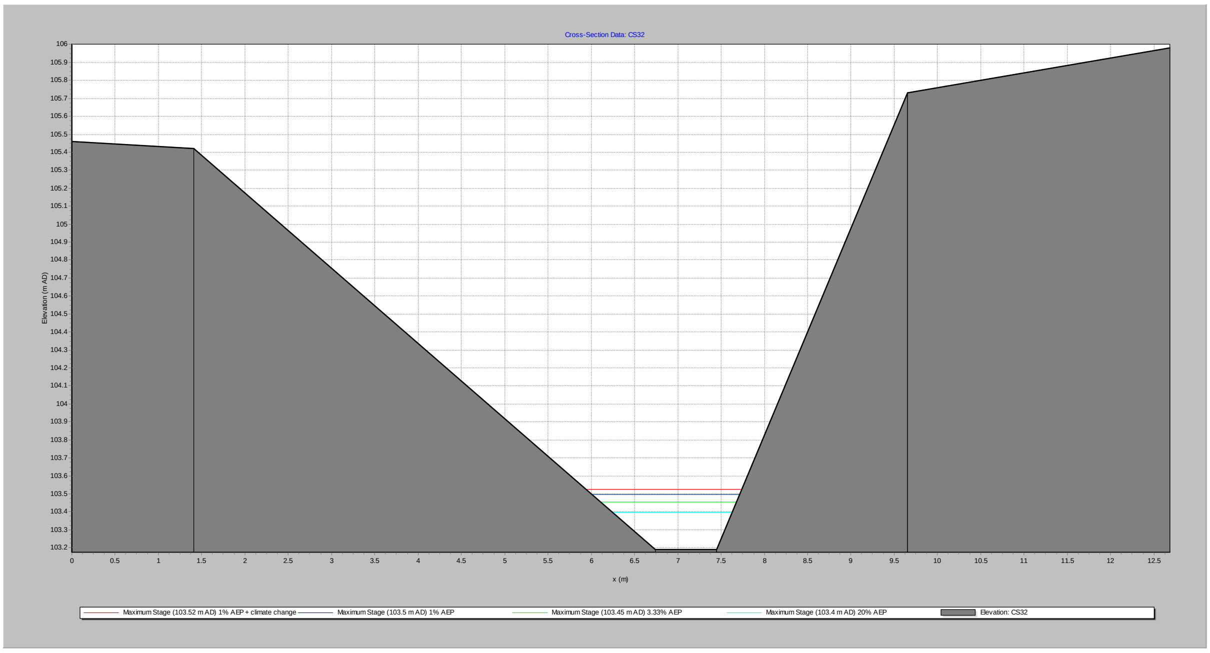

Figure E.30 Peak levels at cross section CS32

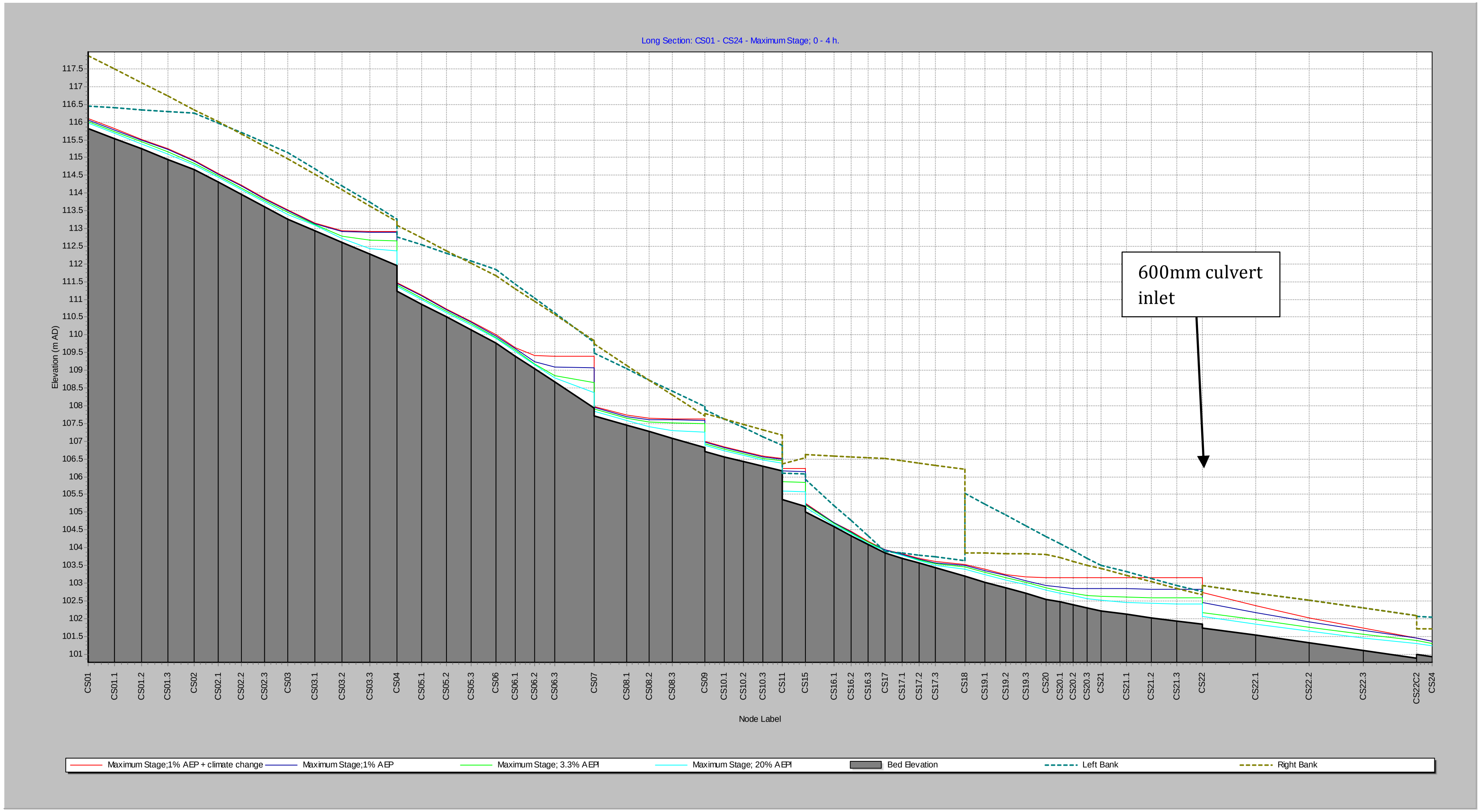

Figure E.15 Long section CS01 to CS24

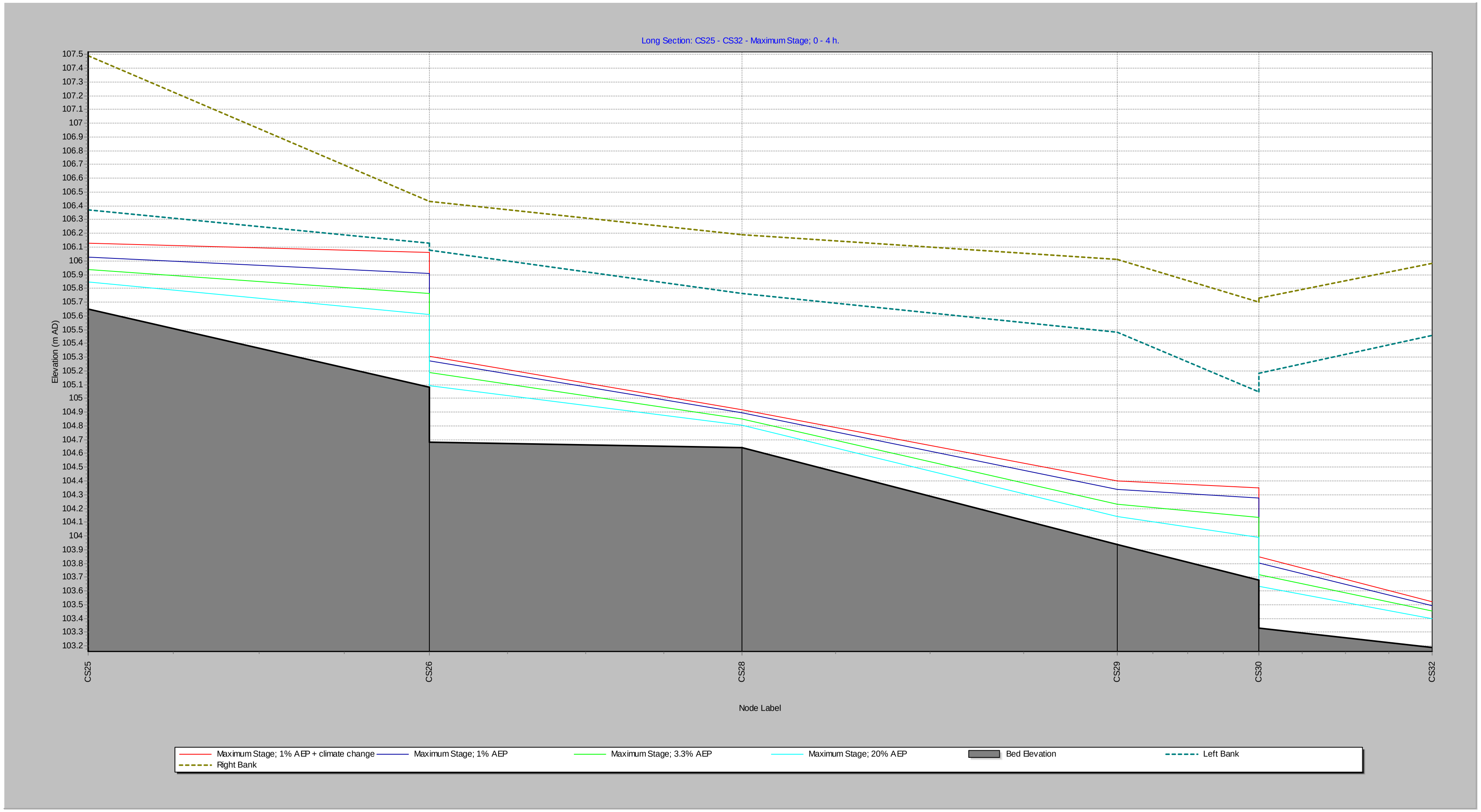

Figure E.15 Long section CS25 to CS32

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APPENDIX F: ISIS OUTPUTS: PROPOSED SCENARIO SCHEMATIC, LONG-SECTION AND CROSS-SECTIONS

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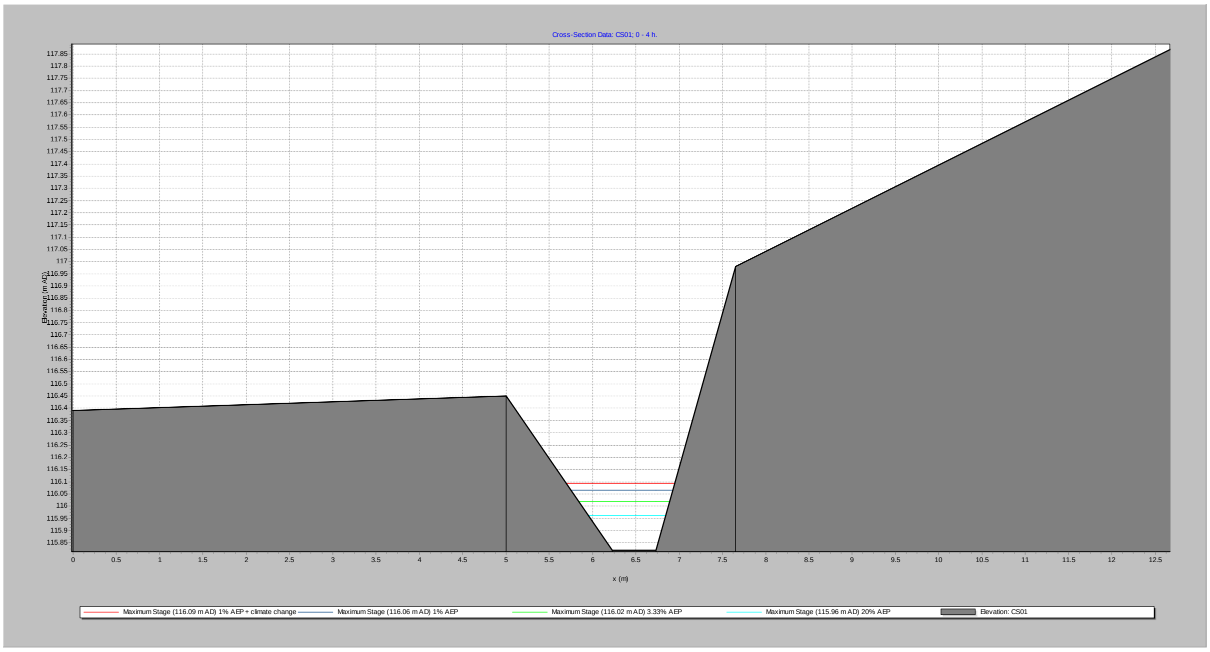

Figure F.1 Peak levels at cross section CS01

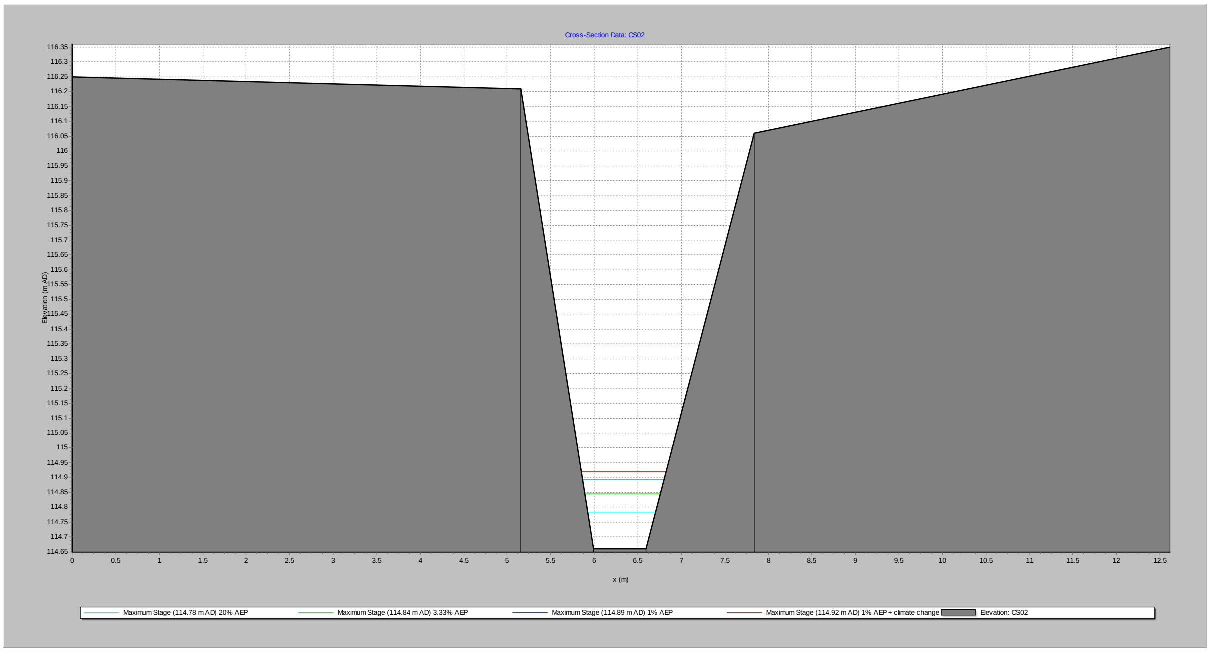

Figure F.2 Peak levels at cross section CS02

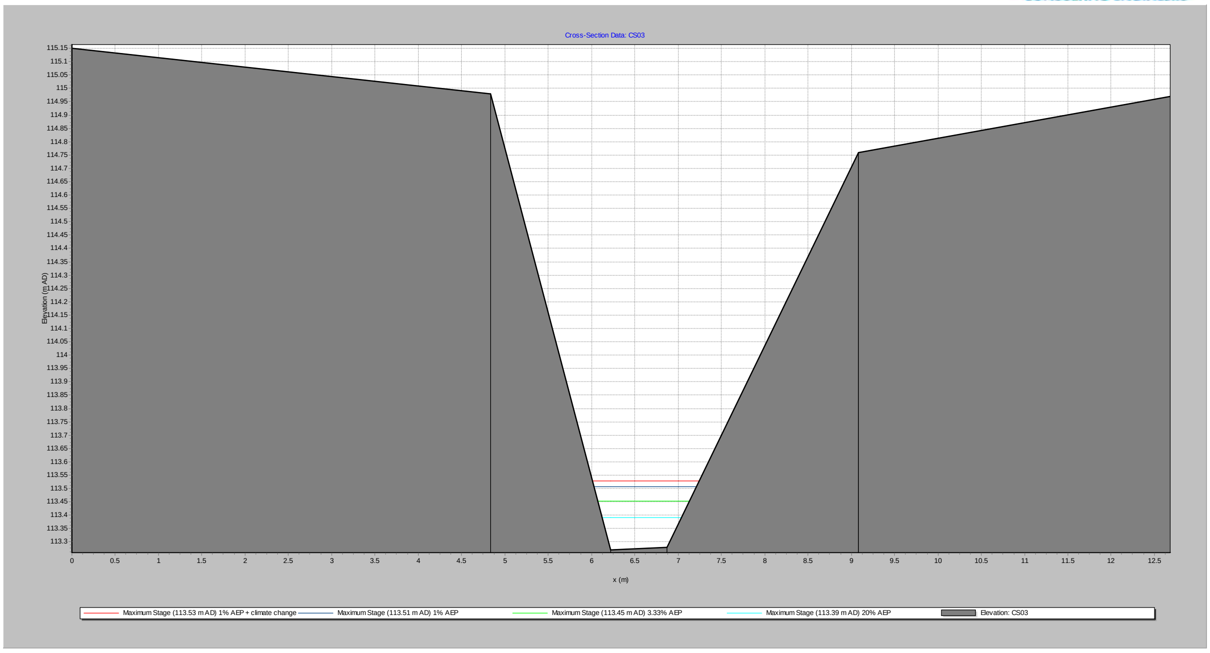

Figure F.3 Peak levels at cross section CS03

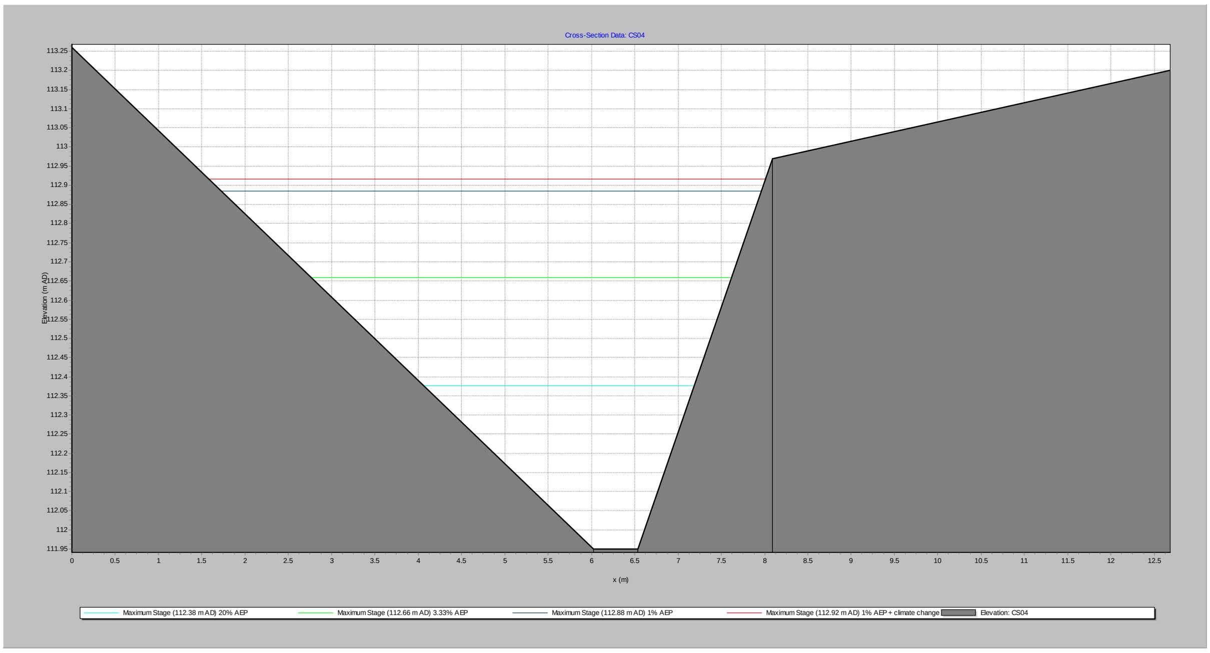

Figure F.4 Peak levels at cross section CS04

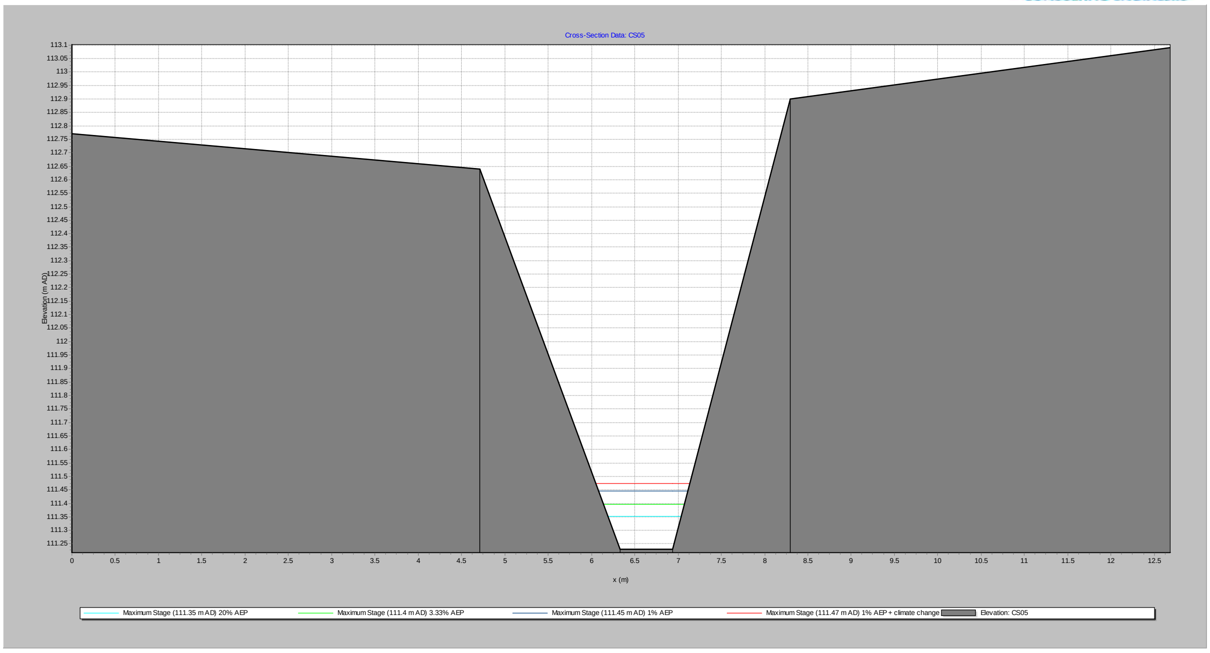

Figure F.5 Peak levels at cross section CS05

Figure F.6 Peak levels at cross section CS06

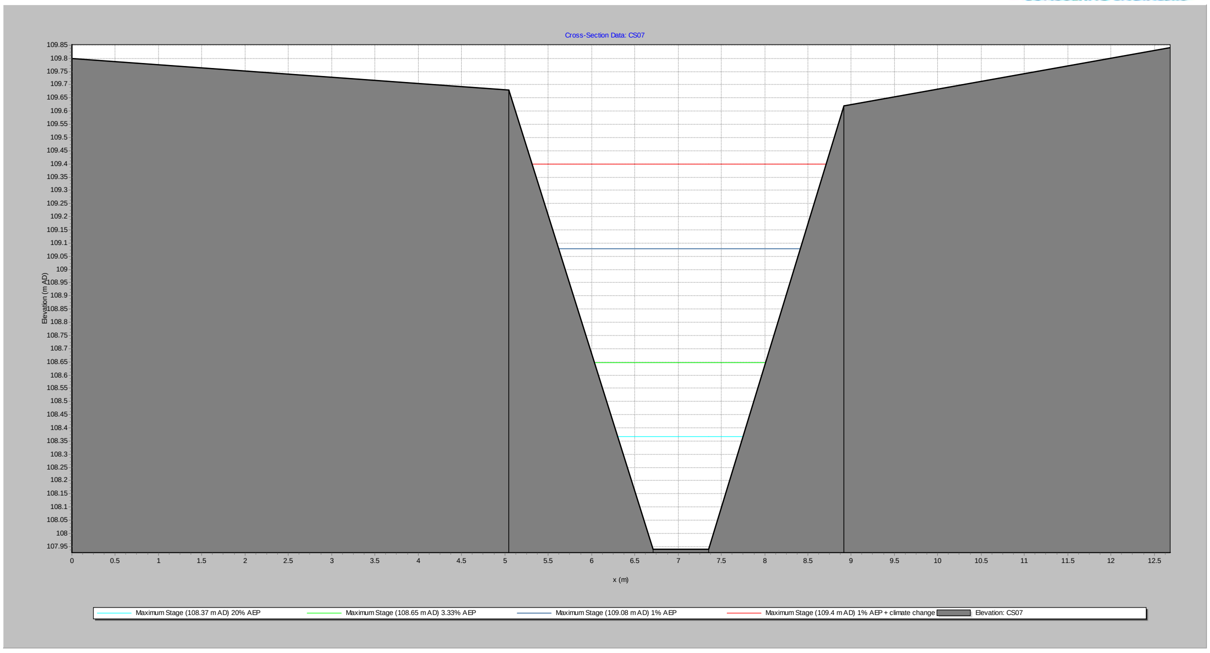

Figure F.7 Peak levels at cross section CS07

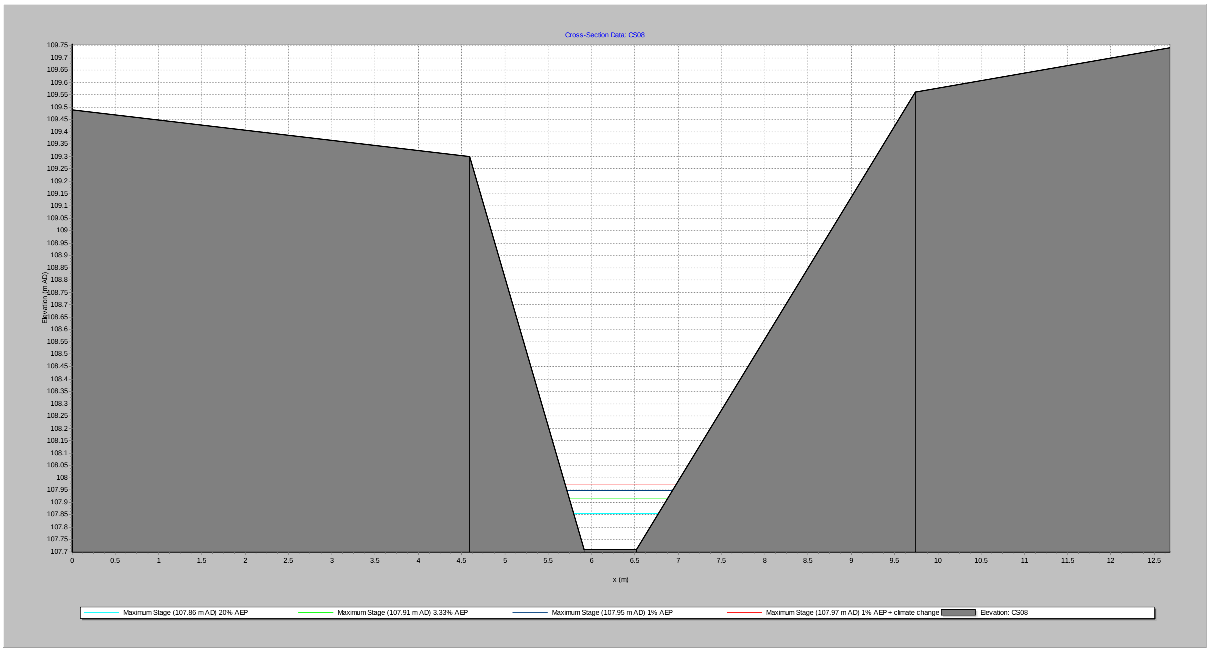

Figure F.8 Peak levels at cross section CS08

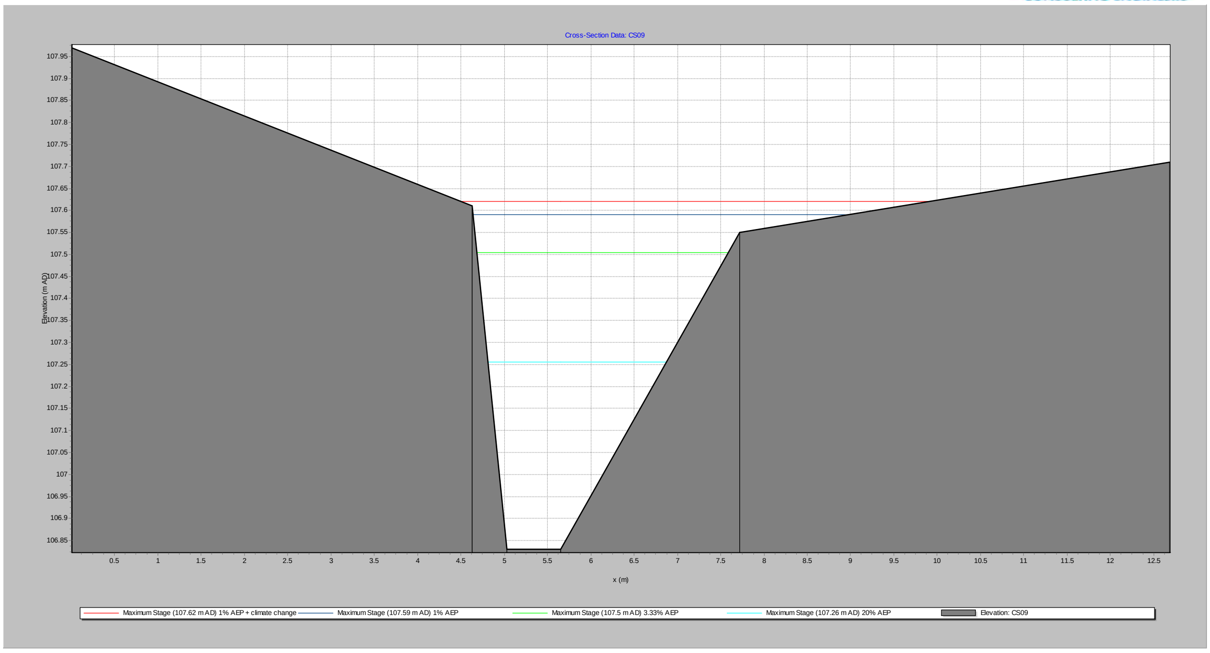

Figure F.9 Peak levels at cross section CS09

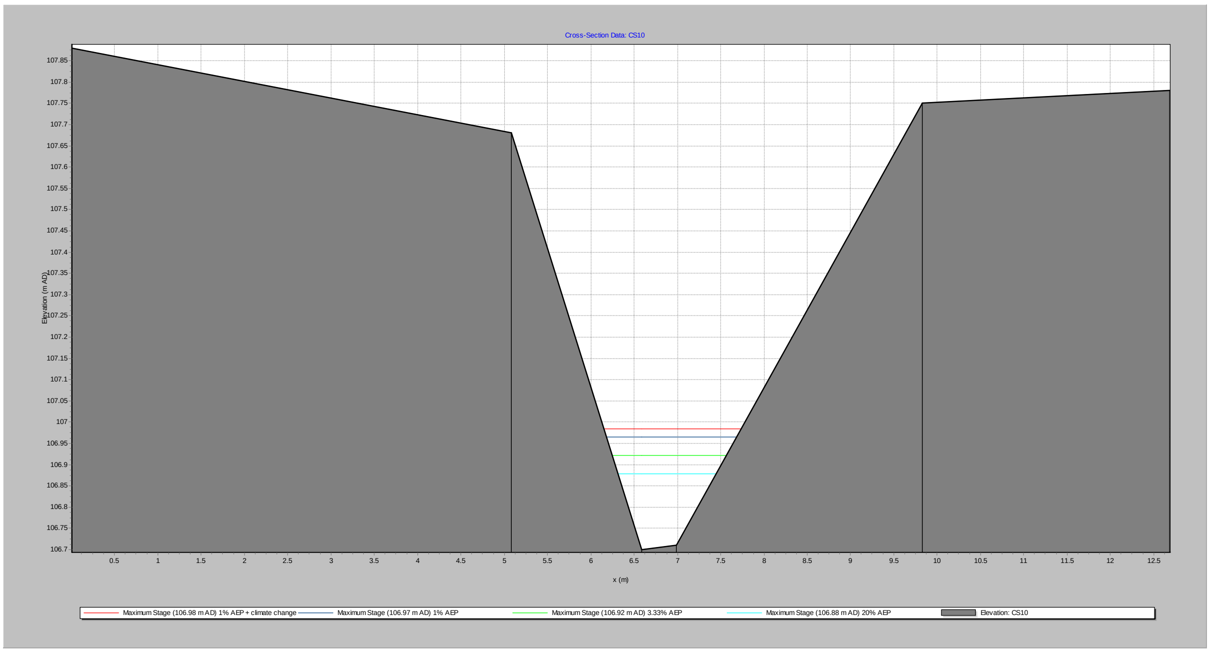

Figure F.10 Peak levels at cross section CS101

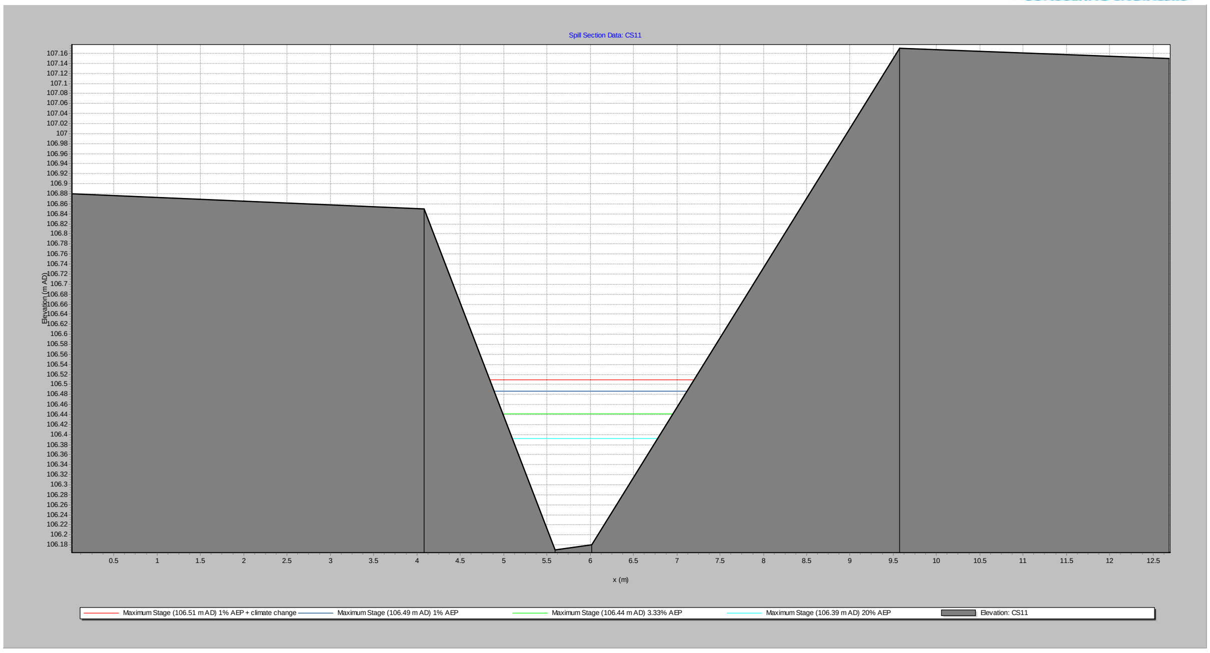

Figure F.11 Peak levels at cross section CS11

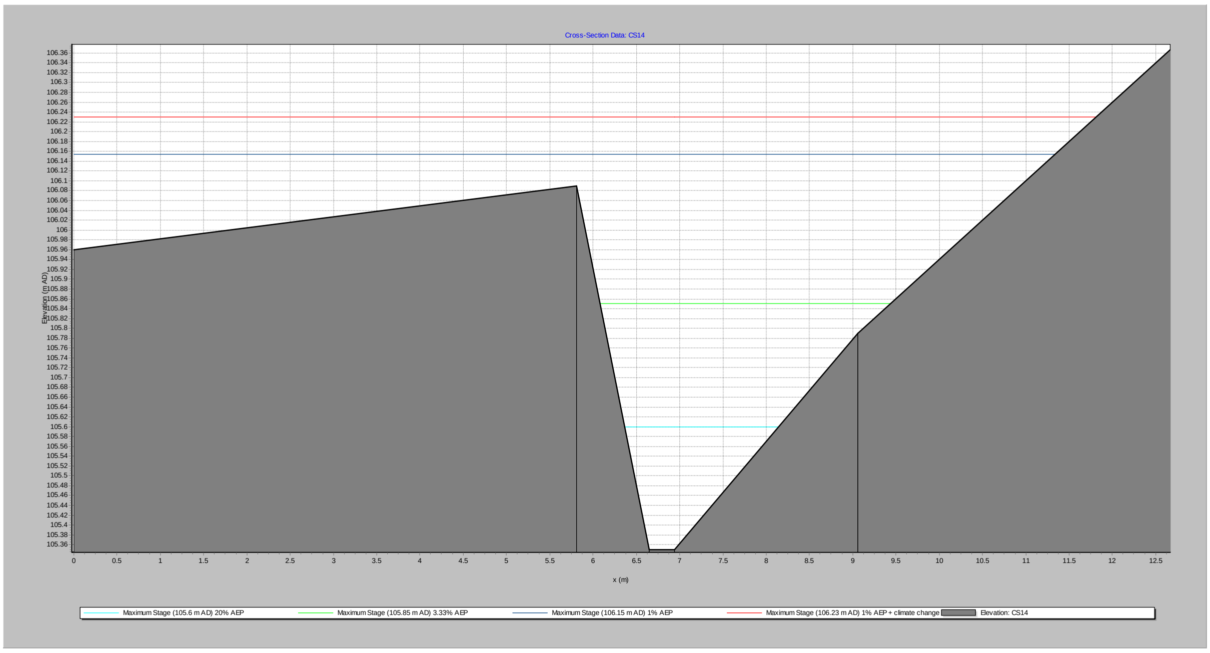

Figure F.12 Peak levels at cross section CS14

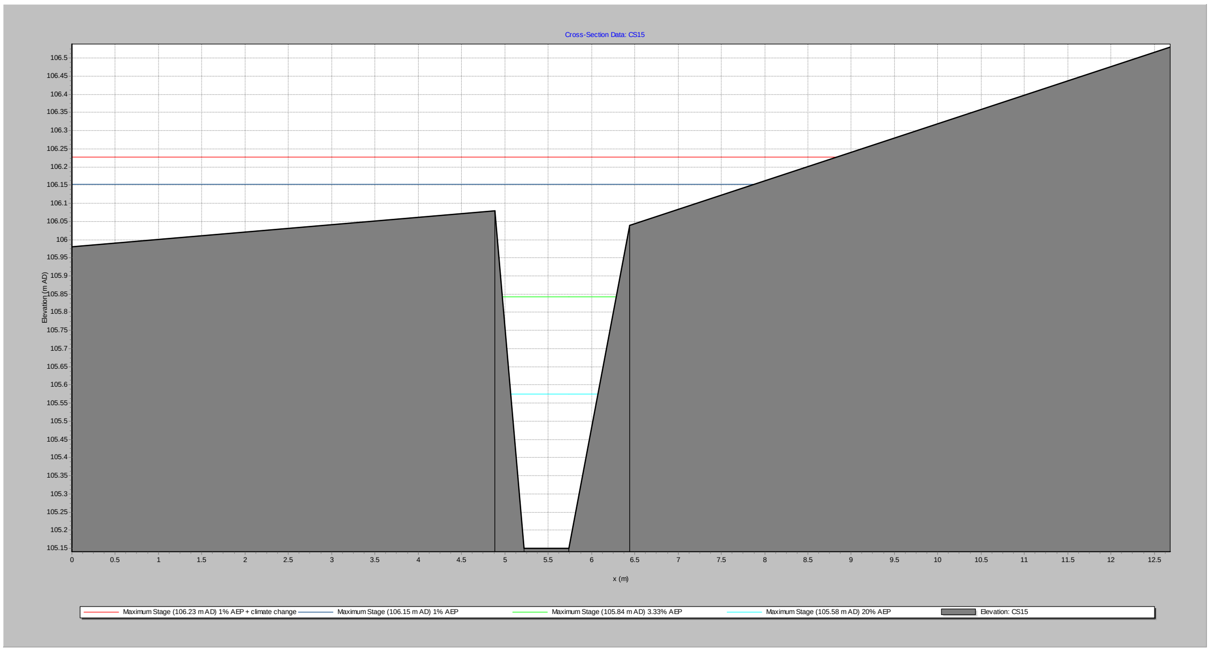

Figure F.13 Peak levels at cross section CS15

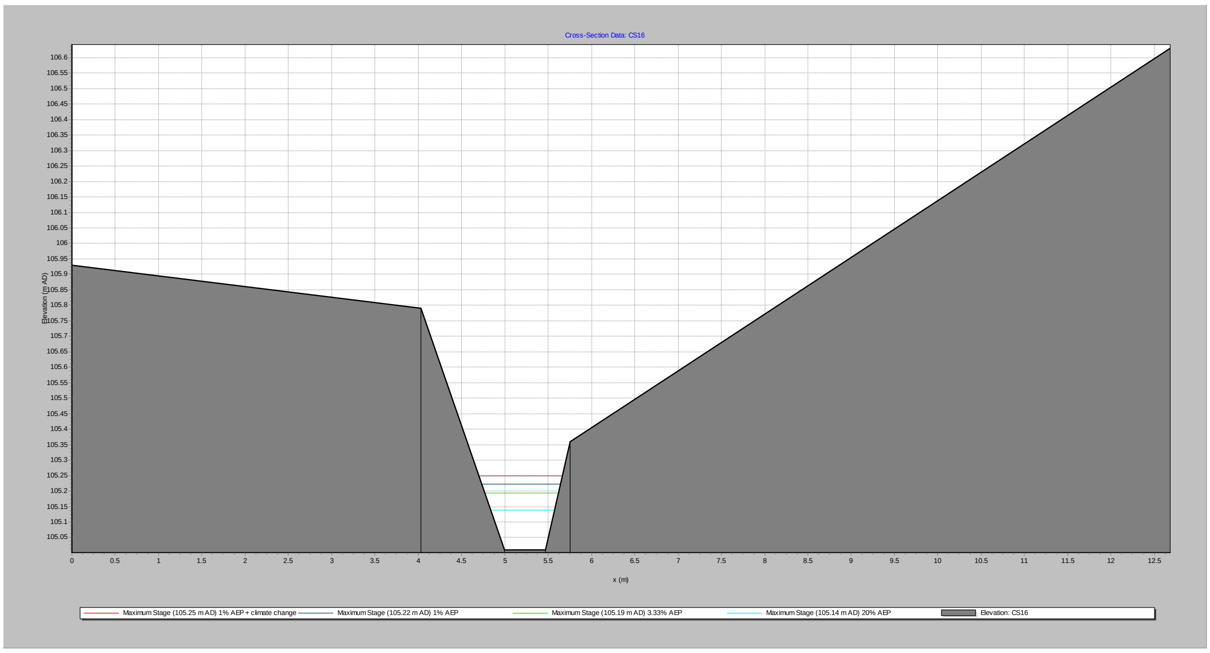

Figure F.14 Peak levels at cross section CS16

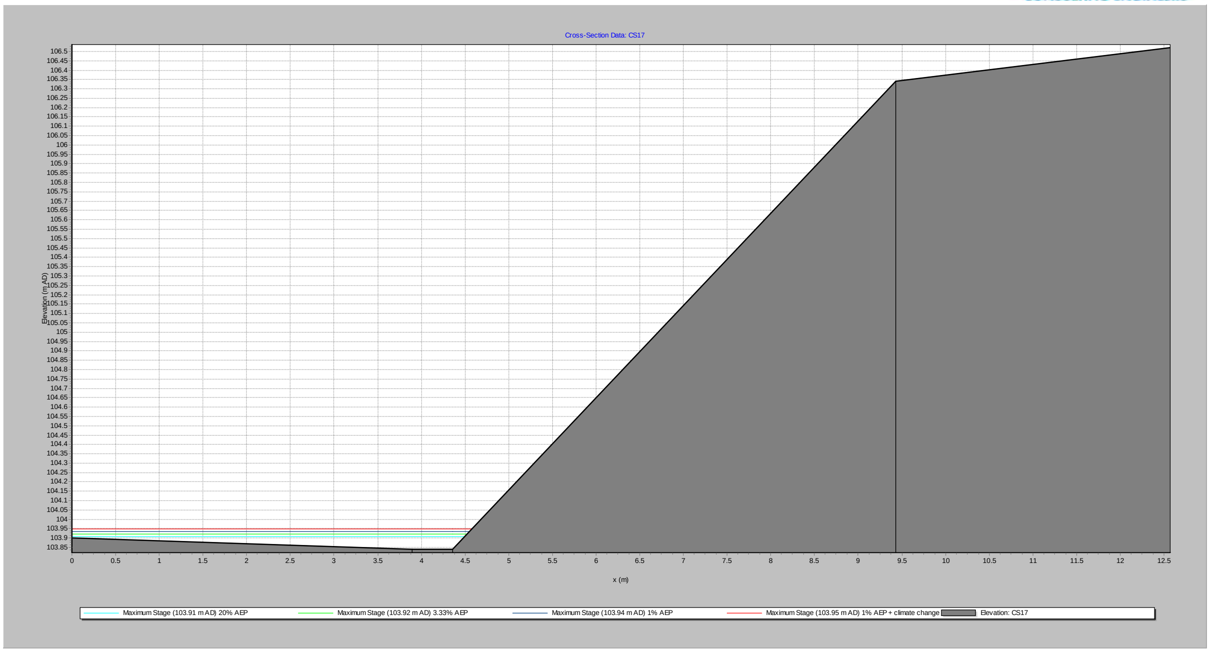

Figure F.15 Peak levels at cross section CS17

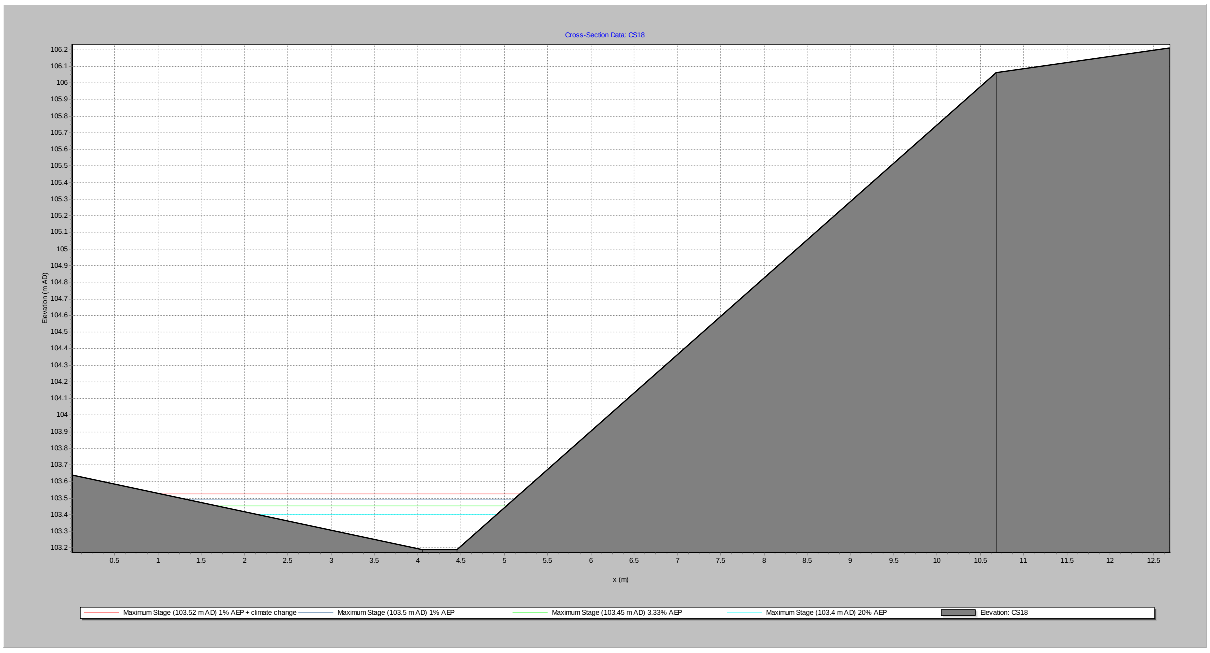

Figure F.16 Peak levels at cross section CS18

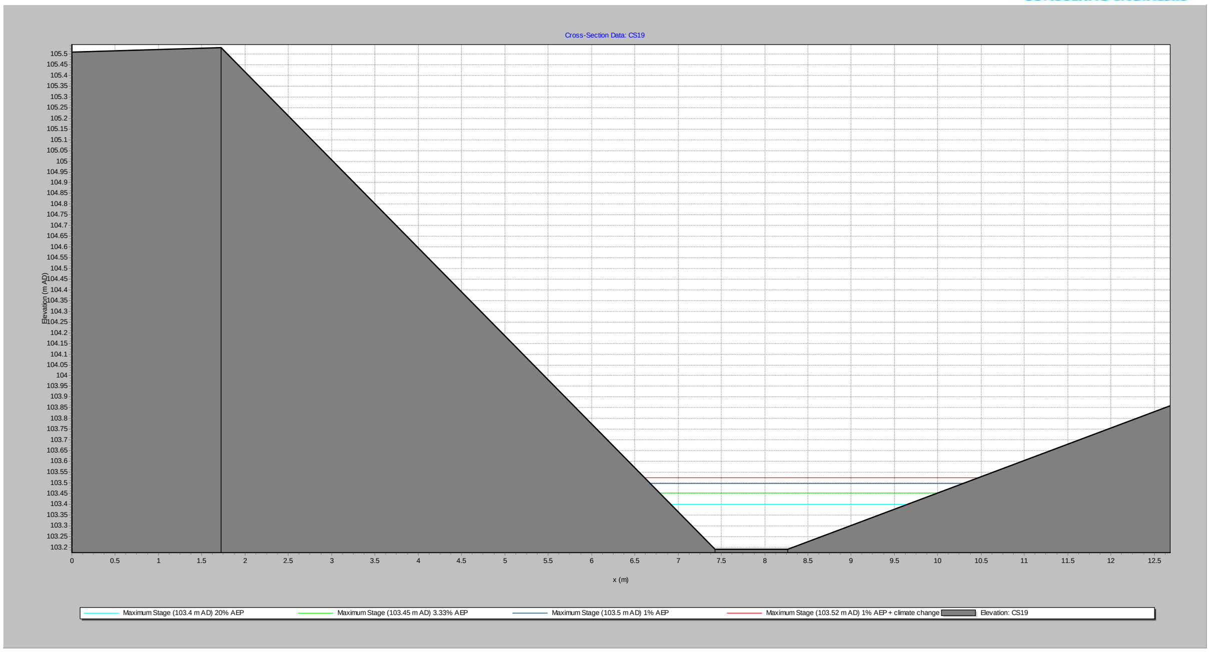

Figure F.17 Peak levels at cross section CS19

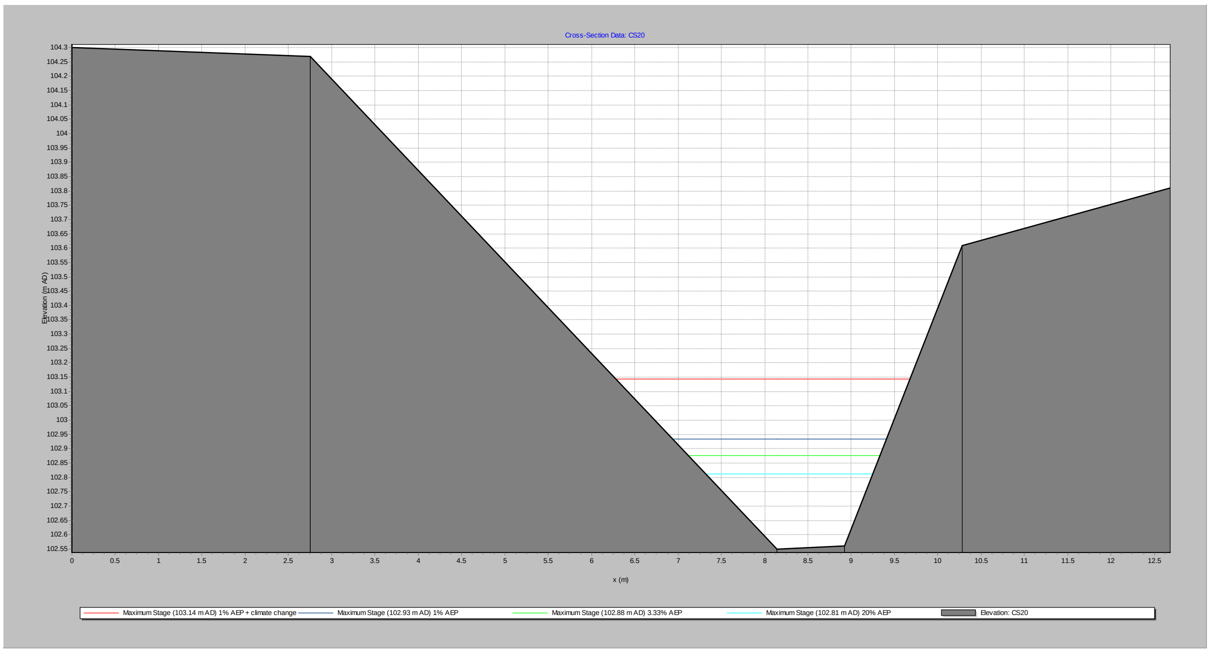

Figure F.18 Peak levels at cross section CS20

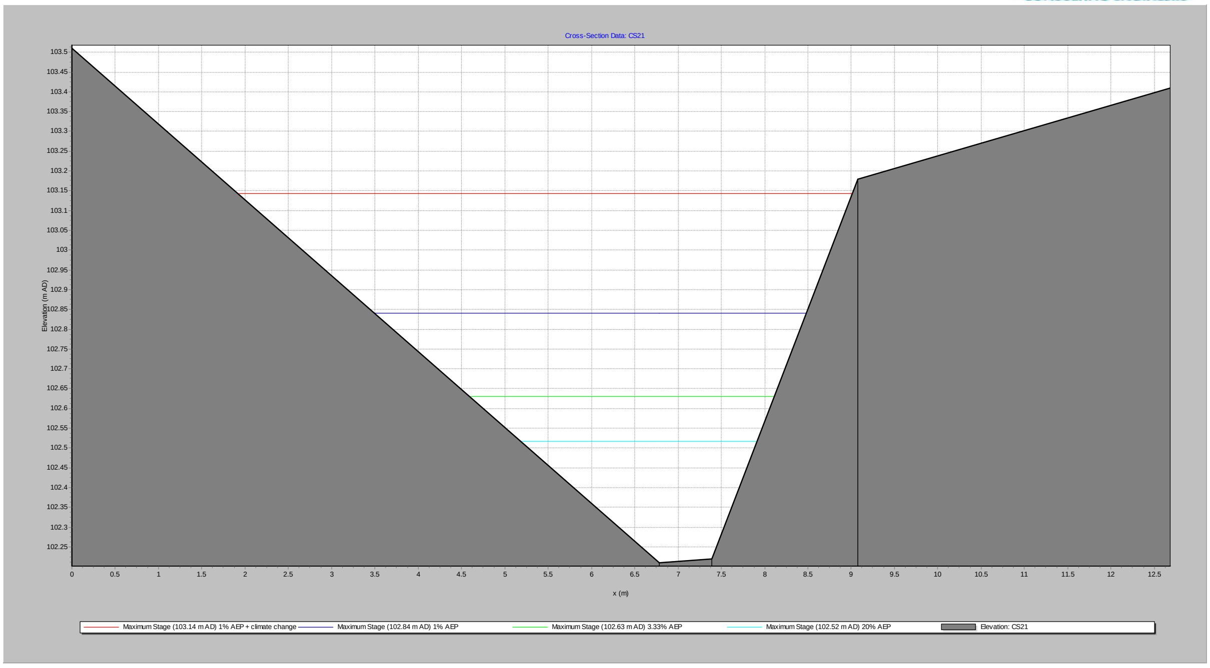

Figure F.19 Peak levels at cross section CS21

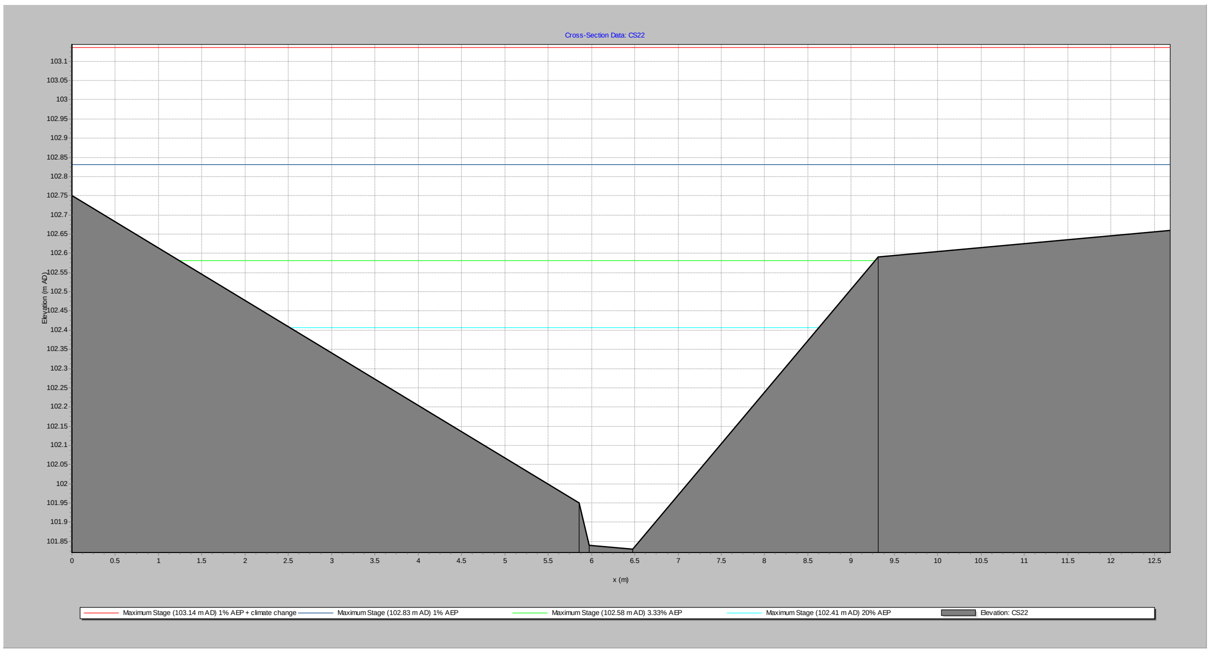

Figure F.20 Peak levels at cross section CS22

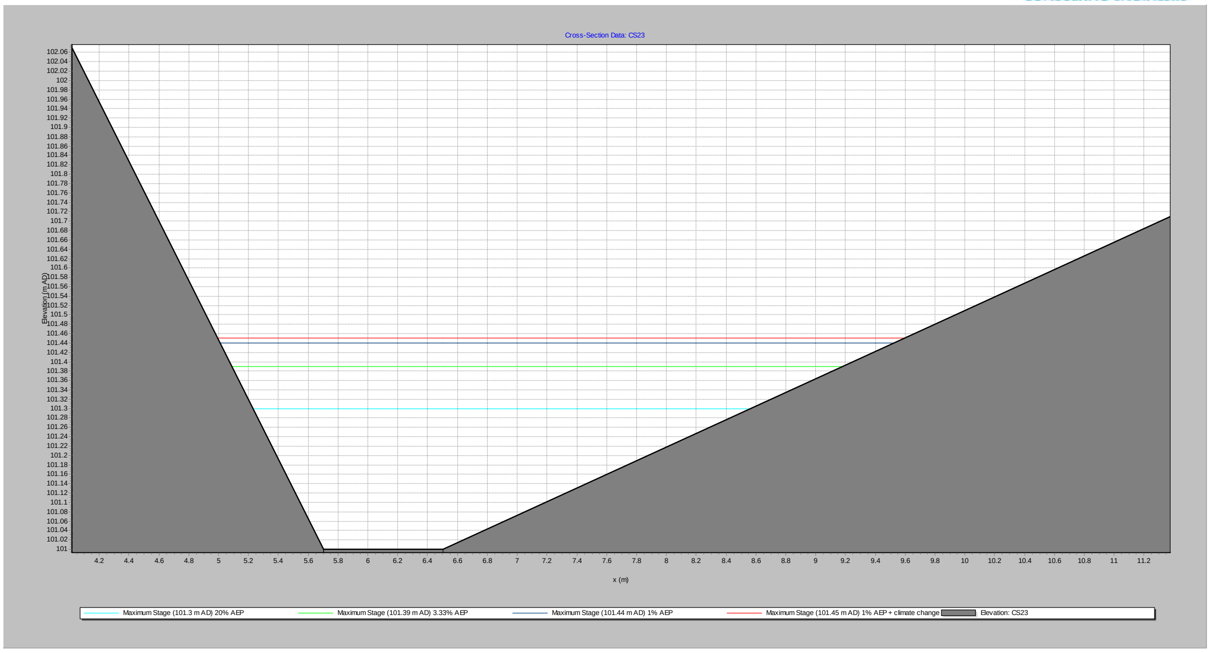

Figure F.21 Peak levels at cross section CS23

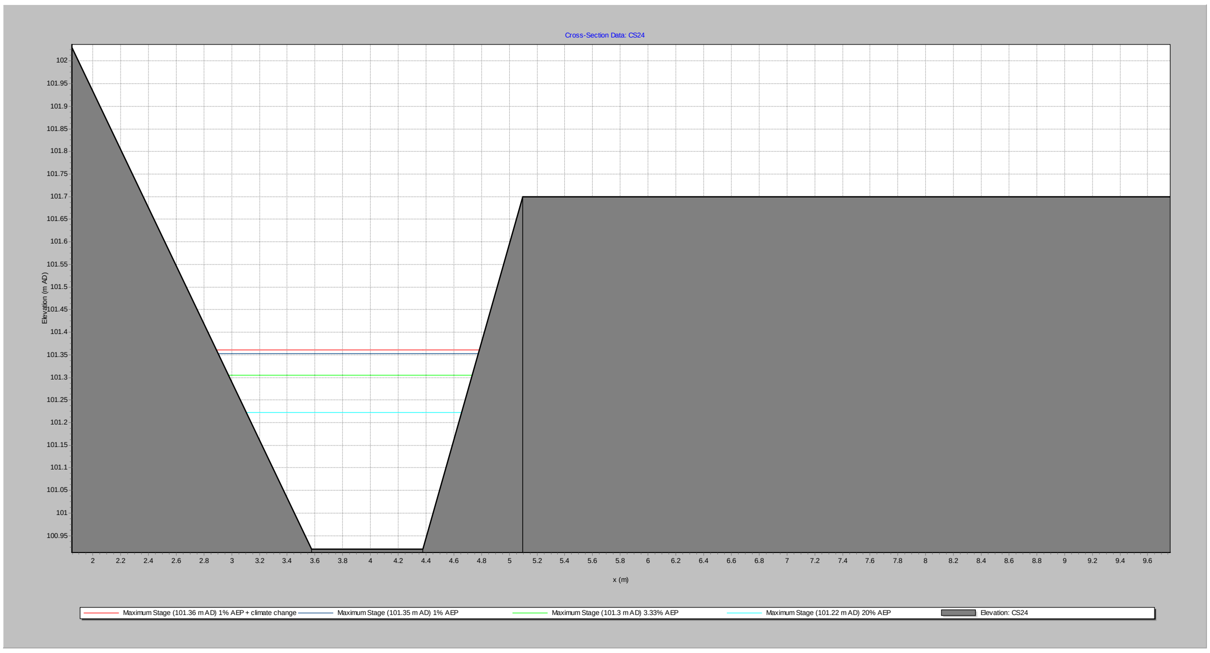

Figure F.22 Peak levels at cross section CS24

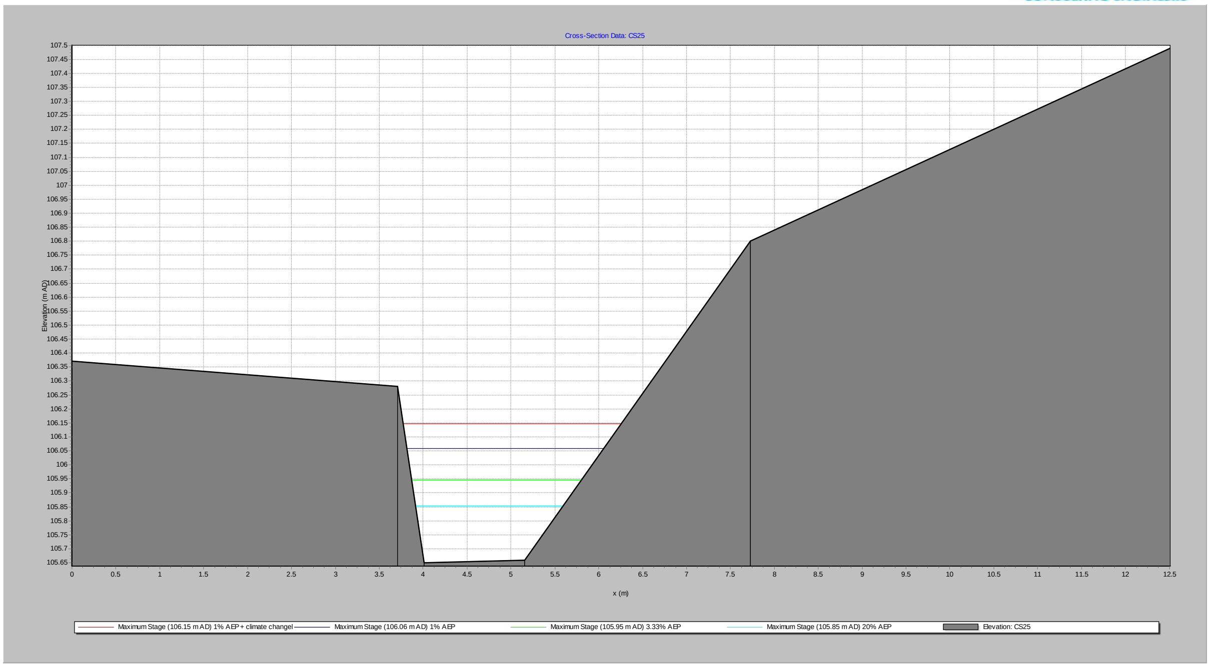

Figure F.23 Peak levels at cross section CS25

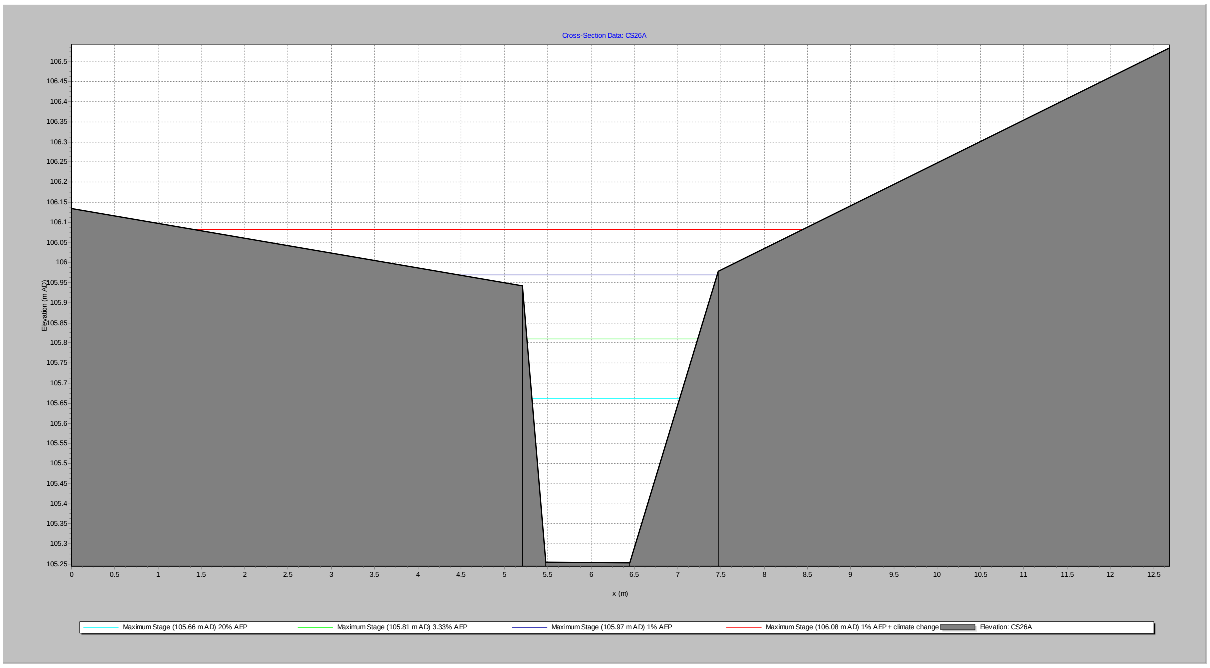

Figure F.24 Peak levels at cross section CS26

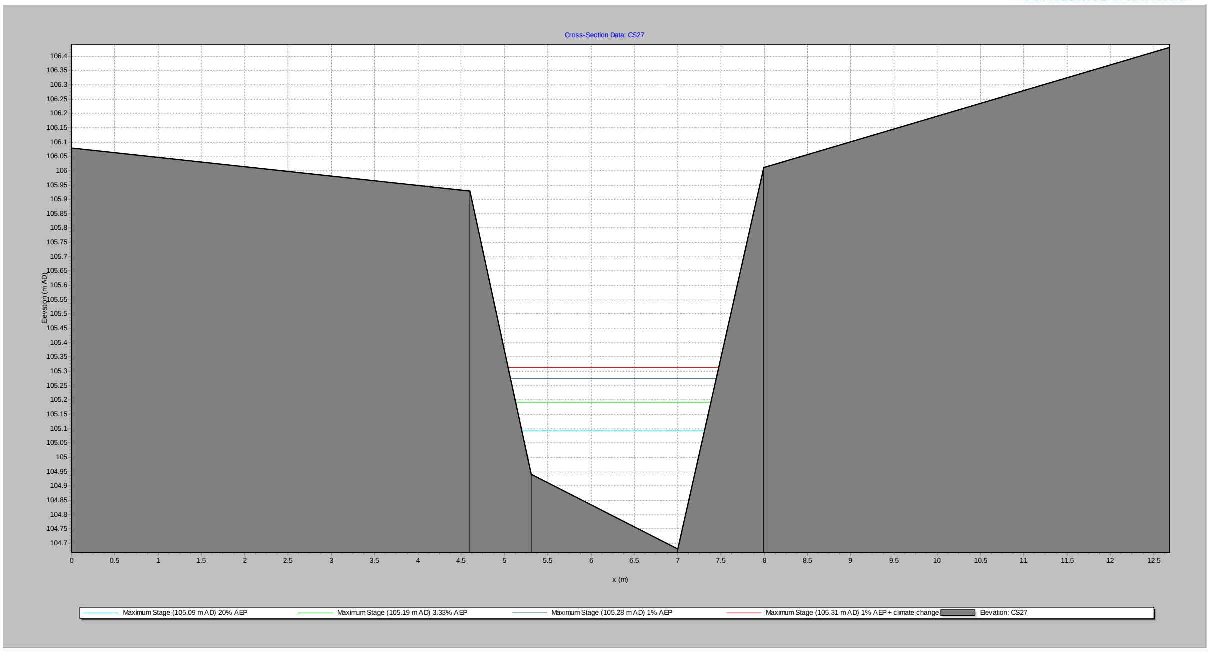

Figure F.25 Peak levels at cross section CS27

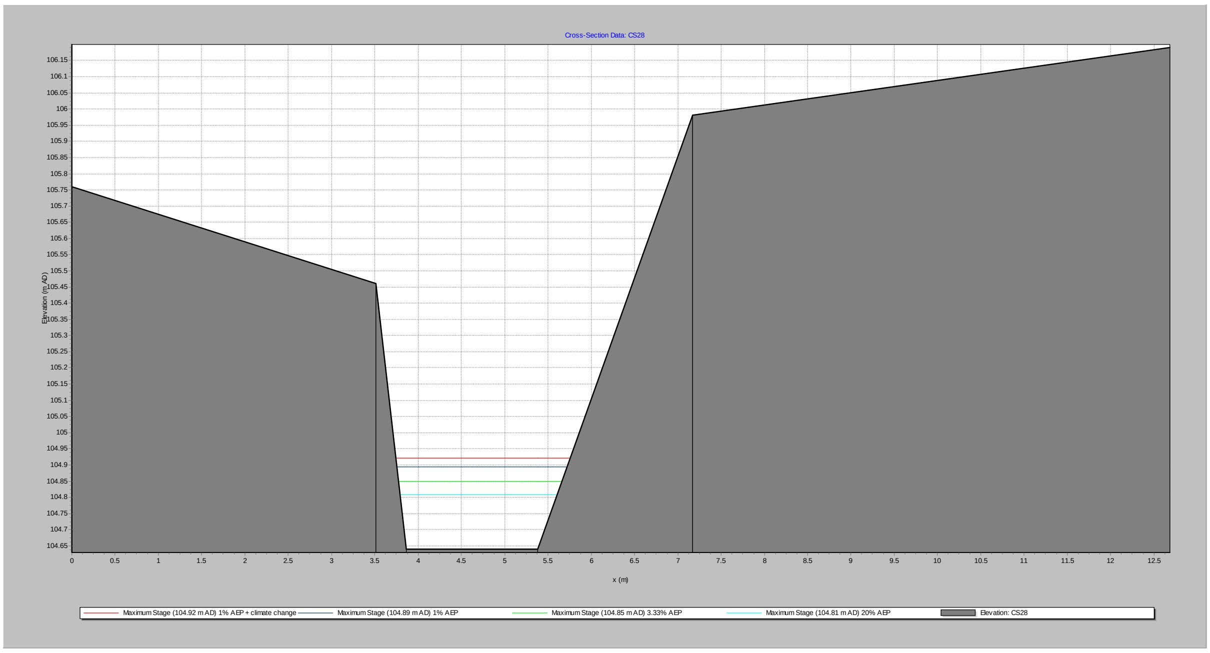

Figure F.26 Peak levels at cross section CS28

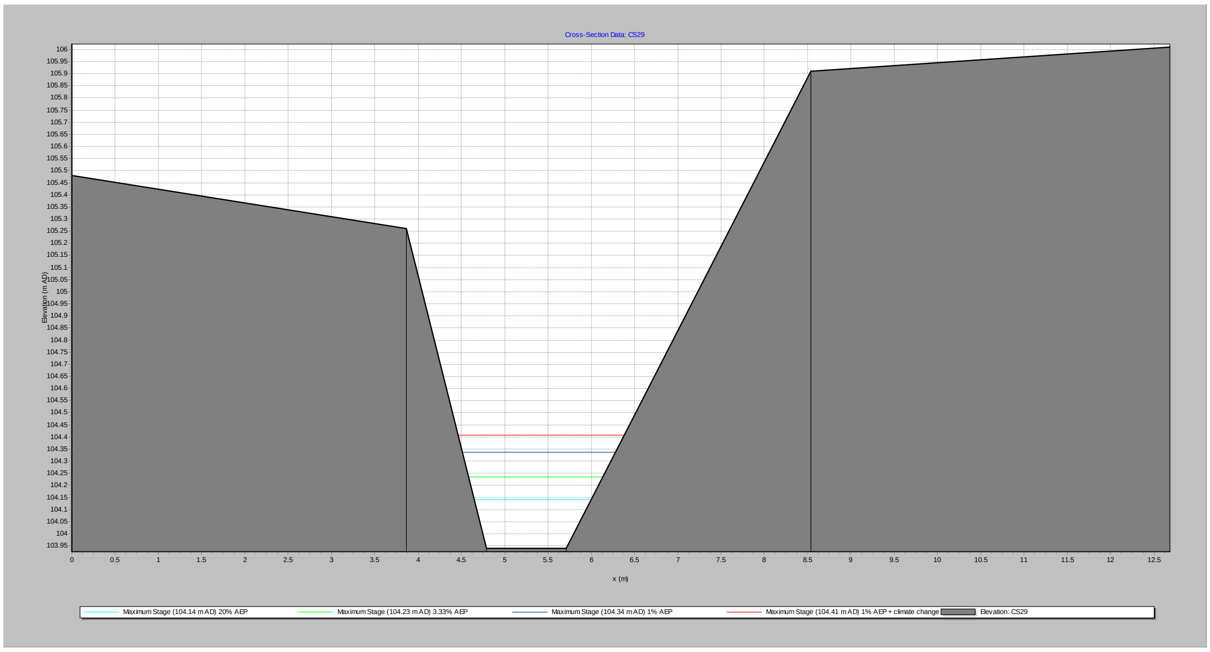

Figure F.27 Peak levels at cross section CS29

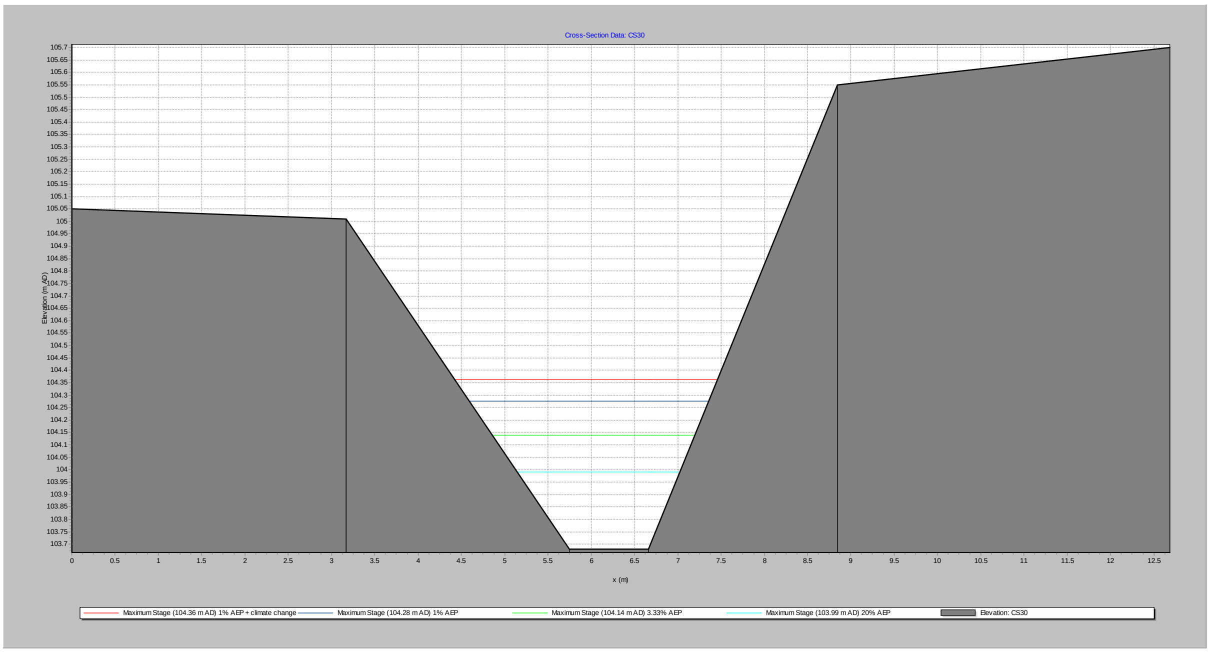

Figure F.28 Peak levels at cross section CS30

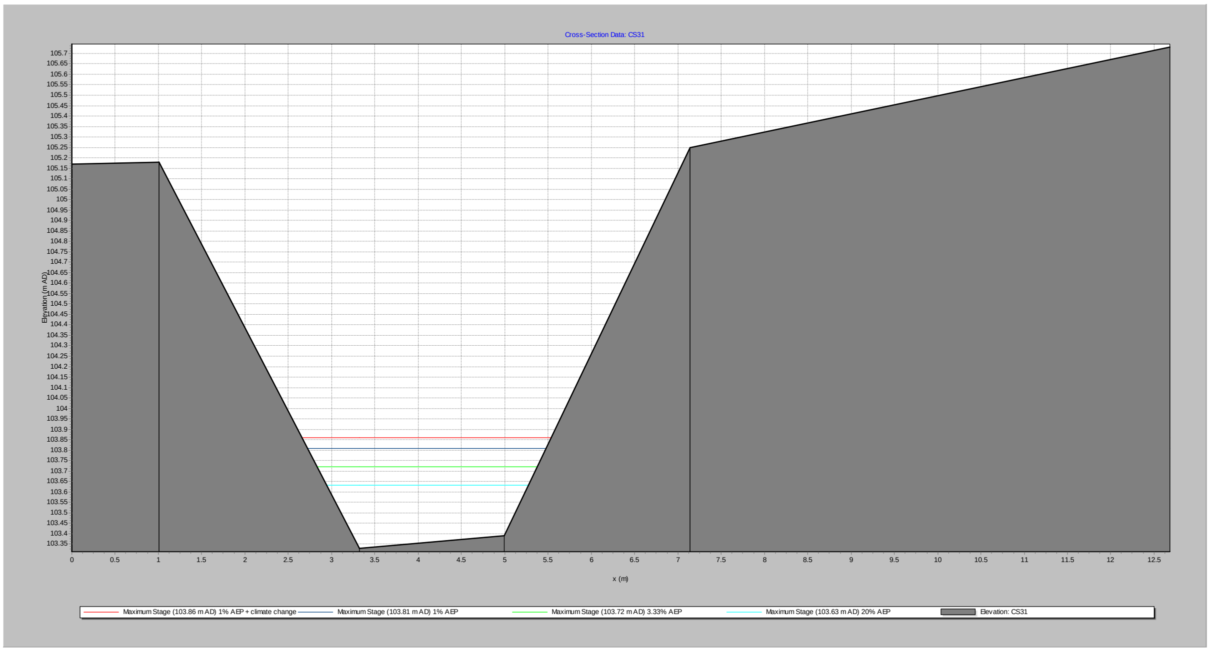

Figure F.29 Peak levels at cross section CS31

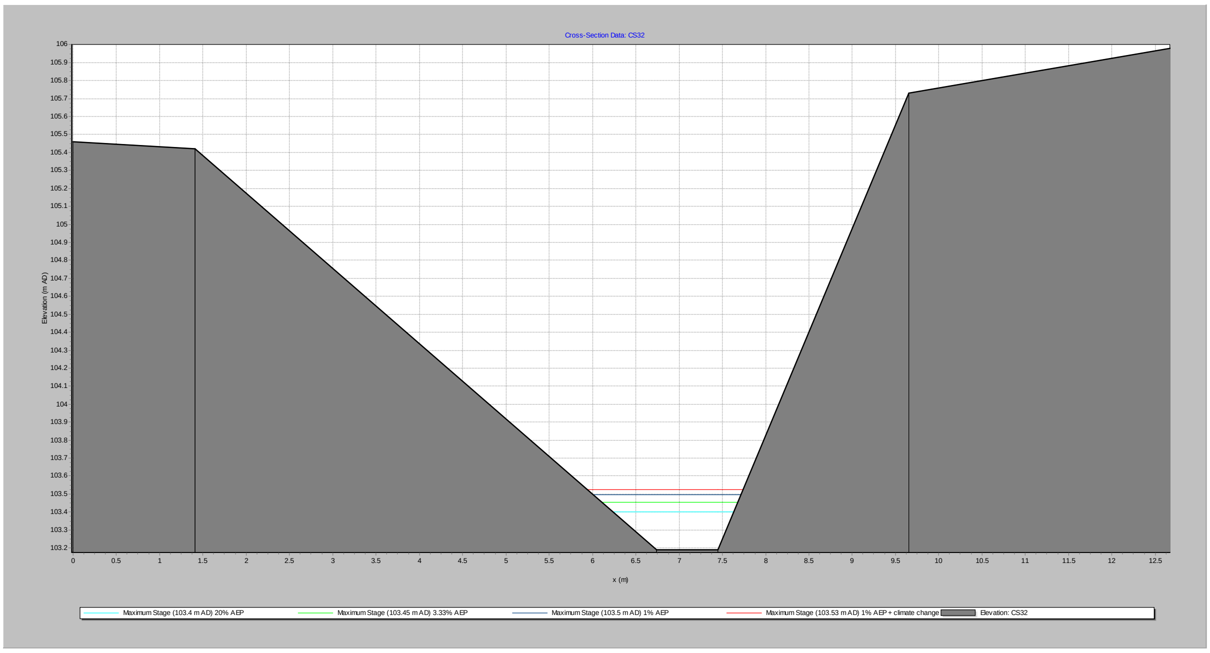

Figure F.30 Peak levels at cross section CS32

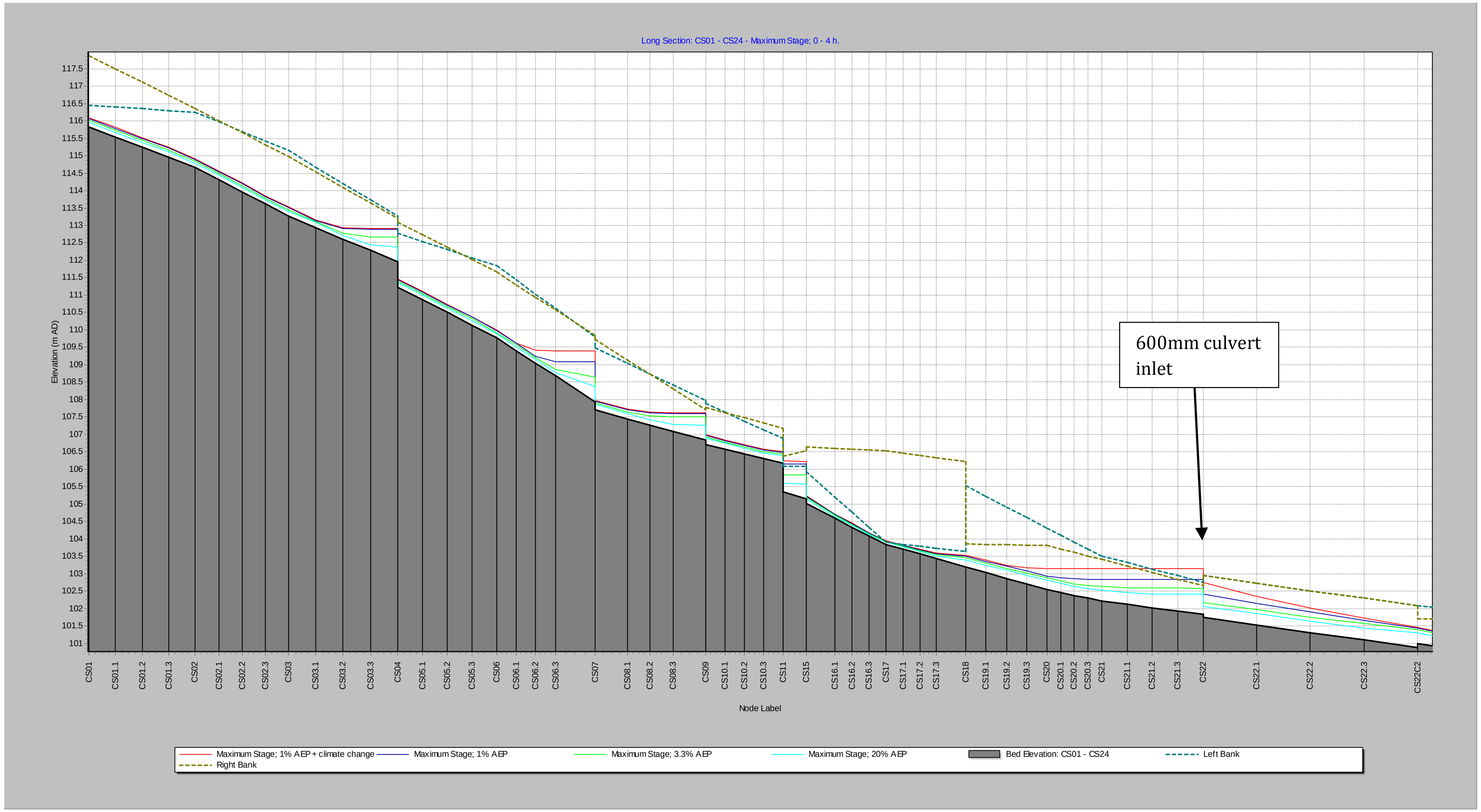

Figure F.31 Long section CS01 to CS24

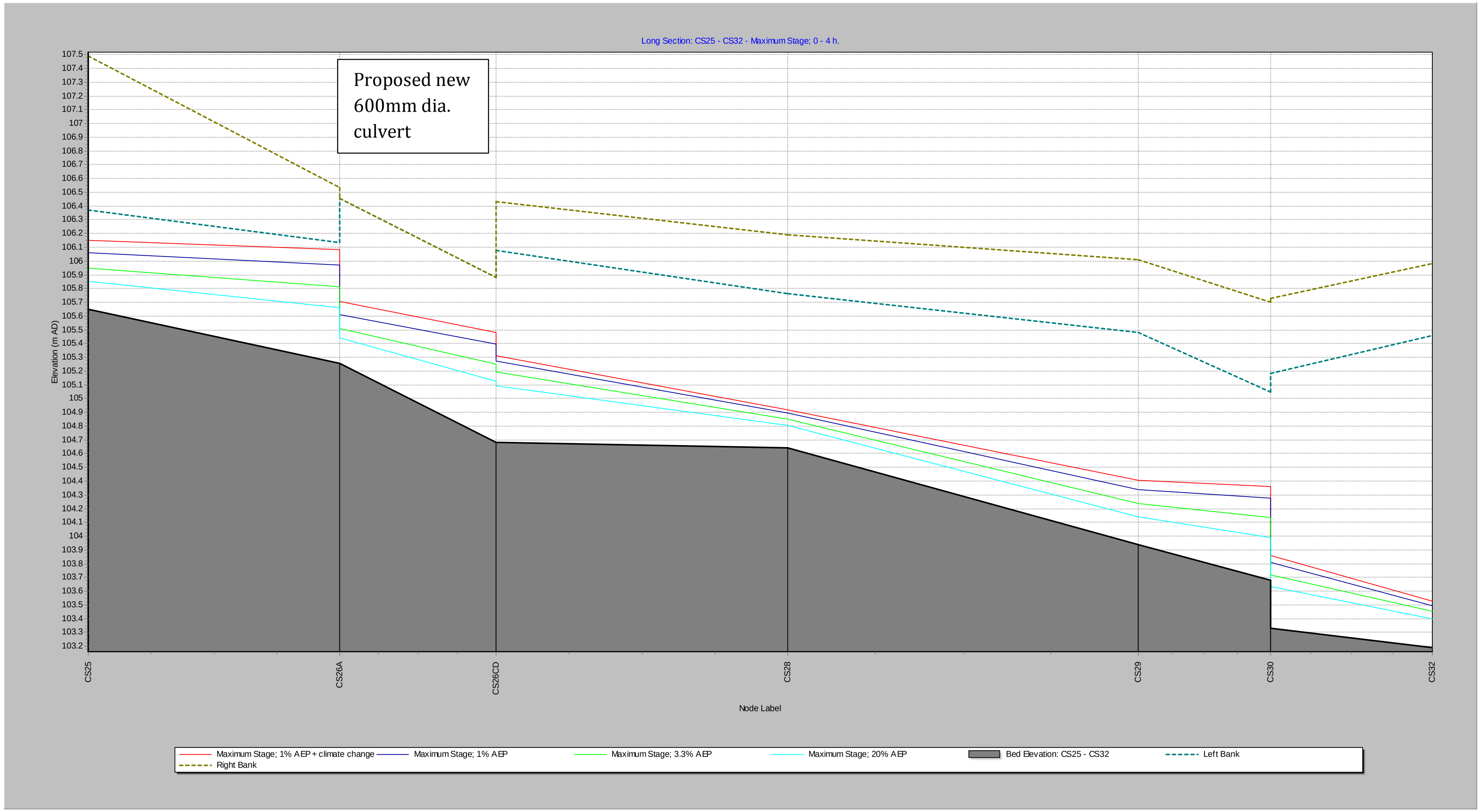

Figure F.32 Long section CS25 to CS32

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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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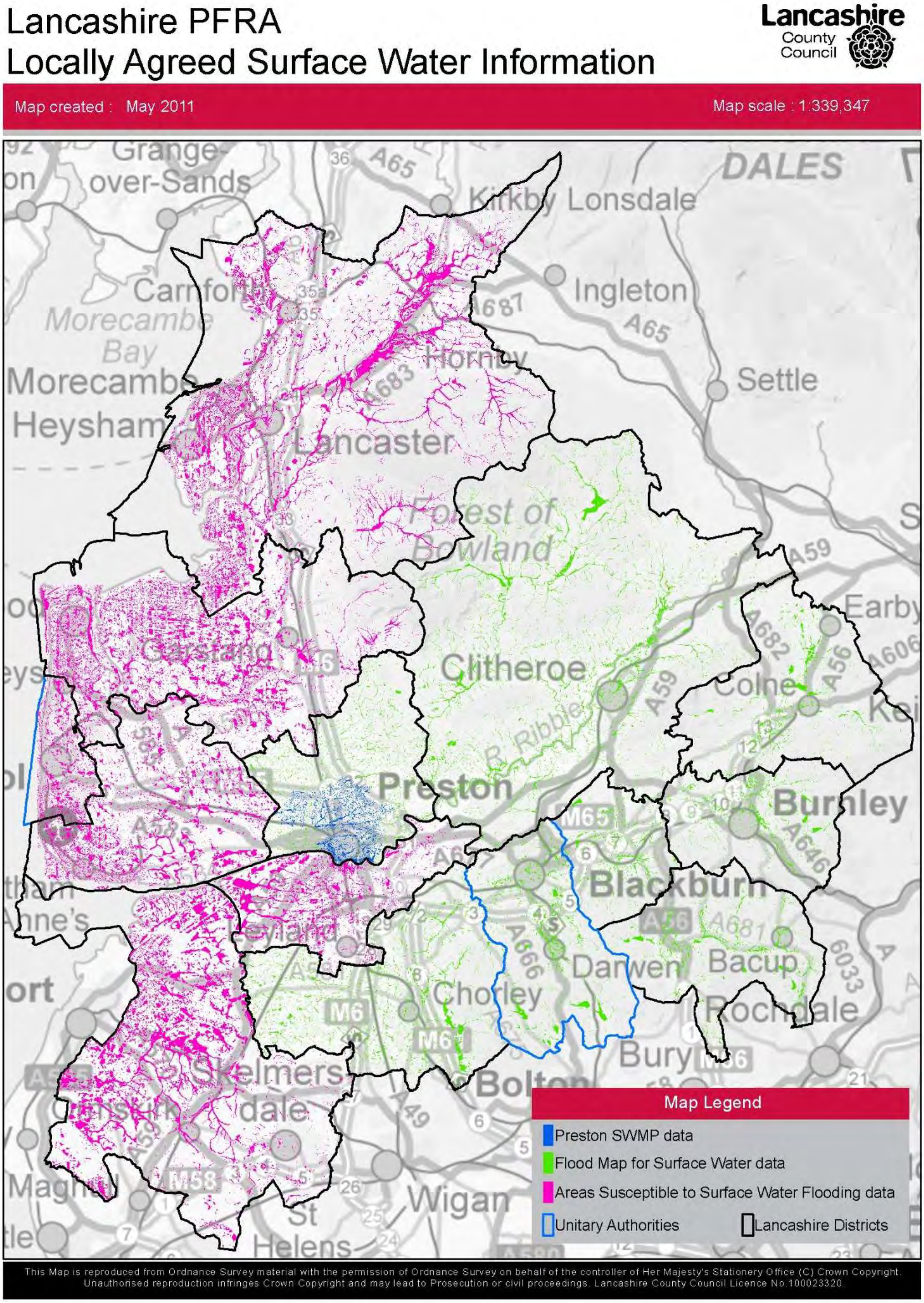
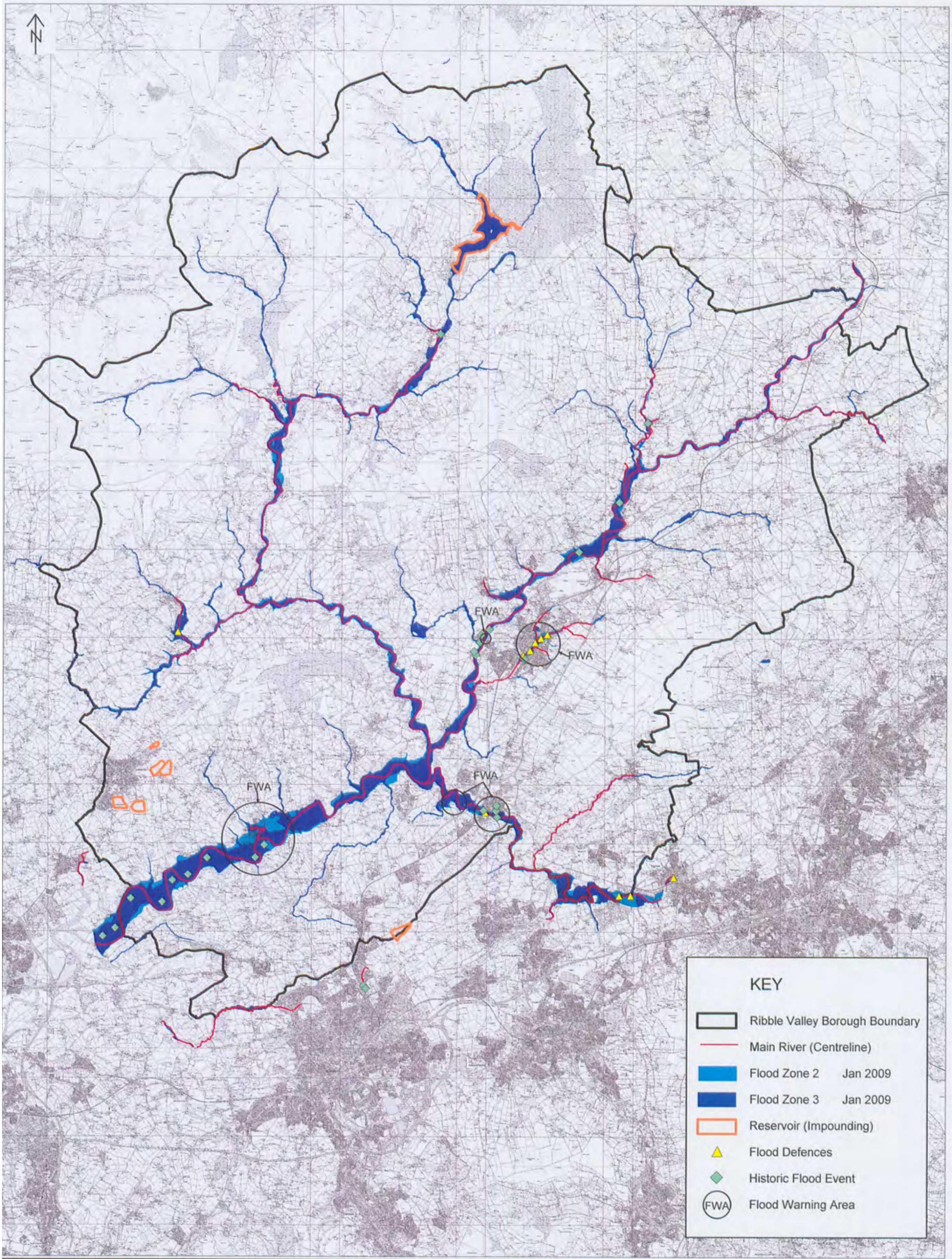


Figure 5.2 – Locally Agreed Surface Water Information



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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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

BETTS HYDRO
CONSULTING ENGINEERS

Development	CHIPPINGS LANE, LONGRIDGE
Project No.	HYD371

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

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

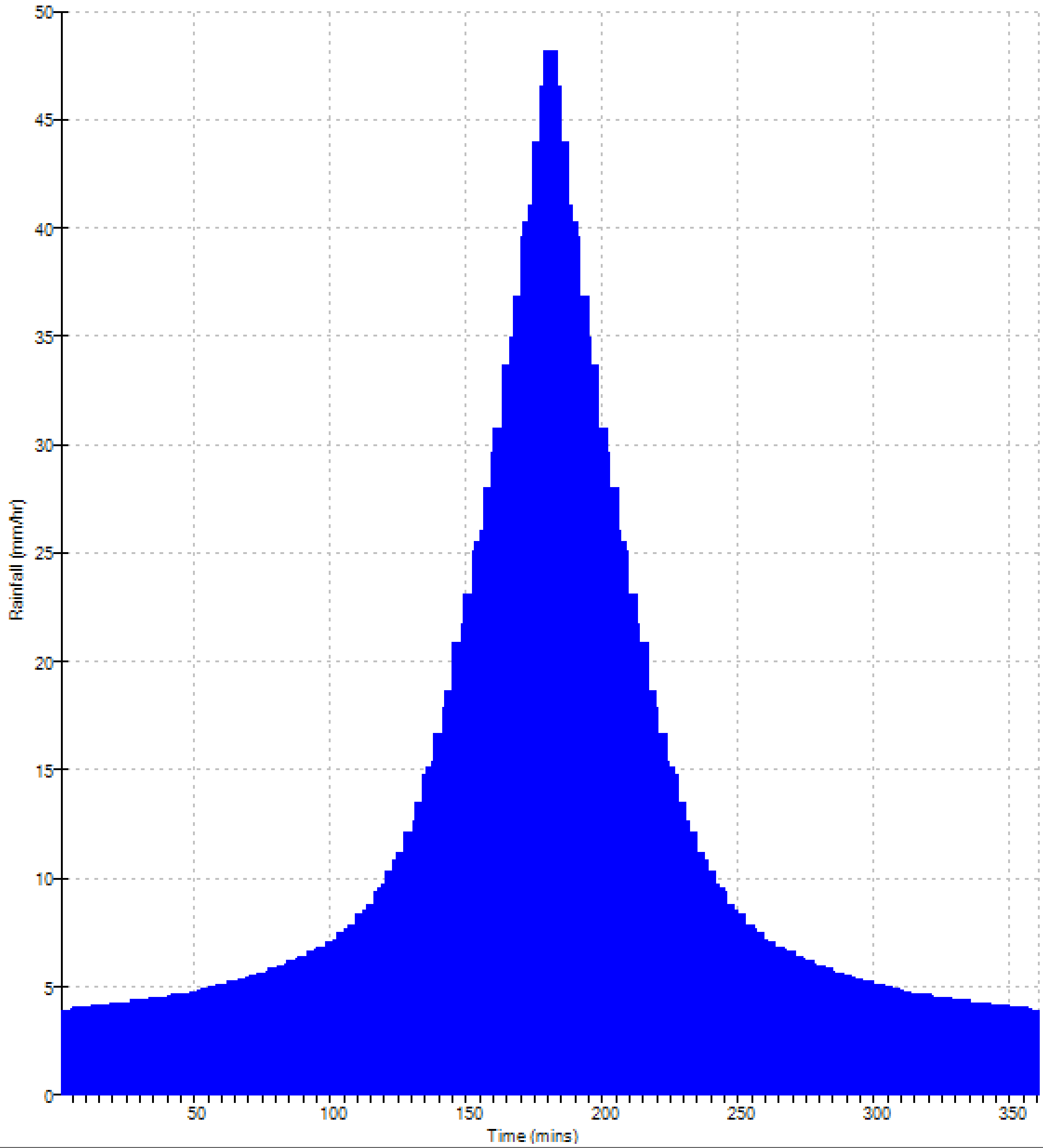
Quick storage Estimates

		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

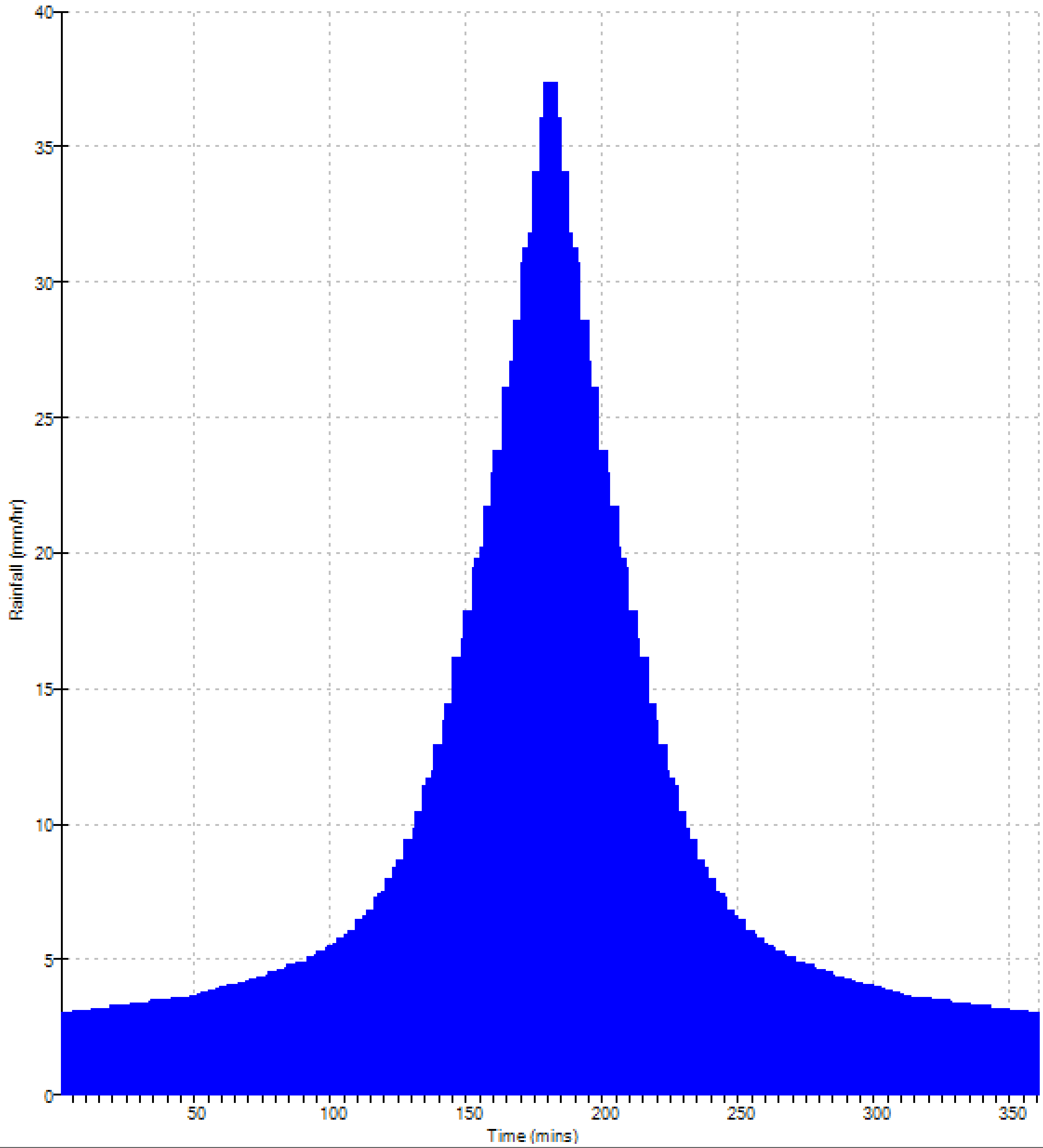
FEH Data	
FEH Rainfall Version	2013
Site Location	GB 360097 438896
Data Type	Point
Peak Intensity (mm/hr)	48.210
Ave. Intensity (mm/hr)	12.298
Return Period (years)	100.0



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

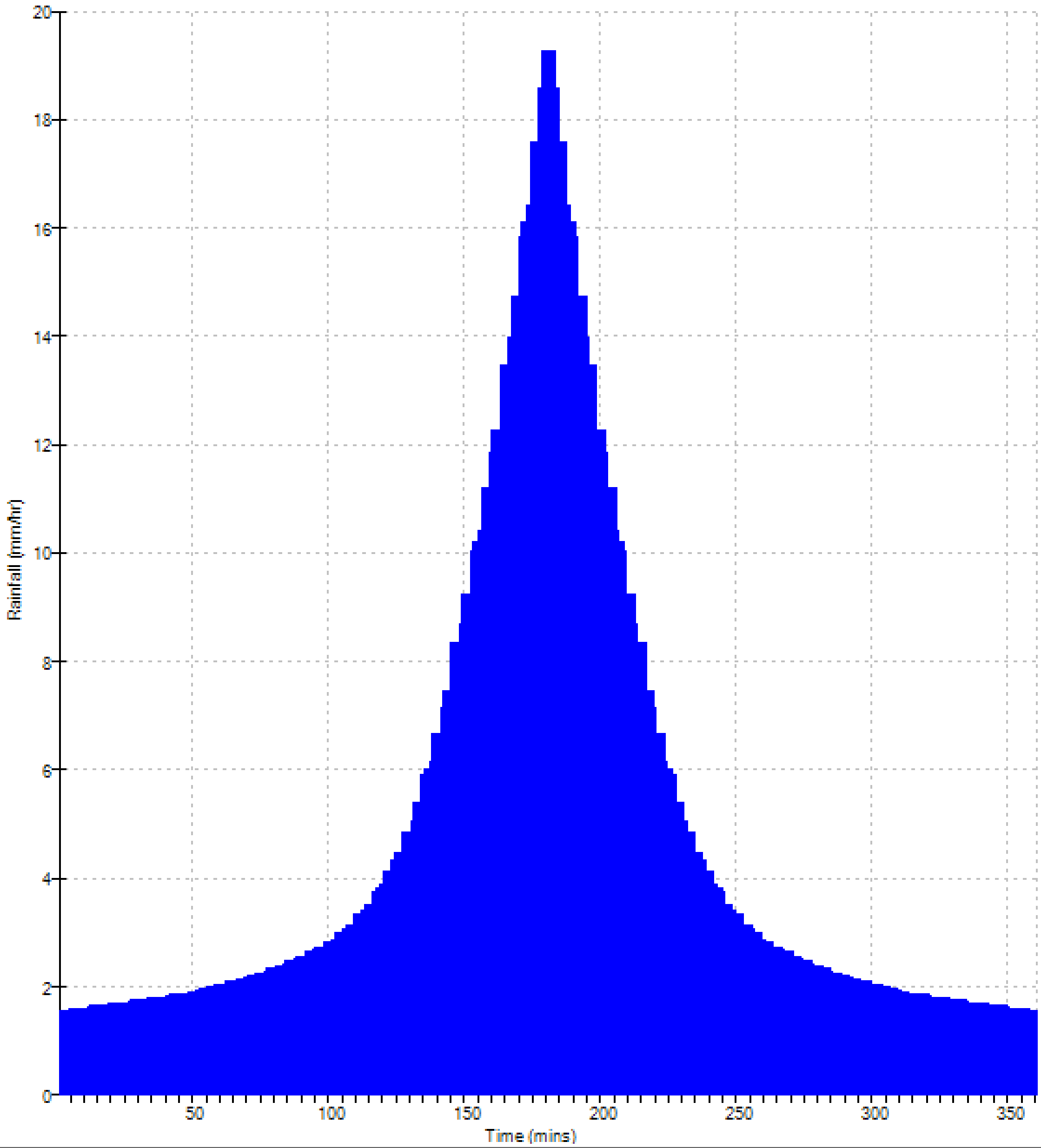


Rainfall profile

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: 0
DATE: 08/11/2018

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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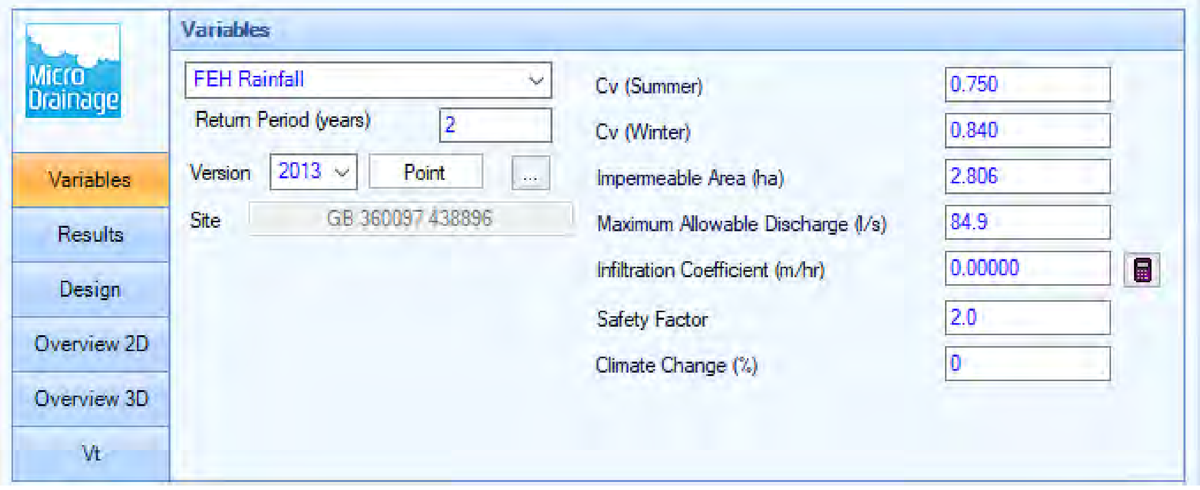
1 YEAR RETURN PERIOD STORM EVENT



Micro Drainage

Variables | Results | Design | Overview 2D | Overview 3D | Vt

Variables

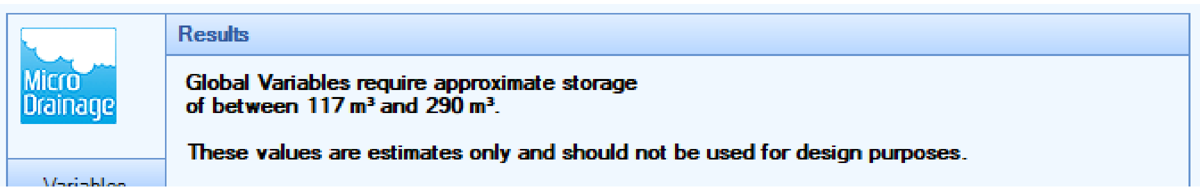
FEH Rainfall

Return Period (years): 2

Version: 2013 | Point

Site: GB 360097 438896

Cv (Summer)	0.750
Cv (Winter)	0.840
Impermeable Area (ha)	2.806
Maximum Allowable Discharge (l/s)	84.9
Infiltration Coefficient (m/hr)	0.00000
Safety Factor	2.0
Climate Change (%)	0



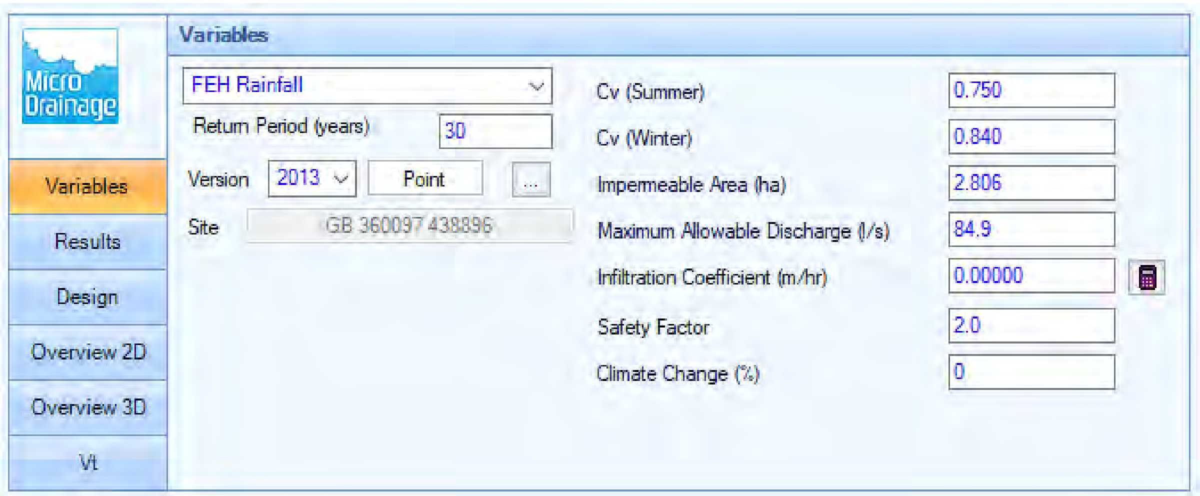
Micro Drainage

Results

Global Variables require approximate storage of between 117 m³ and 290 m³.

These values are estimates only and should not be used for design purposes.

30 YEAR RETURN PERIOD STORM EVENT



Micro Drainage

Variables | Results | Design | Overview 2D | Overview 3D | Vt

Variables

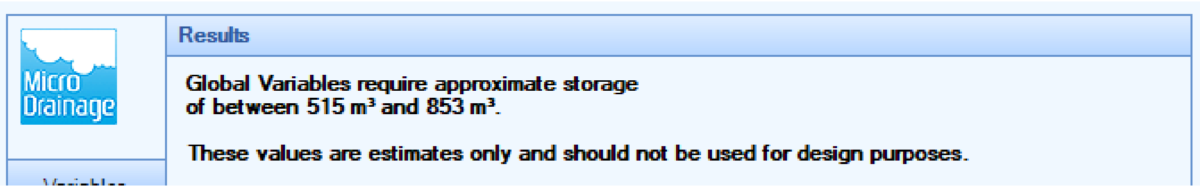
FEH Rainfall

Return Period (years): 30

Version: 2013 | Point

Site: GB 360097 438896

Cv (Summer)	0.750
Cv (Winter)	0.840
Impermeable Area (ha)	2.806
Maximum Allowable Discharge (l/s)	84.9
Infiltration Coefficient (m/hr)	0.00000
Safety Factor	2.0
Climate Change (%)	0



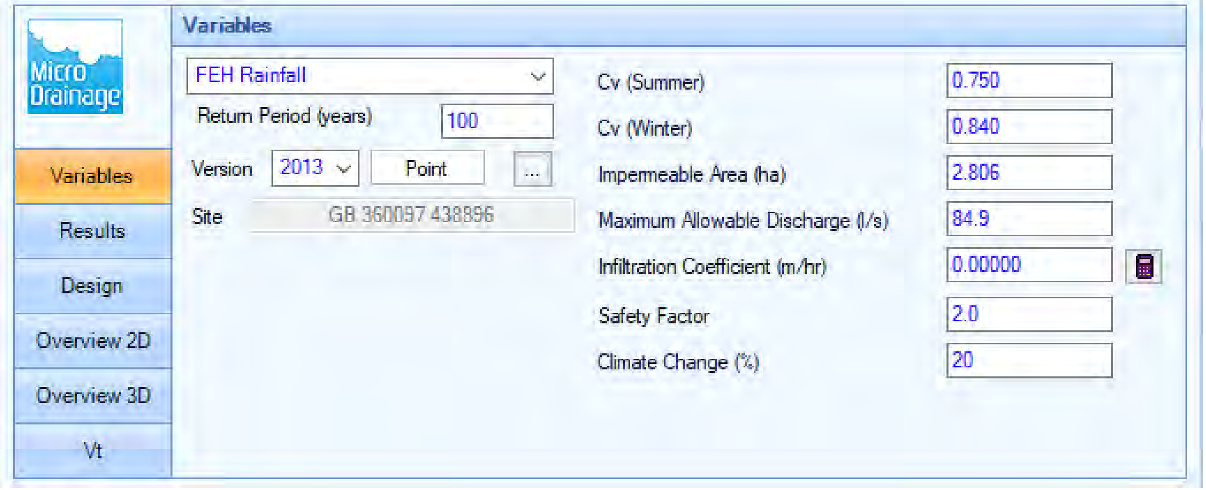
Micro Drainage

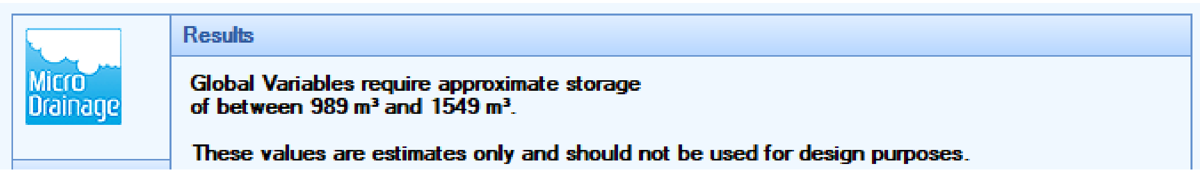
Results

Global Variables require approximate storage of between 515 m³ and 853 m³.

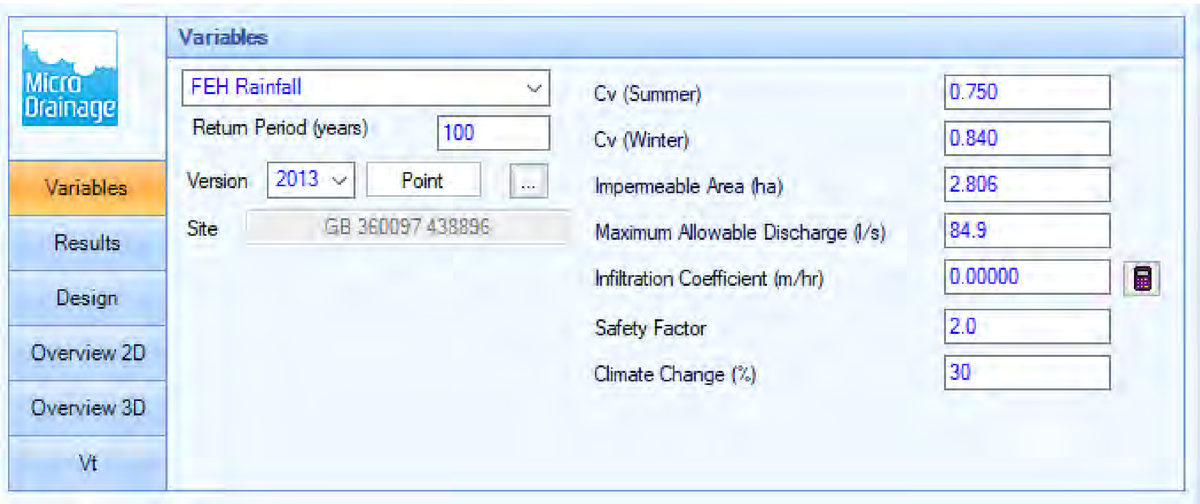
These values are estimates only and should not be used for design purposes.

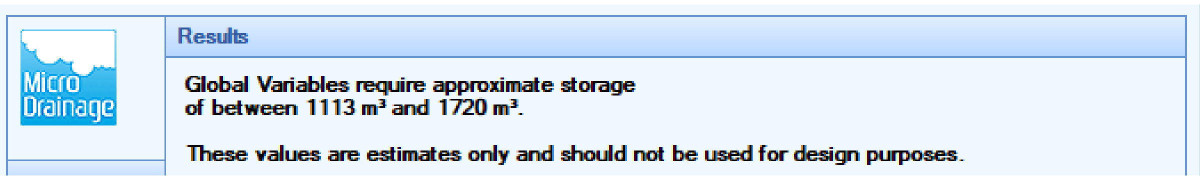
100 YEAR RETURN PERIOD STORM EVENT + 20% CLIMATE CHANGE





100 YEAR RETURN PERIOD STORM EVENT + 30% CLIMATE CHANGE





100 YEAR RETURN PERIOD STORM EVENT + 40% CLIMATE CHANGE

Micro Drainage

Variables | Results | Design | Overview 2D | Overview 3D | Vt

Variables

FEH Rainfall	
Return Period (years)	100
Version	2013 — Point
Site	GB 360097 438896
Cv (Summer)	0.750
Cv (Winter)	0.840
Impermeable Area (ha)	2.806
Maximum Allowable Discharge (l/s)	84.9
Infiltration Coefficient (m/hr)	0.00000
Safety Factor	2.0
Climate Change (%)	40

Micro Drainage

Results

Global Variables require approximate storage of between 1240 m³ and 1892 m³.

These values are estimates only and should not be used for design purposes.

APPENDIX M: TYPICAL SUDS DETAILS

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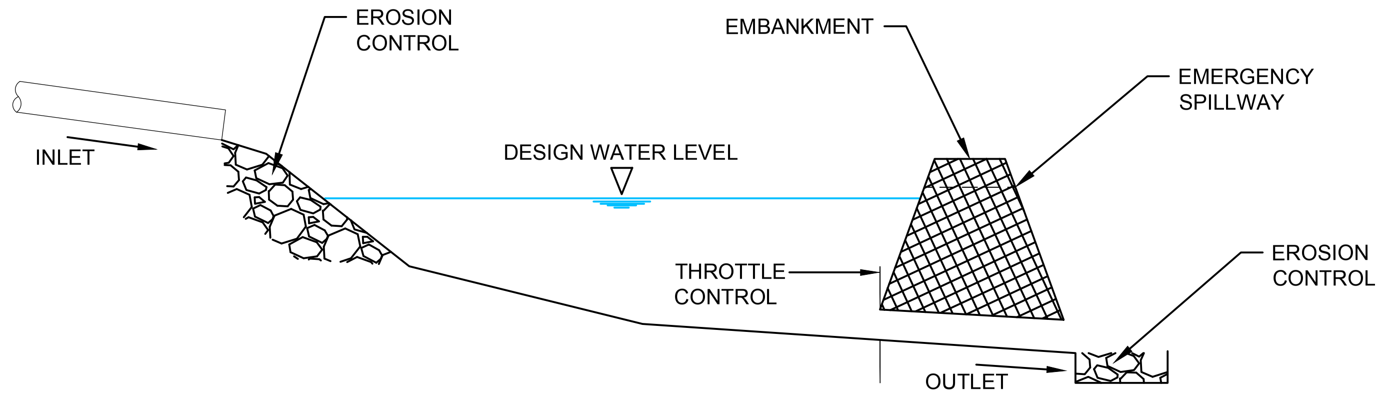
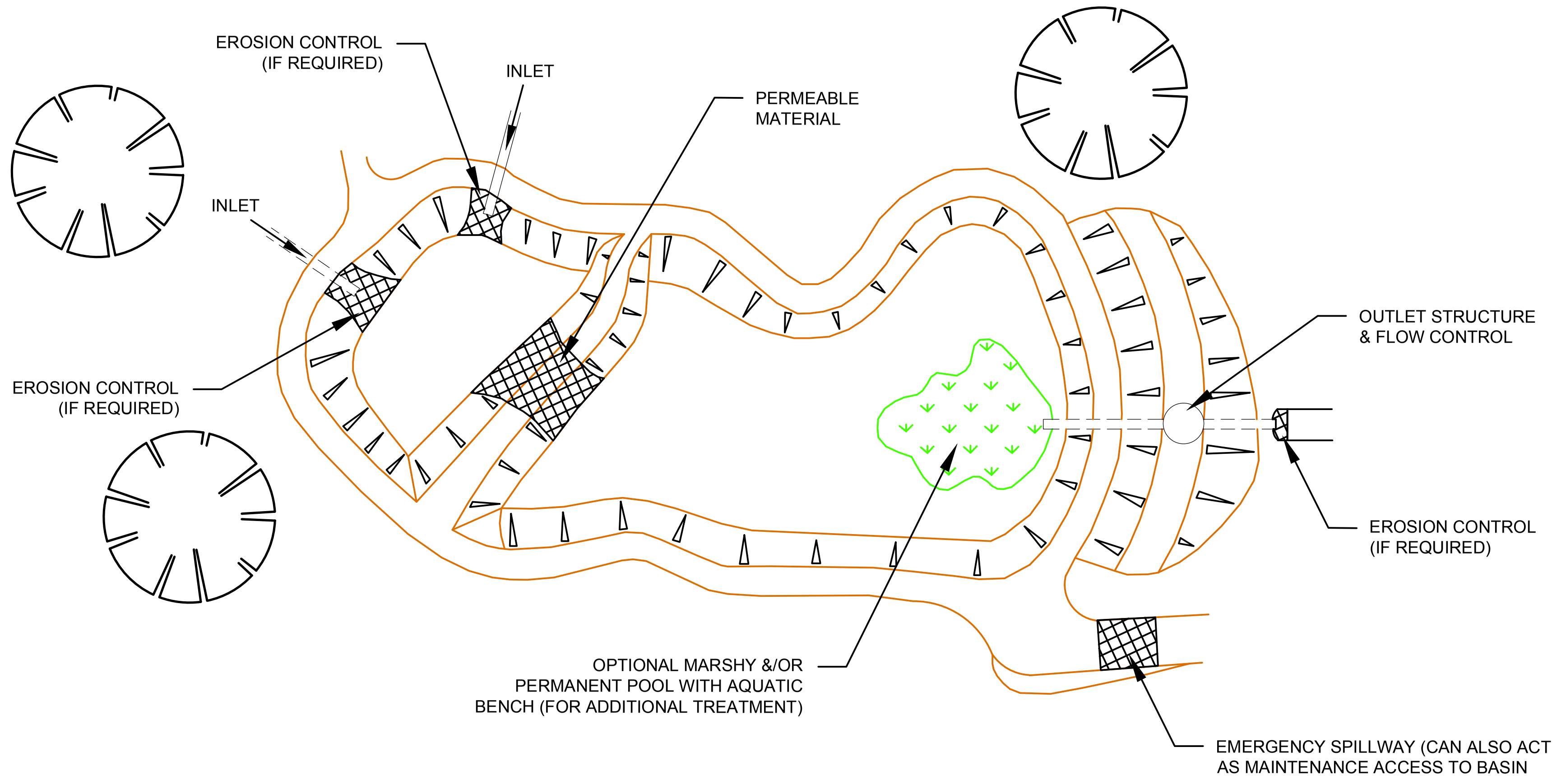
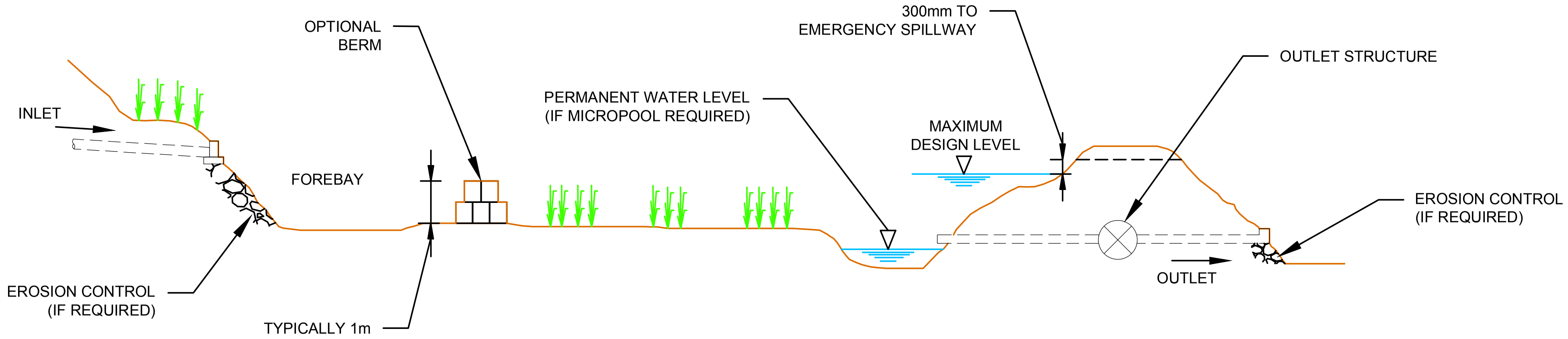


SCHEMATIC OF DETENTION BASIN PROFILE



PLAN VIEW



ELEVATION

DO NOT SCALE

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 6, 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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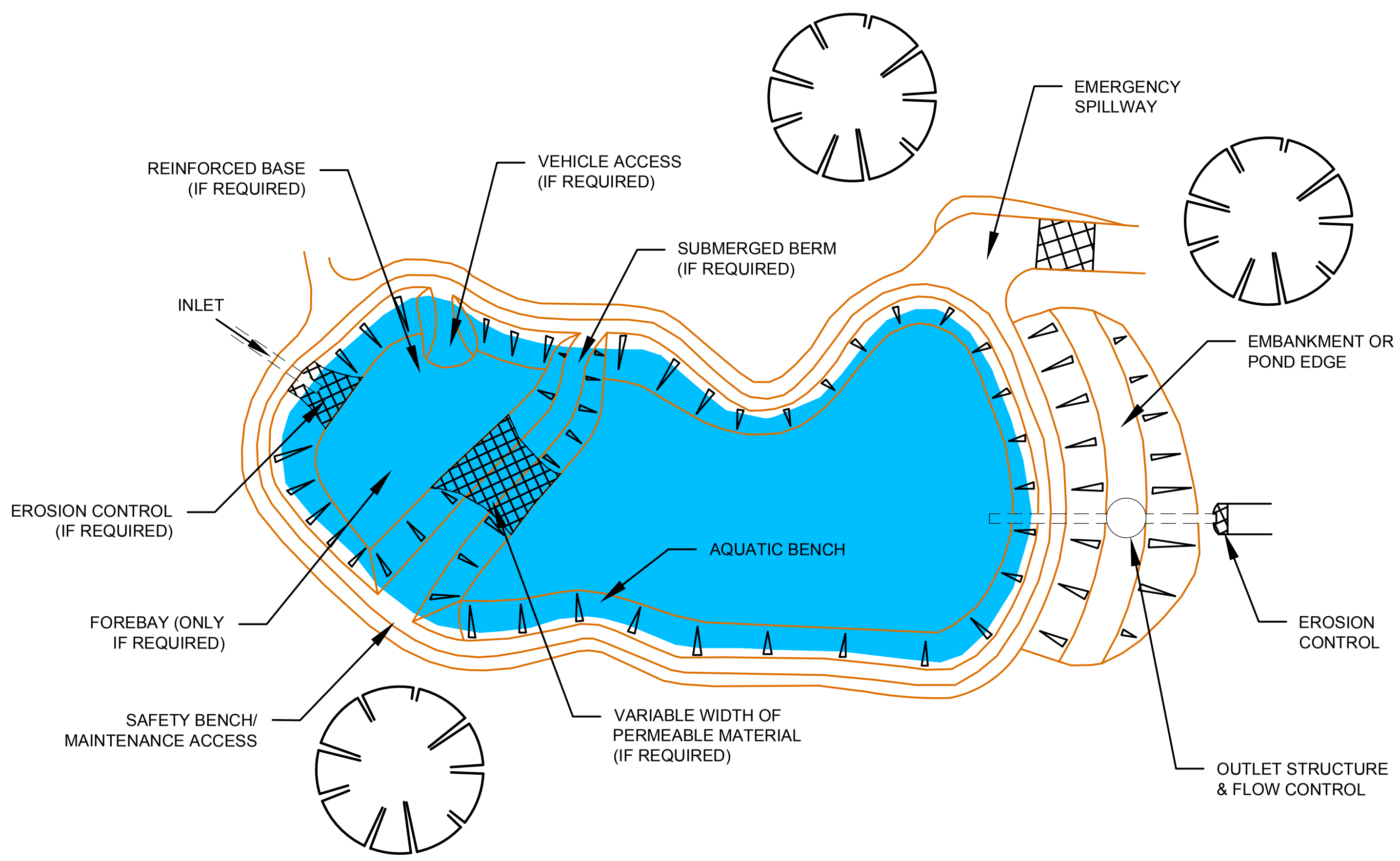
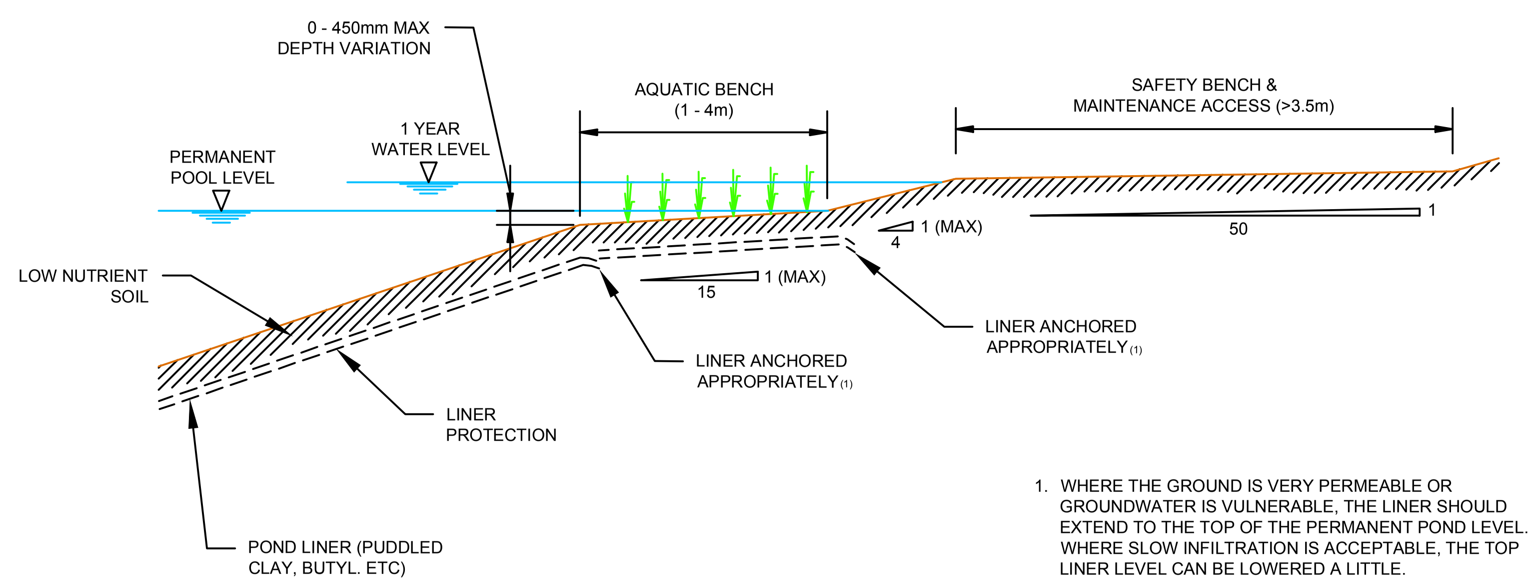
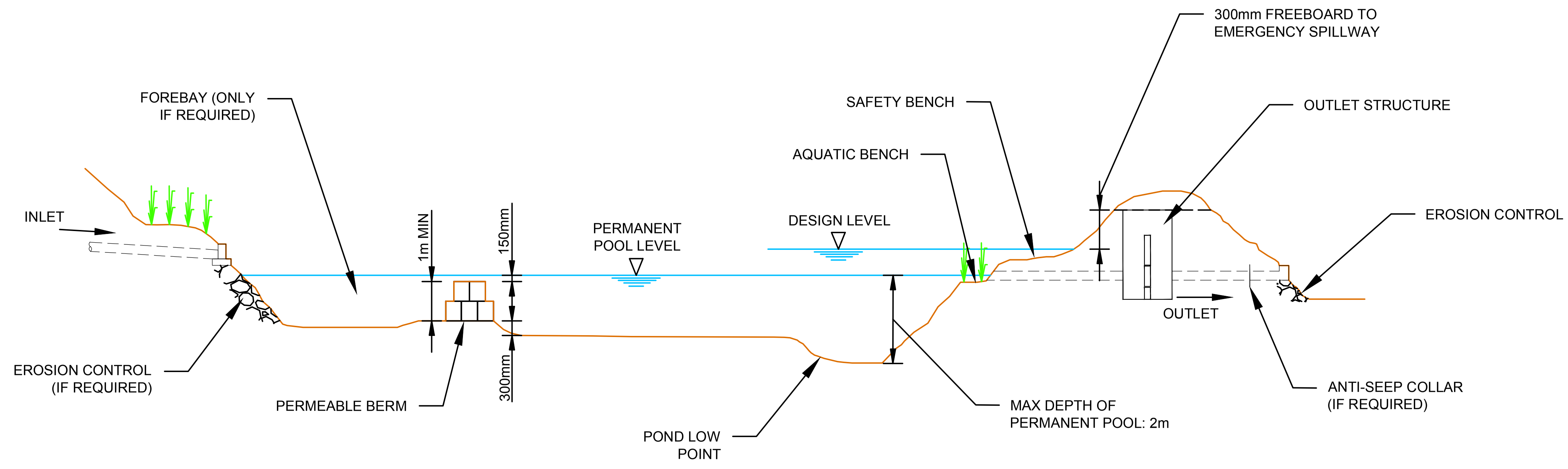


PLAN VIEW



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 6, 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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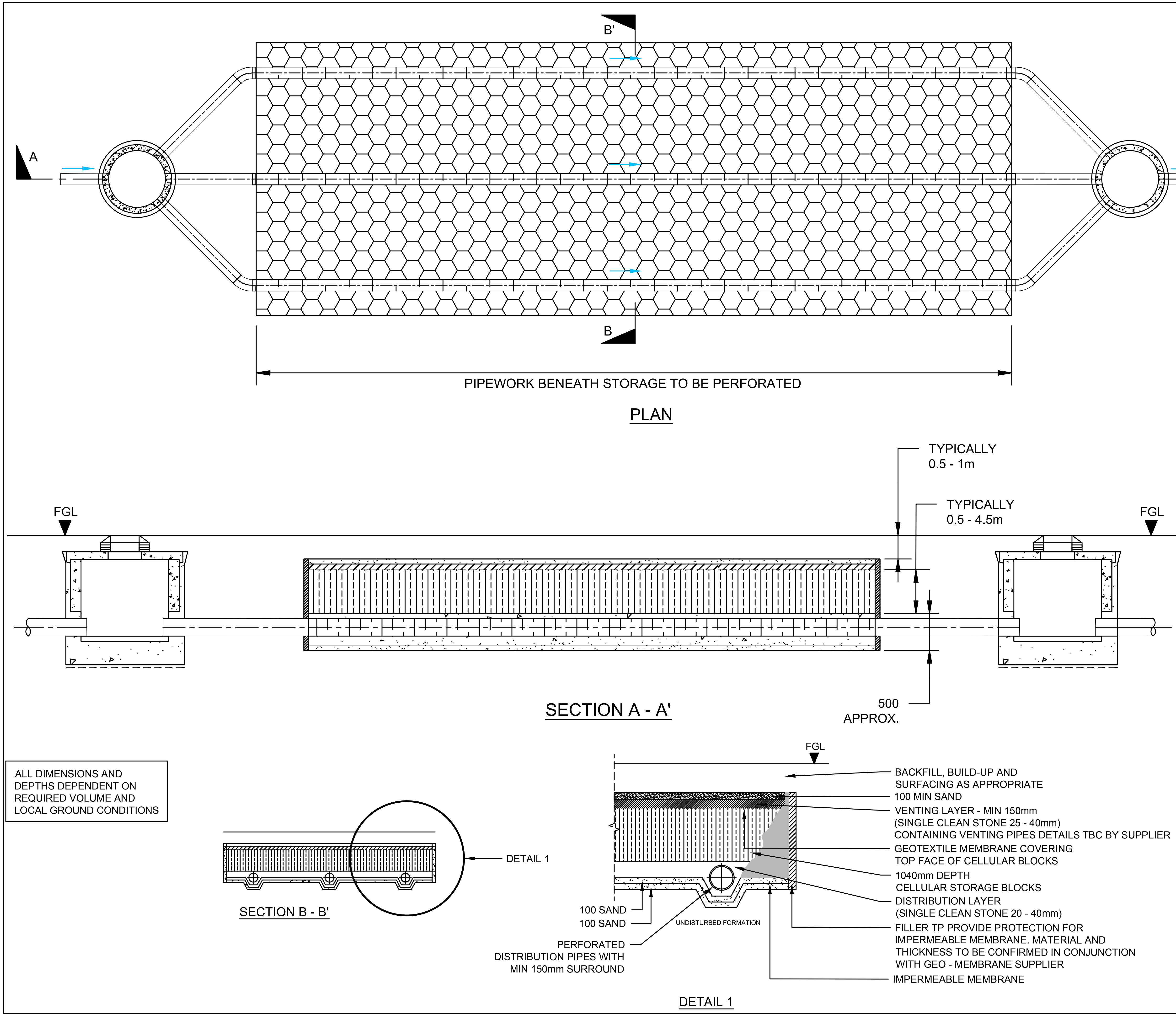

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 6, 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

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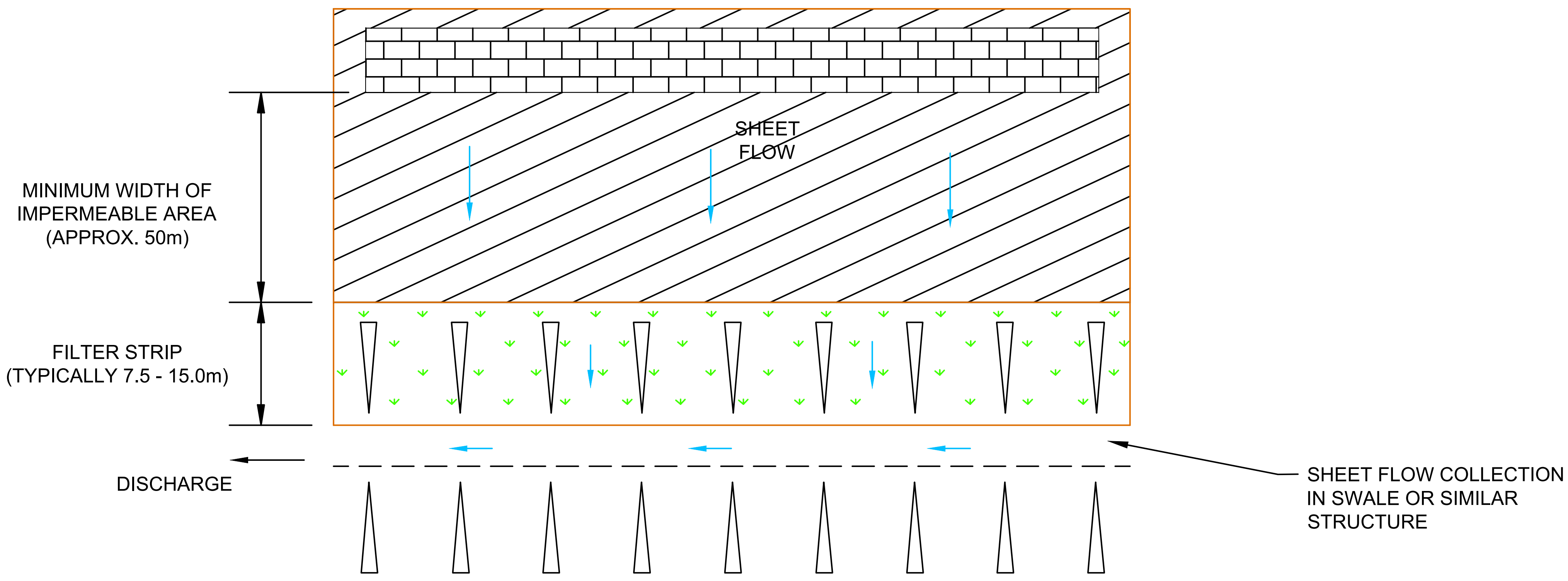
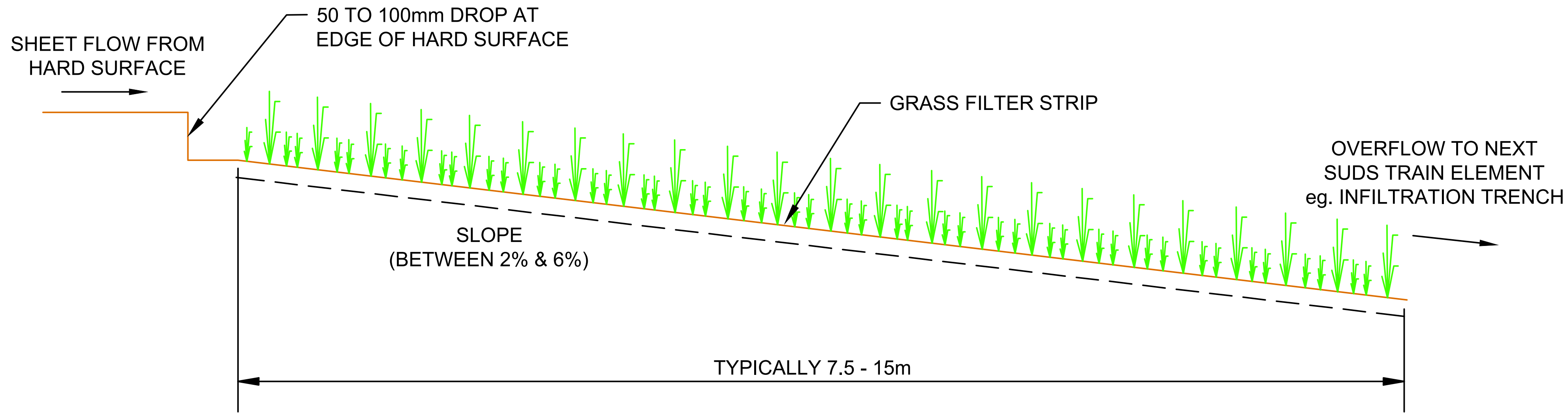


PLAN



ELEVATION

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk

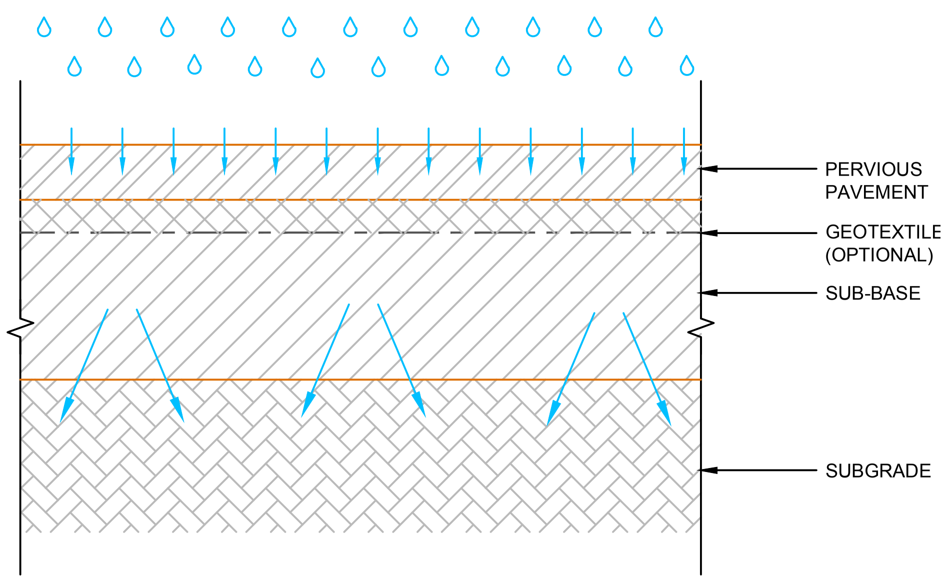
PROJECT: TYPICAL SUDS DETAIL

TITLE: FILTER STRIPS

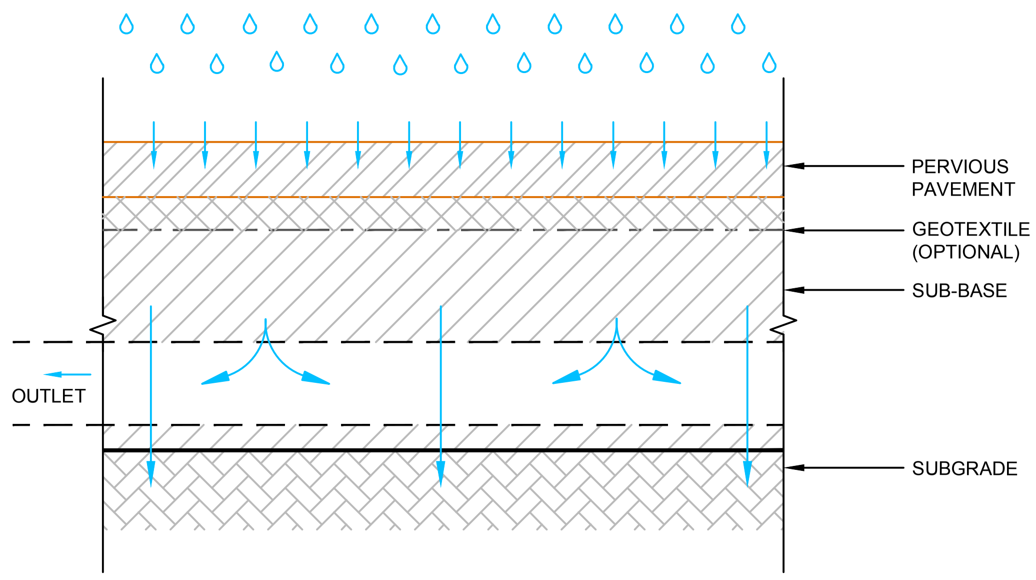
DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
SEP 2014	@ A3	CP	RDN

PROJECT No:	DRAWING No:	REV:
BETTS	107	A

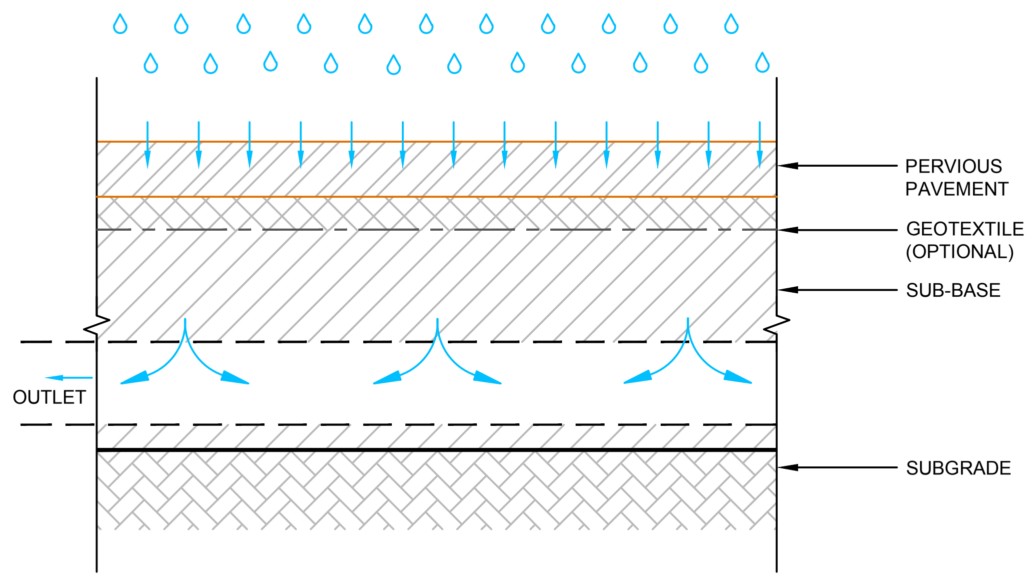
DO NOT SCALE



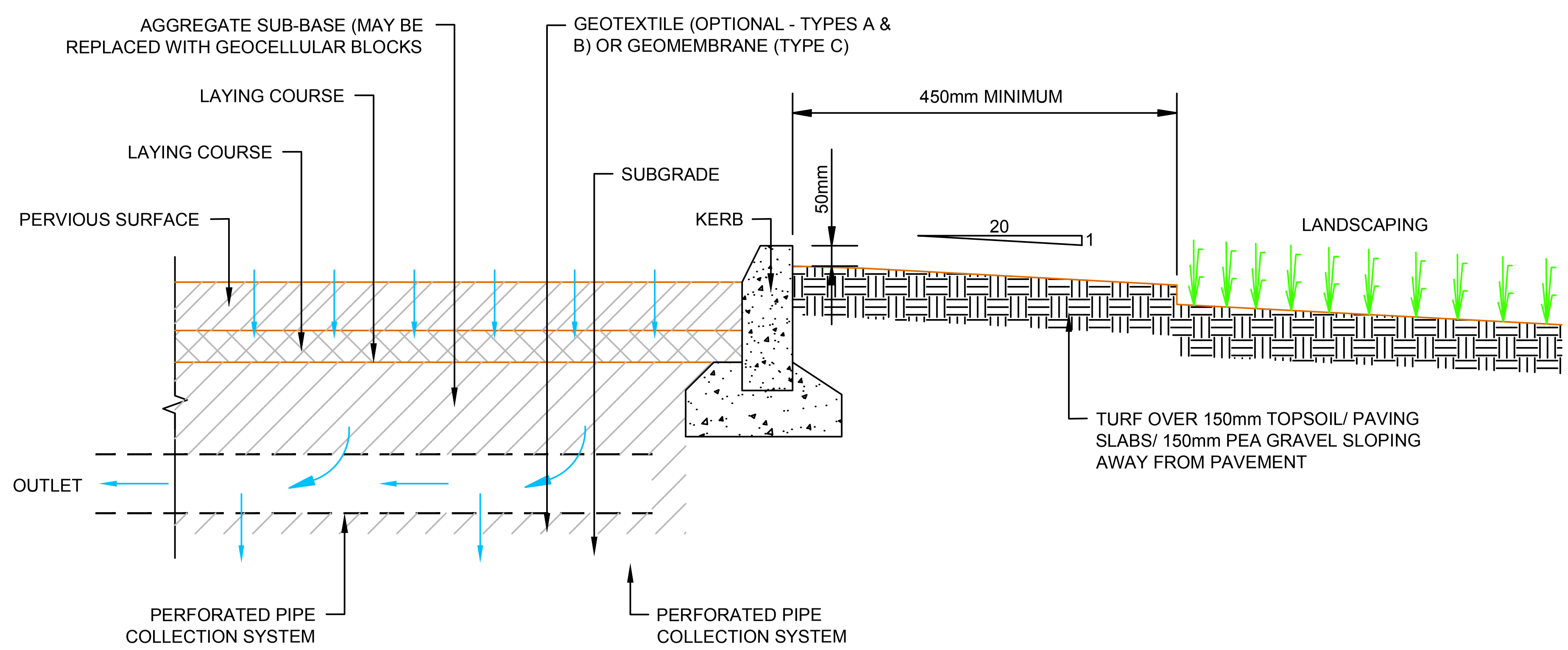
TYPE A: TOTAL INFILTRATIPN



TYPE B: PARTIAL INFILTRATION



TYPE C: NO INFILTRATION



LANDSCAPING DETAIL

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DRAWING STATUS: PRELIMINARY

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CIVIL AND STRUCTURAL ENGINEERS
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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

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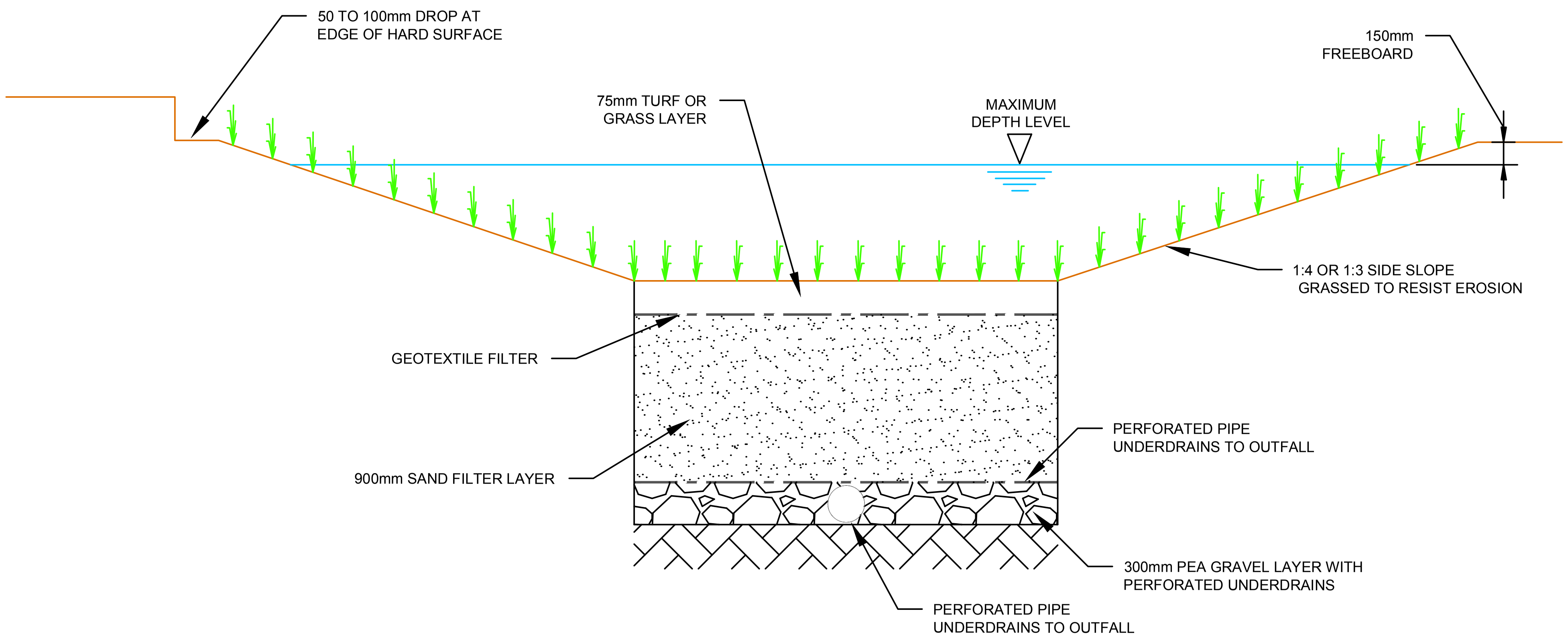

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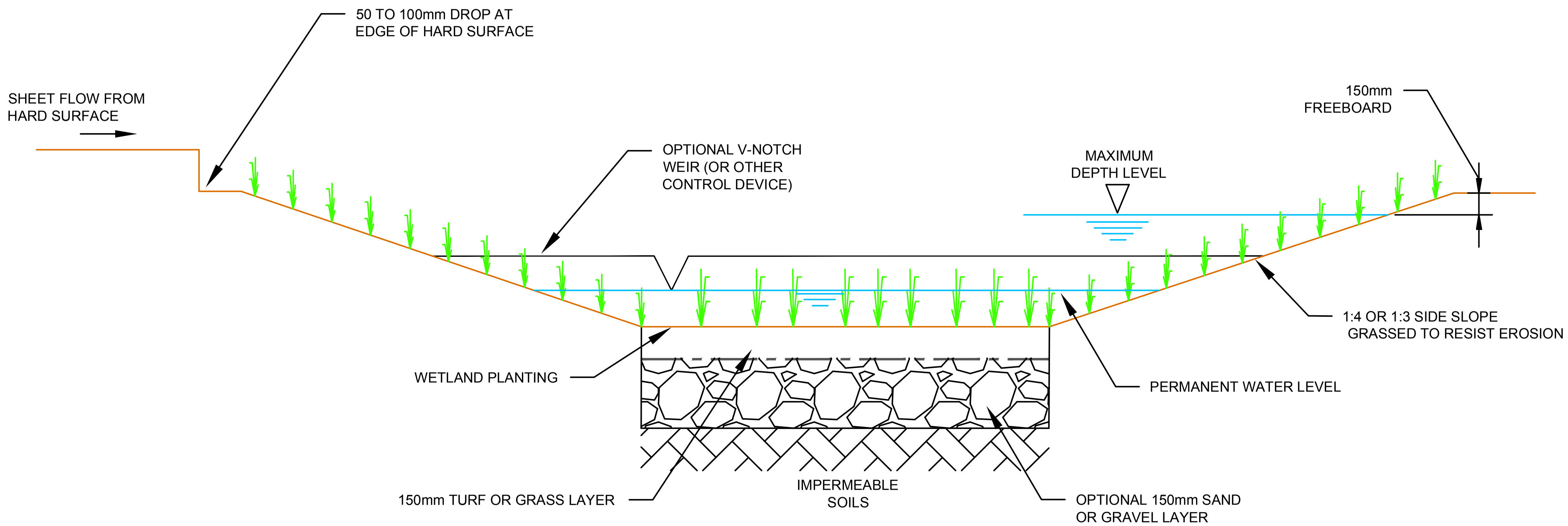

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PROJECT: TYPICAL SUDS DETAIL

TITLE: SWALES (1 of 2)

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

PROJECT No:	DRAWING No:	REV:
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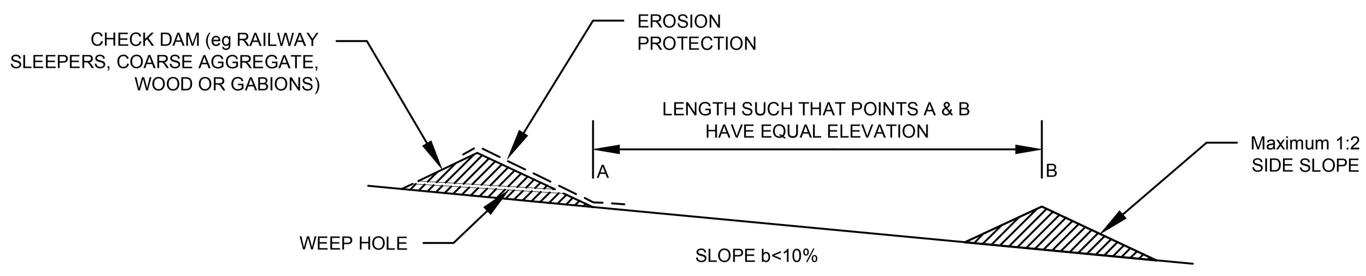

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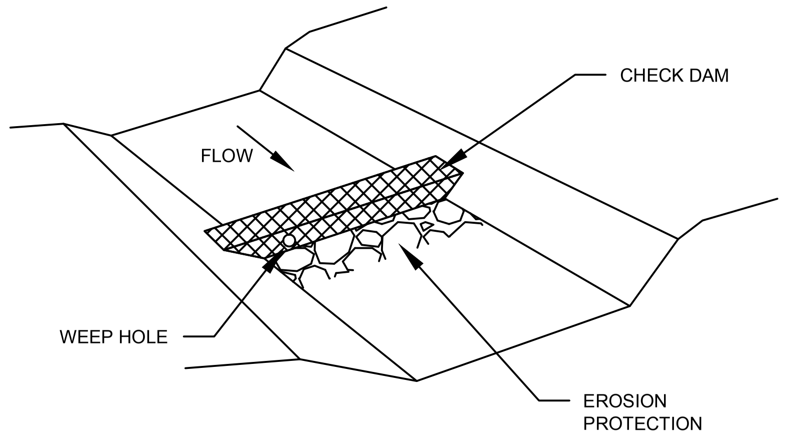

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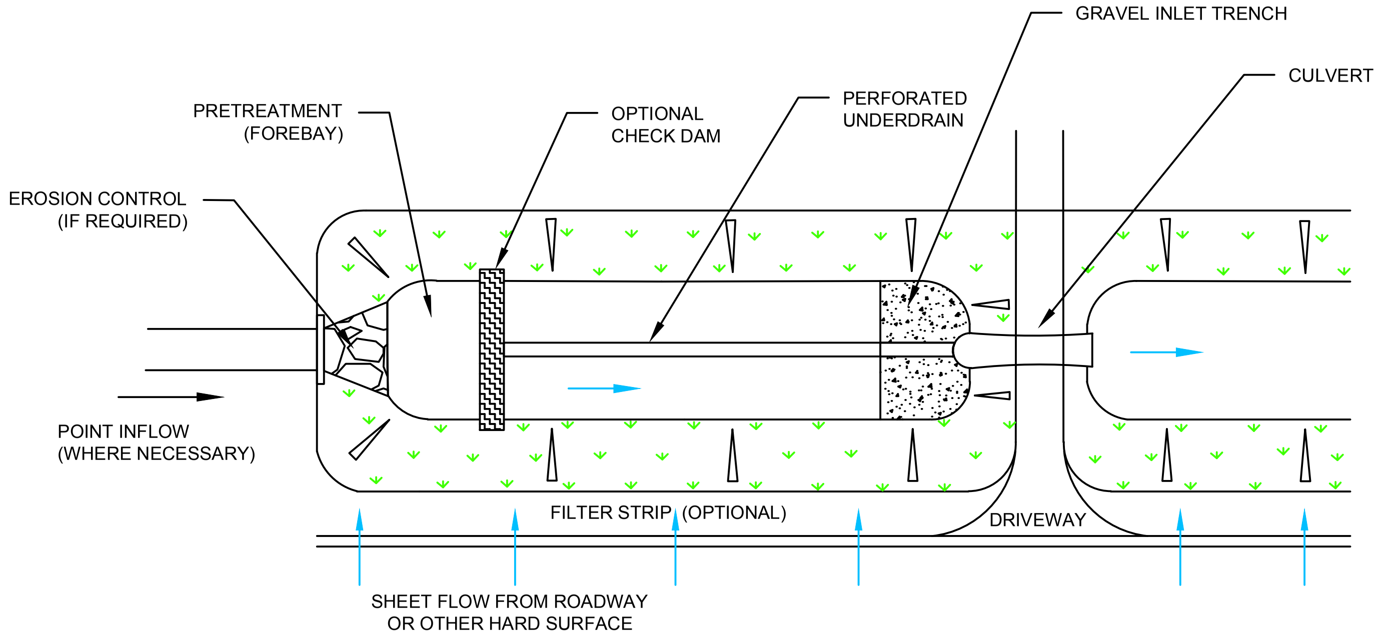

ENHANCED DRY SWALE

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

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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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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 Hydro Ltd must be sought.

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Appendix B
Hydraulic Assessment

BETTS HYDRO
CONSULTING ENGINEERS

LAND AT CHIPPING LANE, LONGRIDGE

HYDRAULIC ASSESSMENT

For
Barratt Homes Manchester
4 Brindley Road,
City Park,
Manchester,
M16 9HQ.

July 2016

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LAND AT CHIPPING LANE, LONGRIDGE

HYDRAULIC ASSESSMENT

Document Tracking Sheet

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CONTENTS

Figures & Tables

Specialist Software

- Flood Estimation Handbook FEH CD-ROM (v.3.0) – Determination of Catchment Descriptors and depths of rainfall.

- ISIS (3.7) – 2013 - 1D Hydraulic Model

Abbreviations & Acronyms

AEP	Annual Exceedance Probability	mAOD	Metres Above Ordnance Datum
BGL	Below Ground Level	NGR	National Grid Reference
CC	Climate Change	NPPF	National Planning Policy Framework
EA	Environment Agency	OS	Ordnance Survey
FEH	Flood Estimation Handbook	PFRA	Preliminary Flood Risk Assessment
FRA	Flood Risk Assessment	PPS	Planning Policy Statement
FZ	Flood Zone	SFRA	Strategic Flood Risk Assessment
Ha	Hectare	LCC	Lancashire County Council
LLFA	Lead Local Flood Authority	TWL	Top Water Level
LPA	Local Planning Authority	UU	United Utilities

1.0 EXISTING SITE SITUATION

1.1 The proposed development site is located on land at Chipping Lane, Longridge and is directly accessed off Chipping Lane. The Ordnance Survey National Grid Reference (OS NGR) for the site is Eastings 360073, Northings 437980 and the nearest postcode is PR3 2NA.

1.2 The proposed development area is edged in red Figure 1 (below). A location plan is included Appendix A.

Figure 1: Aerial Photograph of site (proposed development area edged in red)

1.3 Two small watercourses enter the site from the south east and south west and flow in a north westerly direction, leaving the site via 600mm diameter culvert outfall by Chipping Lane north of the site.

1.4 The Environment Agency flood zone maps indicated that the site is entirely within Flood Zone 1, implying that the site is at low risk of fluvial flooding.

1.6 From a flood risk perspective it was considered prudent to undertake a hydraulic assessment of the watercourse to assess the peak water levels in the watercourse in both the existing and the post development scenarios.

2.0 DEVELOPMENT PROPOSALS

2.1 The initial proposals are a residential development within the red edge boundary indicated in Figure 2 and in Appendix B.

Figure 2: Indicative Planning Proposals

3.0 CATCHMENT DESCRIPTORS

3.1 The Flood Estimation Handbook (FEH) CD-ROM provided catchment descriptors for Higgin Brook upstream of a point north of the development site. Three smaller sub-catchments (Sub A, Sub B and Sub C) upstream of the 600mm culvert were identified using LiDAR data.

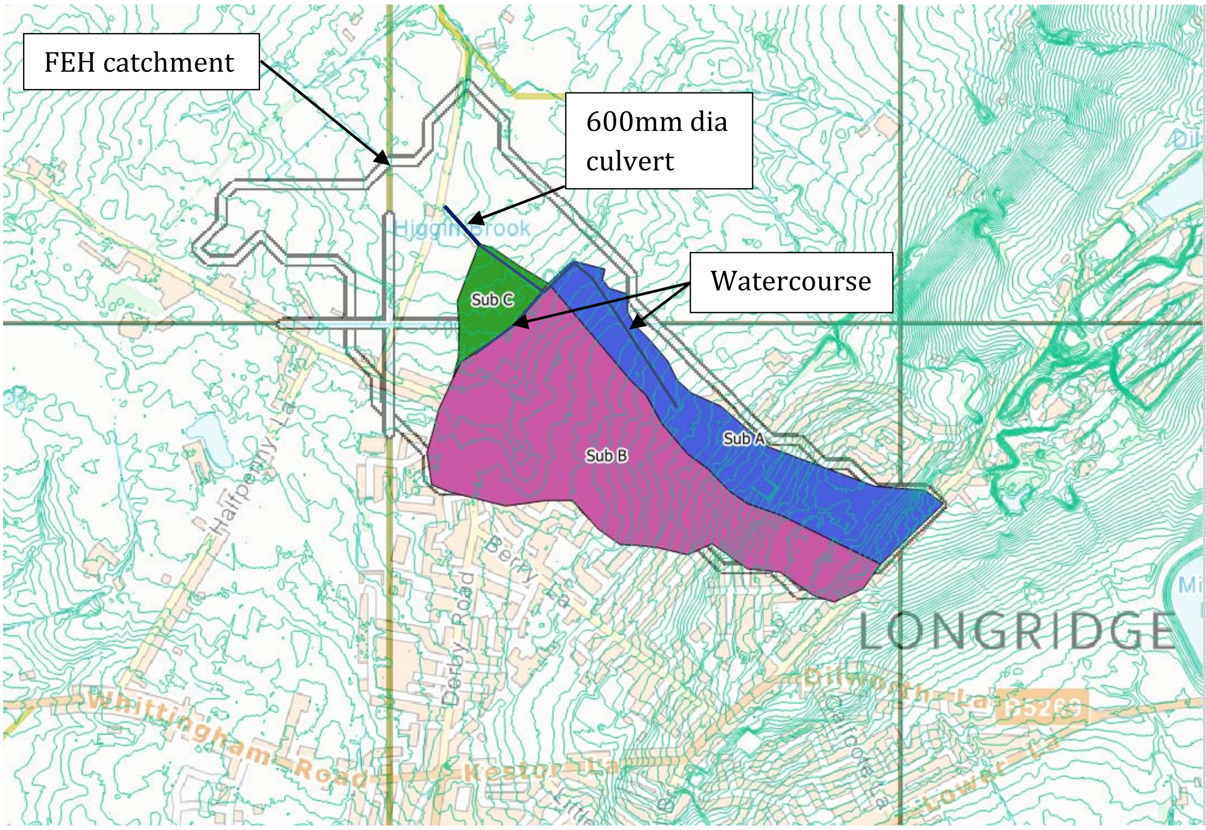

Figure 3: Upstream Sub-catchments

3.2 The FEH Catchment descriptors are summarised below and included in full in Appendix C.

Important Catchment Descriptors: All sub-catchments

DPSBAR (m/km)	22.3	Mean slope between nodes (m/km)
SAAR (mm)	1200	Standard annual average rainfall – 1961-1990
FARL	1.00	Flood attenuation due to reservoirs/lakes (no attenuation)
BFIHOST	0.417	Baseflow index from Hydrology of Soil Types
SPRHOST	35.03	Standard percentage runoff from soil types
PROPWET	0.51	Proportion of time catchment is wet
URBEXT1990	0.1643	Urban extent in 1990 (essentially rural)

3.3 The areas for the sub-catchments were calculated using GIS and mean drainage path length (DPLBAR) was calculated using formula 7.1 from the FEH Volume 5: Catchment Descriptors as follows: $DPLBAR = AREA^{0.548}$. The sub-catchment areas and DPLBAR values are shown in Table 1.

Sub-catchment	Area (km^2)	DPLBAR (km)
Sub A	0.093	0.272
Sub B	0.200	0.414
Sub C	0.022	0.123

Table 1: Sub-catchment specific characteristics

4.0 HYDROLOGY

4.1 The Revitalised Flood Hydrograph (ReFH) method was applied for each sub-catchment based on catchment descriptors. The $URBEXT_{1990}$ <0.5 and BFIHOST<0.65 for all sub-catchments, therefore the use of the ReFH method is appropriate.

4.2 This study has considered the 1 in 5 year (20% AEP), 1 in 30 year (3.3% AEP), 1 in 100 year (1% AEP) and the 1 in 100 year (1% AEP) plus climate change (CC) return period flows in the watercourses.

4.3 These are considered to represent conservative flow estimates (i.e. adopts the precautionary approach). The site is considered to be predominantly greenfield and the catchment characteristics from the FEH CD-ROM were utilised. The peak flow estimates are shown in Table 2 below. Full details are shown in Appendix D.

Sub-Catchment	20% AEP	3.3% AEP	1% AEP	1% AEP + CC
Sub A	0.11	0.18	0.24	0.29
Sub B	0.20	0.32	0.45	0.54
Sub C	0.03	0.06	0.08	0.10

Table 2: ReFH Peak Flow Estimates

4.4 The critical storm duration for the largest sub-catchment (Sub B) was 1.065 hours. It was assumed that the same storm would occur in all sub-catchments, as they are adjacent to one another.

4.5 The full hydrographs for all sub-catchments in all return periods are shown in Figures D.1 to D.10 in Appendix D.

5.0 HYDRAULIC MODELLING

Model Details

5.1 An unsteady state 1D model of the watercourse was developed using ISIS for the existing and the proposed development scenarios.

5.2 A topographical survey of the site and watercourse was undertaken and a 3D ground model was generated. Cross sections through the watercourse were generated from the ground model at locations shown in the model schematics shown in Figure 4. The cross sections (Figures E.1 to E.30) and watercourse profile (Figure E.15) are included in Appendix E.

5.3 The watercourse was modelled in the existing scenario for the 20%, 3.3%, 1% and 1% plus climate change AEP events.

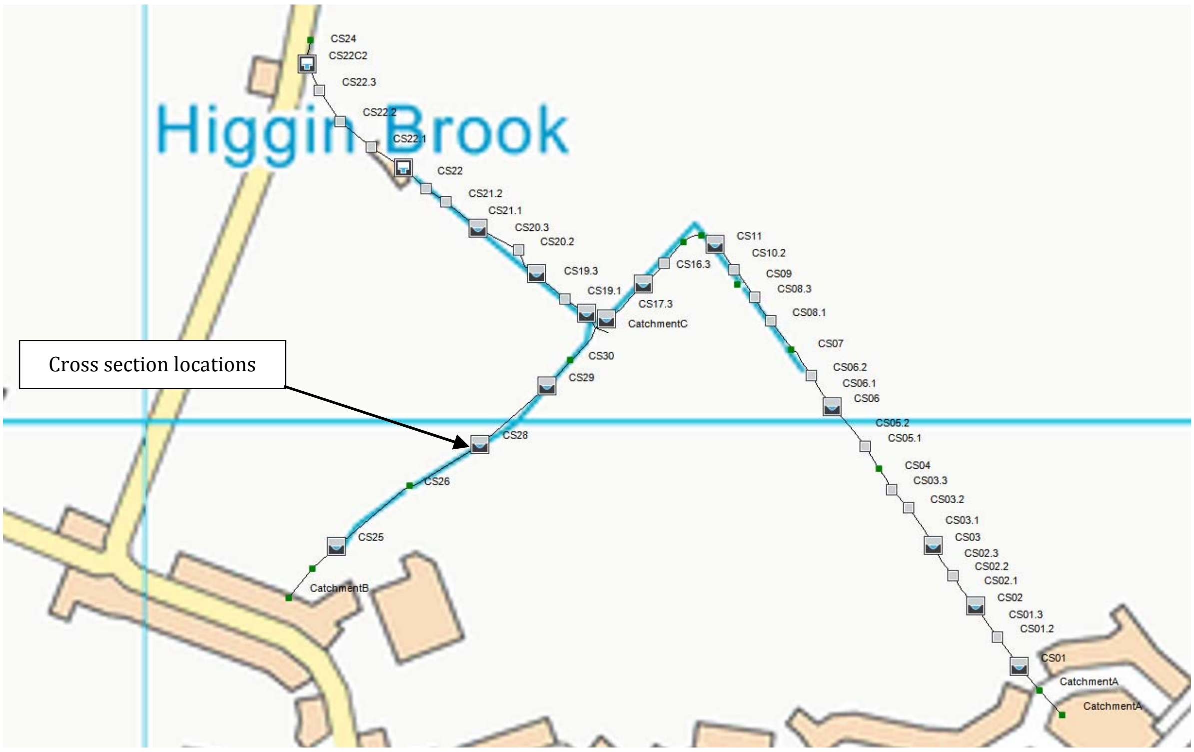

Figure 4: ISIS Model Schematic

5.4 Roughness coefficient allocation was based on aerial imagery. The watercourse channel is straight with some vegetation and as such the channel was assigned a roughness Manning's n value of 0.04 (refer to photographs in Appendix H).

5.5 There are seven structures within the modelled reach of the watercourse:

- 4 no. 300mm diameter pipes;
- 1 no. 525mm diameter pipe;
- 1 no. 575mm diameter pipe;

- 1 no. 600mm diameter pipe.

5.6 Overtopping of the bridges has been modelled in 1-D using a spill unit.

Model Assumptions

5.7 The cross sections were generated from a 3D ground model and so the profile of the channel may not be as true as if cross sections had been specifically surveyed. In some cases, the top water level on the date of the survey may have been used as the bed level. This approach is, however, conservative.

5.8 The diameters of pipes at cross sections 4, 9 and 15 have been assumed to be 300mm due to surveyed information not being available.

Model Results

Existing Scenario

5.7 The hydraulic modelling results including longitudinal profile and cross sections (including peak water levels) are included in Appendix E. Peak water levels for the 20%, 3.3%, 1% AEP and 1% AEP plus climate change events for the existing scenario are shown in Table 3.

5.8 The results show that water levels remain in bank for most of the reach in all AEPs. The peak water level is out of bank at the inlet to the 600mm diameter culvert.

Proposed Scenario

5.9 A 600mm diameter pipe, approximately 26m long, was inserted upstream of cross section number 26 to simulate a proposed crossing. The location of the new crossing is shown in Figure 5.

5.10 The hydraulic modelling results including longitudinal profiles and cross sections (including peak water levels) are included in Appendix F. Peak water levels for the 20%, 3.3%, 1% AEP and 1% AEP plus climate change events for the existing scenario are shown in Table 4.

5.11 Comparison of the existing and post development levels in the 1% AEP plus climate change event shows that peak levels remain largely unchanged, although with some small increases in places. The largest increase is of 27mm at cross section 26/26A, upstream of the proposed new culvert. There is also an increase of 25mm at cross section 25. These increases are relatively small and do not increase flood risk or the likelihood of surcharging of surface water outfalls.

Sensitivity Testing

5.12 Sensitivity testing was carried out on certain key model parameters to determine the effects on the simulated flows and water levels due to controlled changes in accordance with best practice.

5.15 The flow rate was increased by 20% and Manning's n values (channel roughness) were increased and decreased by 20%. These were all undertaken on the 1% AEP flow event (refer to Appendix G for the full sensitivity analysis results).

5.16 The increase in Manning's roughness coefficient, n, resulted in a mean increase in level of 0.022m and a maximum increase of 0.043m, occurring at cross section CS32 at the confluence of sub-catchments A and B. Reducing roughness coefficient by 20% had the effect of maximum decrease in water level of 0.057m. The mean effect was to reduce peak water levels by 0.021m.

5.17 Increasing flow by 20% resulted in a mean increase in peak water level of 0.073m and a maximum of 0.323m occurring at cross section CS07.

5.19 The sensitivity analysis has shown that water levels are not particularly sensitive to changes in channel roughness, with all mean and maximum changes within +/- 0.057m. When the 1% flow was increased by 20%, there were some isolated relatively large increases in water level, the maximum being 0.323m. The mean change was 0.073m and the change throughout most of the modelled reach was less than 0.100m.

5.20 The sensitivity due to these parameters should be taken into account when setting design levels.

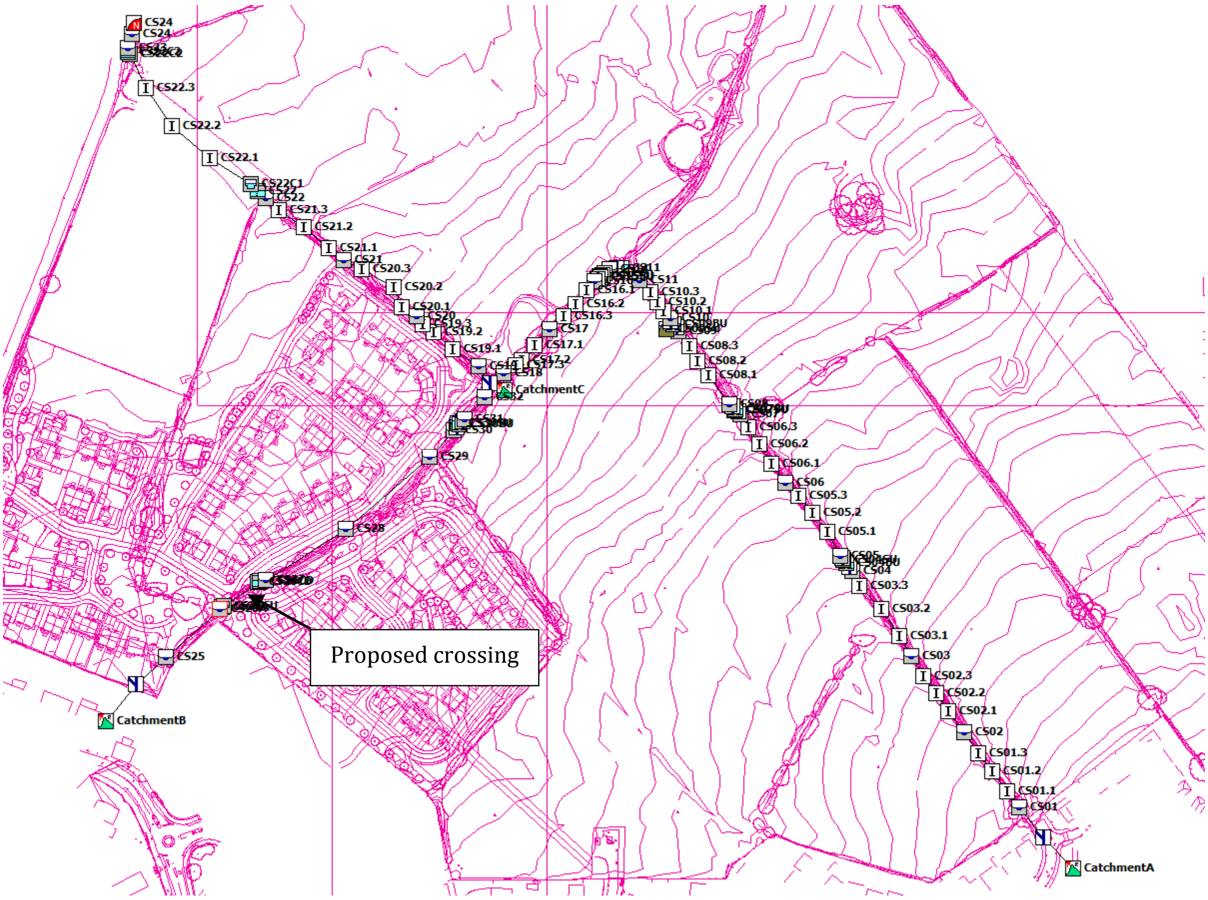

Figure 5: Proposed ISIS model schematic with new crossing

Cross Section	20% AEP (mAOD)	3.3% AEP (mAOD)	1% AEP level (mAOD)	0.1% AEP level (mAOD)
CS01	115.96	116.02	116.06	116.10
CS02	114.79	114.85	114.89	114.92
CS03	113.39	113.45	113.51	113.53
CS04	112.38	112.66	112.88	112.92
CS05	111.36	111.40	111.44	111.47
CS06	109.89	109.92	109.97	110.00
CS07	108.37	108.65	109.08	109.40
CS08	107.86	107.91	107.95	107.97
CS09	107.26	107.51	107.59	107.62
CS10	106.88	106.92	106.97	106.99
CS11	106.39	106.44	106.49	106.51
CS14	105.60	105.85	106.15	106.23
CS15	105.58	105.84	106.15	106.23
CS16	105.14	105.19	105.22	105.25
CS17	103.91	103.92	103.94	103.95
CS18	103.40	103.45	103.50	103.52
CS19	103.40	103.45	103.50	103.52
CS20	102.81	102.88	102.93	103.14
CS21	102.52	102.63	102.84	103.14
CS22	102.40	102.58	102.83	103.14
CS23	101.30	101.39	101.44	101.45
CS24	101.22	101.31	101.35	101.36
CS25	105.85	105.93	106.03	106.13
CS26	105.61	105.76	105.91	106.06
CS27	105.09	105.19	105.27	105.31
CS28	104.81	104.85	104.89	104.92
CS29	104.14	104.23	104.34	104.40
CS30	103.99	104.14	104.27	104.35
CS31	103.63	103.72	103.81	103.85
CS32	103.40	103.45	103.50	103.52

Table 3: Peak 20%, 3.3%, 1% and 0.1% AEP existing water levels

Cross Section	20% AEP (mAOD)	3.3% AEP (mAOD)	1% AEP level (mAOD)	0.1% AEP level (mAOD)
CS01	115.96	116.02	116.06	116.10
CS02	114.79	114.85	114.89	114.92
CS03	113.39	113.45	113.51	113.53
CS04	112.38	112.66	112.88	112.92
CS05	111.35	111.40	111.45	111.47
CS06	109.89	109.92	109.97	110.00
CS07	108.37	108.65	109.08	109.40
CS08	107.86	107.91	107.95	107.97
CS09	107.26	107.50	107.59	107.62
CS10	106.88	106.92	106.97	106.99
CS11	106.39	106.44	106.49	106.51
CS14	105.60	105.85	106.15	106.23
CS15	105.58	105.84	106.15	106.23
CS16	105.14	105.19	105.22	105.25
CS17	103.91	103.92	103.94	103.95
CS18	103.40	103.45	103.50	103.53
CS19	103.40	103.45	103.50	103.53
CS20	102.81	102.88	102.93	103.15
CS21	102.52	102.63	102.84	103.14
CS22	102.41	102.58	102.83	103.14
CS23	101.30	101.39	101.44	101.45
CS24	101.22	101.31	101.35	101.36
CS25	105.86	105.95	106.06	106.15
CS26A	105.67	105.81	105.97	106.09
CS27	105.09	105.19	105.28	105.31
CS28	104.81	104.85	104.89	104.92
CS29	104.14	104.24	104.34	104.41
CS30	103.99	104.14	104.28	104.36
CS31	103.63	103.72	103.81	103.86
CS32	103.40	103.45	103.50	103.53

Table 4: Peak 20%, 3.3%, 1% and 0.1% AEP proposed water levels

6.0 LOW FLOW ANALYSIS

6.1 In order to determine a typical water level above which to set the levels of the surface water outfalls, a low flow analysis was undertaken in accordance with the Institute of Hydrology Report number 108 (IH 108). The analysis included the soil HOST classification, the UK Hydrometric Register and the Flood Estimation Handbook (FEH) CD-ROM.

6.2 An extract from the soil HOST maps is shown in Figure 6, indicating that the soil classification for the catchment is 711m.

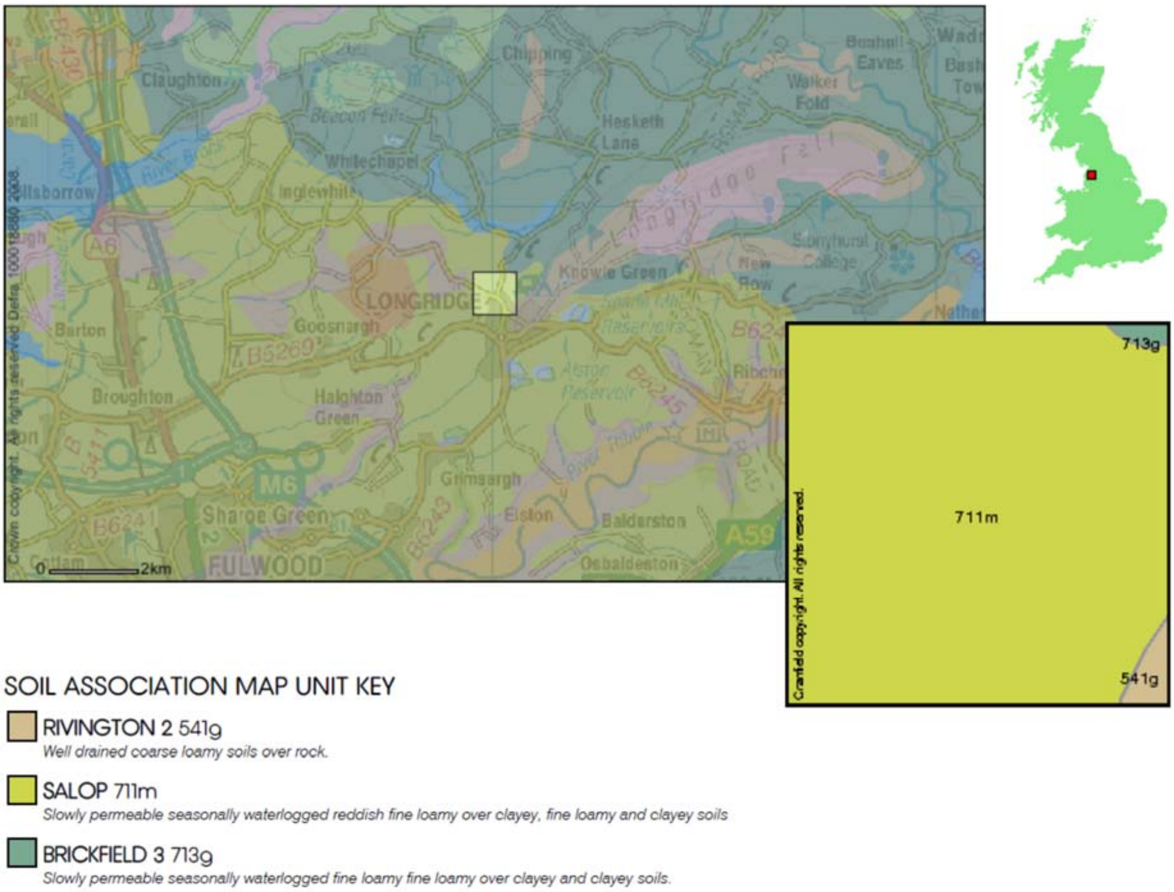

Figure 6: Soil HOST map classification

6.3 The FEH CD-ROM gives the Catchment Area = 0.52km² and standard average annual rainfall, SAAR = 1200mm. The FEH catchment is shown in Figure 7.

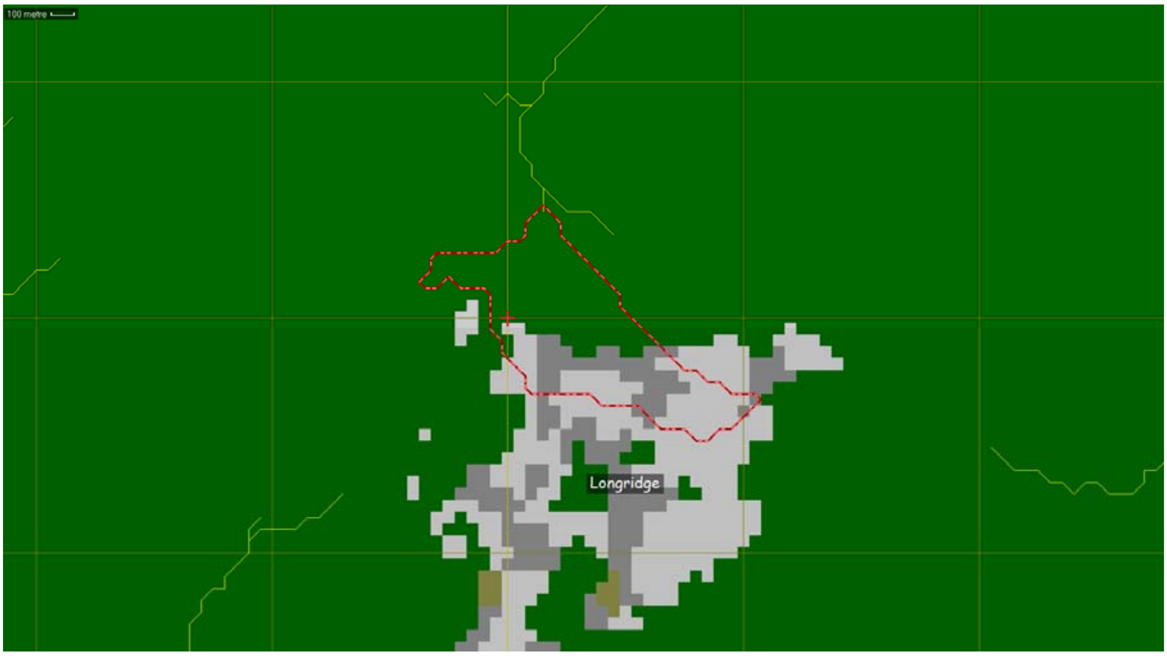

Figure 7: FEH CD-ROM catchment

6.4 From UK Hydrometric Register River Hodder @ Hodder Place (Station Number 71008):

Potential evaporation, PE = 600mm

6.5 From Institute of Hydrology (IH) report 108, section 7.3.2:

Annual Average Runoff Depth (AARD) = SAAR – Losses
Losses = r x PE where r=1 for SAAR>= 850mm

AARD = 1200 – 600
AARD = 600mm

Convert AARD to Mean Flow (MF)

MF = AARD x AREA x (3.17×10^{-5})
MF = 600 x 0.52 x 3.17×10^{-5}
MF = 0.0099 m^3/s

6.6 From IH 108 Appendix 4

Soil type 711m gives the 95 percentile 1-day flow, Q95(1), of 10.7% of mean flow, therefore

Q95(1) = MF x 10.7/100
Q95(1) = 0.0011 m^3/s

6.7 From IH 108 Table 7.1:

Curve 10: Q95(1) percentage of 10.0% is closest to Q95(1) of 10.7% given by soil

Percentile	% Mean Flow	Flow (m^3/s)
2	428.96	0.0425
5	303.93	0.0301
50	52.46	0.0052
80	21.25	0.0021
90	13.75	0.0014
95	10.00	0.0010
99	5.89	0.0006

Table 5: Flow duration

6.8 Flow duration curve is shown in Figure 8.

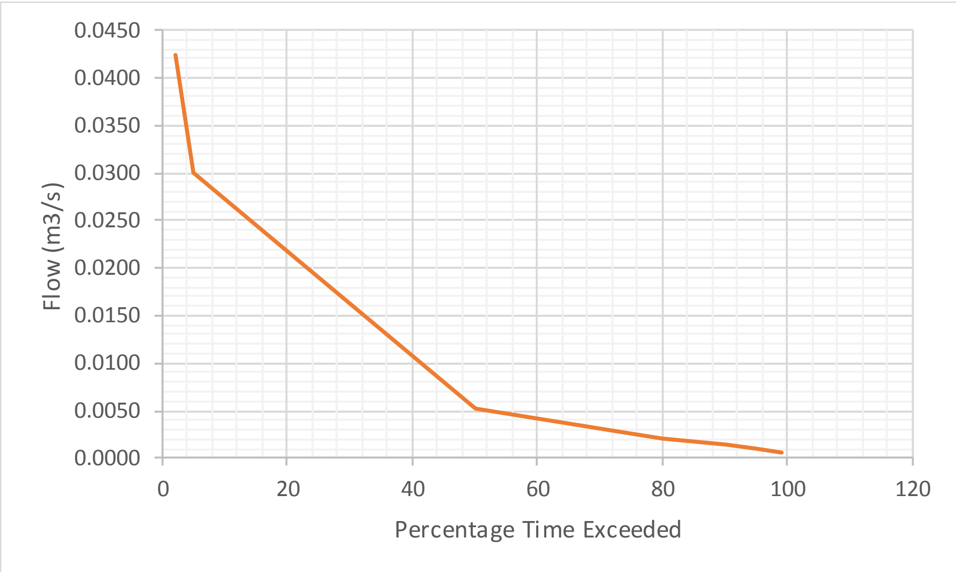

Figure 8: Flow Duration Curve

6.9 The Q95(1) flow of 0.001 m^3/s is too low to be run in the hydraulic model, and so a Manning's equation calculation has been undertaken on a typical cross section to determine the typical water level. The typical cross section is shown in Figure 9.

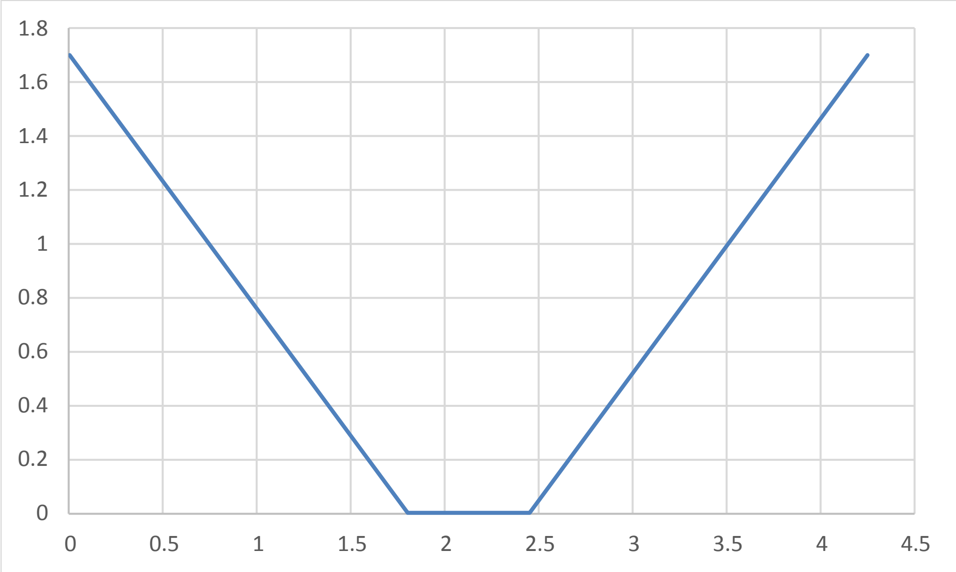

Figure 9: Typical cross section

6.10 Manning's equation is as follows:

$$Q = \frac{AR^{2/3}\sqrt{S}}{n}$$

where Q is flow, A is area of flow, R is hydraulic radius and S is gradient.

6.11 Using the average gradient of 0.025 and a Manning's roughness coefficient of 0.06, Manning's equation yields:

$$A = \frac{Qn}{R^{2/3}\sqrt{S}}$$

$$A = \frac{0.01 \times 0.06}{0.011^{2/3}\sqrt{0.025}}$$

$$A = 0.008\ m^3$$

6.12 The flow area of $0.008m^3$ corresponds to a depth in the typical channel cross section of 0.012m. It is therefore recommended that the invert levels of surface water outfalls be set at 300mm above this level.

7.0 CONCLUSIONS

6.1 The hydraulic assessment has indicated that peak water levels in the watercourses remain largely within banks for events up to the 1% AEP plus climate change.

6.2 A thorough sensitivity analysis of key parameters has been undertaken and has shown that the model results are not significantly affected by changes in those parameters.

6.3 A low flow analysis was undertaken to determine the Q95(1) flow. The Q95(1) flow was calculated to be $0.001m^3/s$.

6.4 A Manning's equation calculation provided a typical depth in the channel of 0.012m. It is recommended that the invert levels of the surface water outfalls be set at 300mm above the Q95(1) water level.

BIBLIOGRAPHY & REFERENCES

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Planning Practice Guidance, CLG (2014)
Institute of Hydrology Report No. 108 (1992)

Web-based References

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British Geological Survey – http://www.bgs.ac.uk/opengeoscience/home.html
Chronology of British Hydrological Events – www.dundee.ac.uk/
CIRIA – http://www.ciria.org/
Cranfield University – http://www.landis.org.uk/soilscapes/
Environment Agency – www.environment-agency.gov.uk/
FloodProBE – http://www.floodprobe.eu/
Flood Forum – http://www.floodforum.org.uk/
Flood London – http://www.floodlondon.com/
Flood Resilience Group – http://www.floodresiliencegroup.org/frg/
Fylde Borough Council– http://www.fylde.gov.uk/
Google Maps – http://maps.google.co.uk/
Lancashire County Council- http://www.lancashire.gov.uk/home/2010/classic/index.asp
Streetmap – http://www.streetmap.co.uk/
United Utilities - http://www.unitedutilities.com/default.aspx

APPENDIX A: LOCATION PLAN

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OS X (Eastings) 360073
OS Y (Northings) 437980
Nearest Post Code PR3 2NA
Lat (WGS84) N53:50:12 (53.836529)
Long (WGS84) W2:36:30 (-2.608205)
Lat,Long 53.836529,-2.608205
Nat Grid SD600379 / SD6007337980

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APPENDIX B: INDICATIVE PLANNING LAYOUT

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WARNING TO HOUSE PURCHASERS
Property Misdescriptions Act 1991

Buyers are warned that this is a working drawing and is not intended to be treated as descriptive material describing, in relation to any particular property or development, any of the specified matters prescribed by any Order made under the above act. The contents of this drawing may be subject to change at any time, and alterations and variations can occur during the progress of the works without revisions of the drawing. Consequently the layout, form, content and dimensions of the finished construction may differ materially from those shown. Nor do the contents of this drawing constitute a contract, part of any contract, or warranty.

SCHEDULE OF ACCOMMODATION

Abb	House Type	Range	Description	Sqft	No	Total Sqft	Percentage
AFFORDABLE TYPES							
ASH	Ashford	CLASSIC	2 bedroom traditional house	634	15	9510	13
BAM	Bampton	CLASSIC	3 bedroom traditional house	737	12	8844	10
BEA	Beadle	CLASSIC	2 Bedroom LTH bungalow	594	5	2970	4
FOX	Foxton	CLASSIC	1 bedroom elderly apartment	653	2	1306	2
FOX	Foxton 1st	CLASSIC	1 bedroom elderly apartment	665	2	1330	2
AFFORDABLE TOTAL					**36**	**23960**	**31**
PRIVATE SALE TYPES							
FOX	Foxton	CLASSIC	1 bedroom elderly apartment	653	2	1306	2
FOX	Foxton 1st	CLASSIC	1 bedroom elderly apartment	665	2	1330	2
BEA	Beadle	CLASSIC	2 Bedroom LTH bungalow	594	5	2970	4
ASH	Ashford	CLASSIC	2 bedroom traditional house	634	3	1902	3
BAR	Barwick	CLASSIC	3 bed traditional house	831	10	8310	8
MOR	Morpeth	CLASSIC	3 bed dual aspect house	956	16	15296	14
CHE	Cheadle	CLASSIC	3 bed detached house	939	6	5634	5
DEWS	Dewsbury	CLASSIC	3 bedroom traditional house	795	2	1590	2
HELMS	Helmsley	CLASSIC	4 bed 2.5 storey townhouse	1108	9	9972	8
SOM	Somerton	CLASSIC	4 bed detached house	1159	7	8113	6
THO	Thornbury	CLASSIC	4 bed detached house	1203	2	2406	2
KEN	Kennington	CLASSIC	4 bed detached house	1270	6	7620	5
FAR	Farringdon	CLASSIC	3 bed detached house	1082	2	2164	2
LIN	Lincoln	CLASSIC	4 bed dual aspect corner house	1243	10	12430	8
TOTAL					**82**	**81043**	**69**
GRAND TOTAL					**118**	**105003**	**100**

PHASE 1 SITE GROSS AREA: 13.22 **ACRES**
NON DEVELOPABLE AREA 7.13 **ACRES**
NET DEVELOPABLE AREA 6.09 **ACRES**
DENSITY 17242 **Sq.ft/acre**

Rev	Description	Date	Drawn	Chk'd

BARRATT
HOMES
MANCHESTER

Barratt Homes Manchester
(A division of BDW Trading Ltd)
4 Brindley Road
City Park
Manchester
M16 9HQ
Tel: 0161 872 0161
Fax: 0161 855 2828

Job
CHIPPING LANE
LONGRIDGE

Title
PHASE 1 PLANNING LAYOUT

Design By	Date	Drawing Number	Rev
AA	25/11/15	459-PL01	
Drawn By	Scale @ A1		
AA	1:500		

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APPENDIX C: FEH CATCHMENT DATA & DESCRIPTIONS

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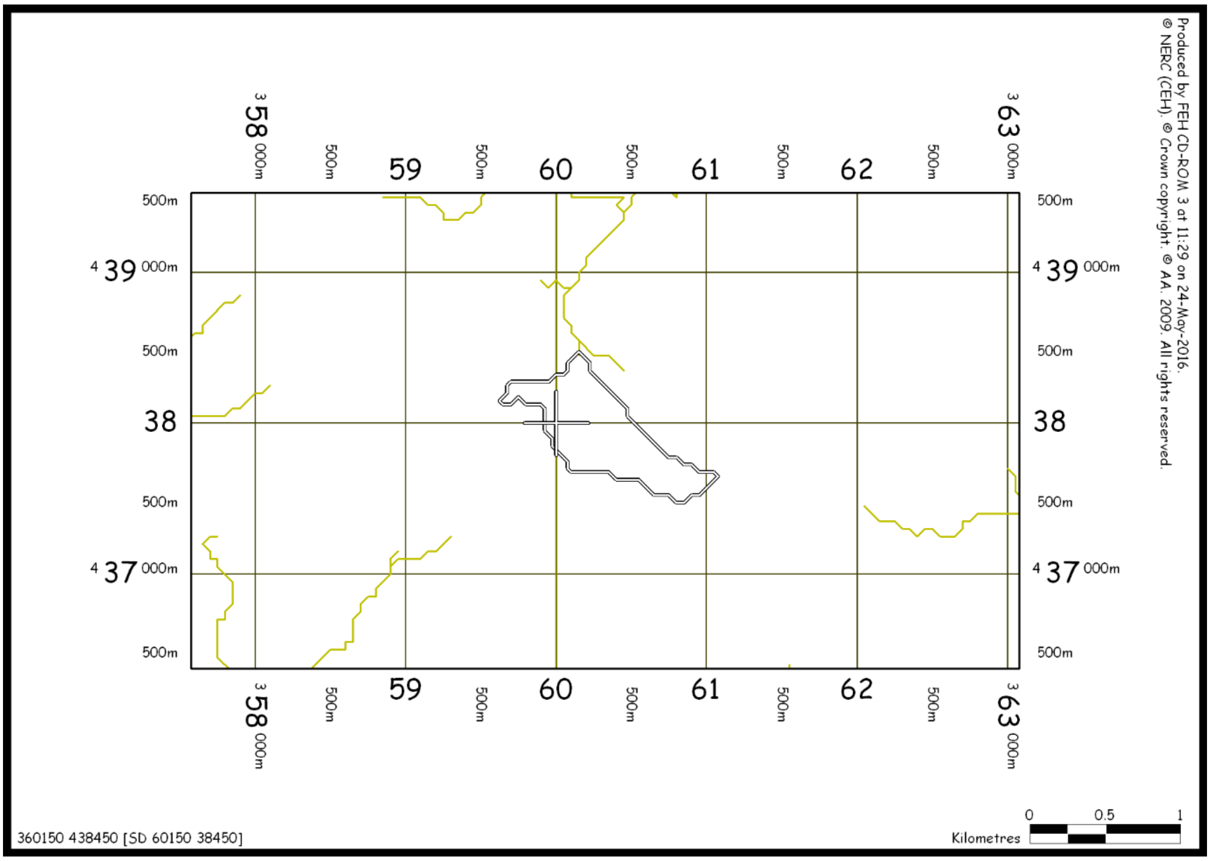
Higgin Brook catchment and catchment characteristics



AREA	0.52	URBLOC1990	1.515
ALTBAR	115	C	-0.025
ASPBAR	325	D1	0.40671
ASPVAR	0.65	D2	0.33211
BFIHOST	0.417	D3	0.41529
DPLBAR	0.77	E	0.29629
DPSBAR	22.3	F	2.45864
FARL	1	C(1 km)	-0.025
LDP	1.58	D1(1 km)	0.404
PROPWET	0.51	D2(1 km)	0.33
RMED-1H	10.5	D3(1 km)	0.417
RMED-1D	39.7	E(1 km)	0.296
RMED-2D	51.6	F(1 km)	2.453
SAAR	1200		
SAAR4170	1137		
SPRHOST	35.03		
URBCONC1990	0.964		
URBEXT1990	0.1643		

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APPENDIX D: REVITALISED FLOOD HYDROGRAPH METHOD OUTPUTS [PEAK FLOW ESTIMATES]

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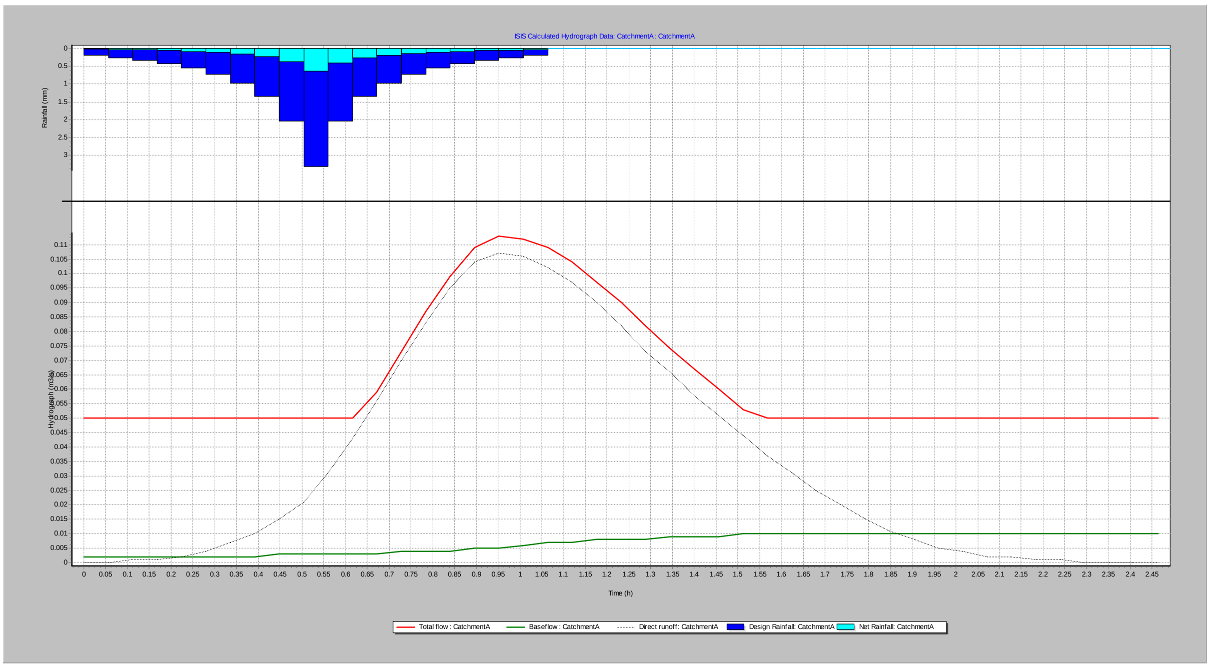

Figure D.1 Sub-catchment A 1 in 5 year (20% AEP) flow hydrograph

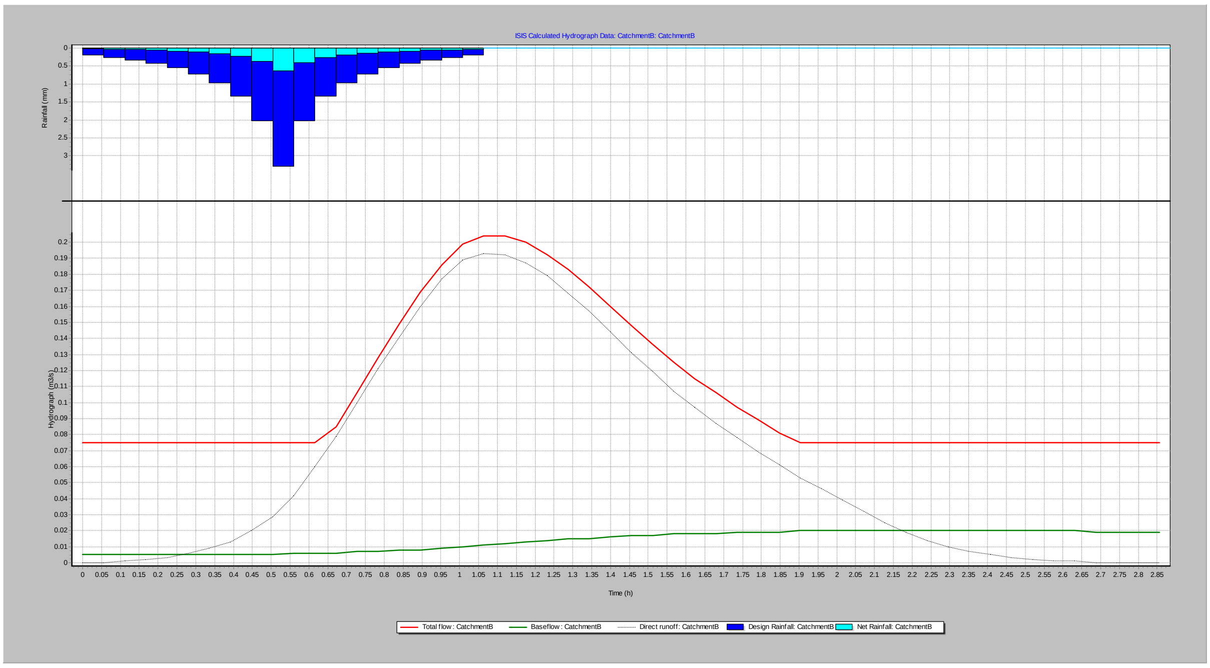

Figure D.2 Sub-catchment B 1 in 5 year (20% AEP) flow hydrograph

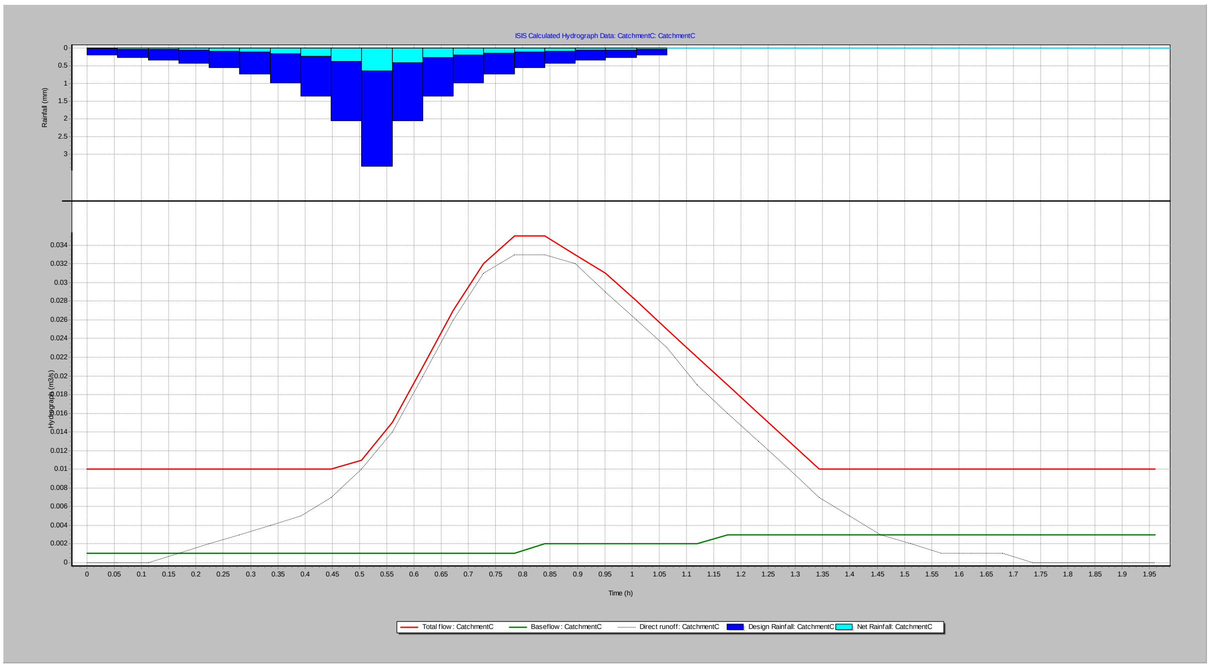

Figure D.3 Sub-catchment C 1 in 5 year (20% AEP) flow hydrograph

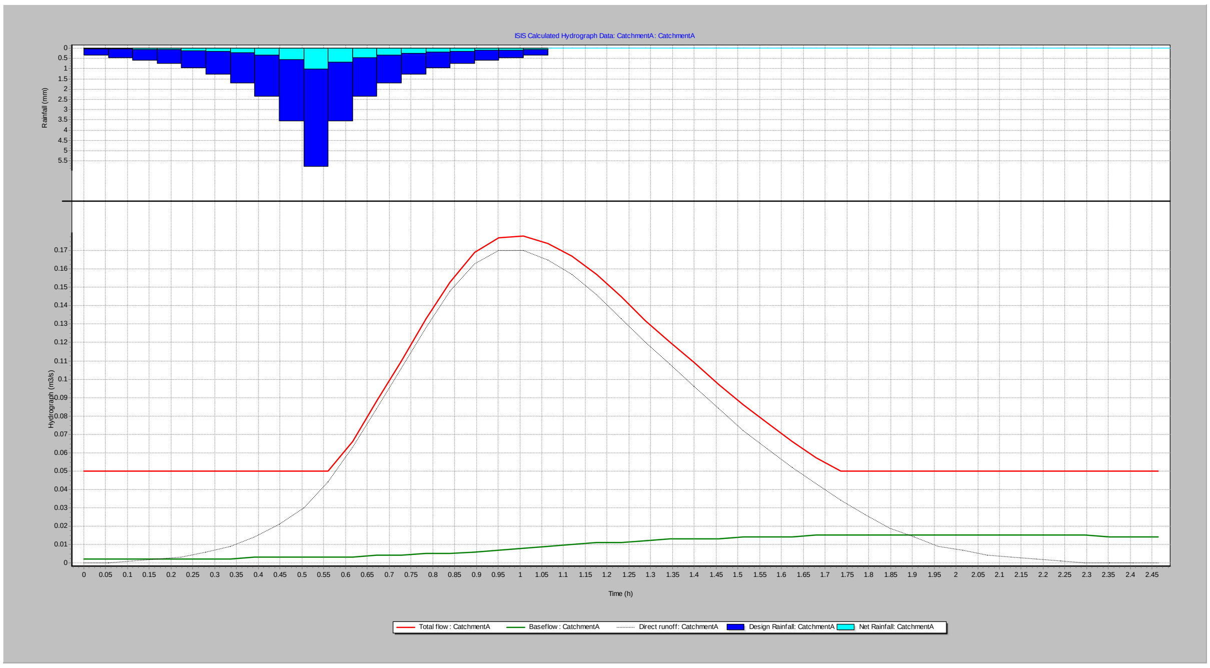

Figure D.4 Sub-catchment A 1 in 30 year (3.3% AEP) flow hydrograph

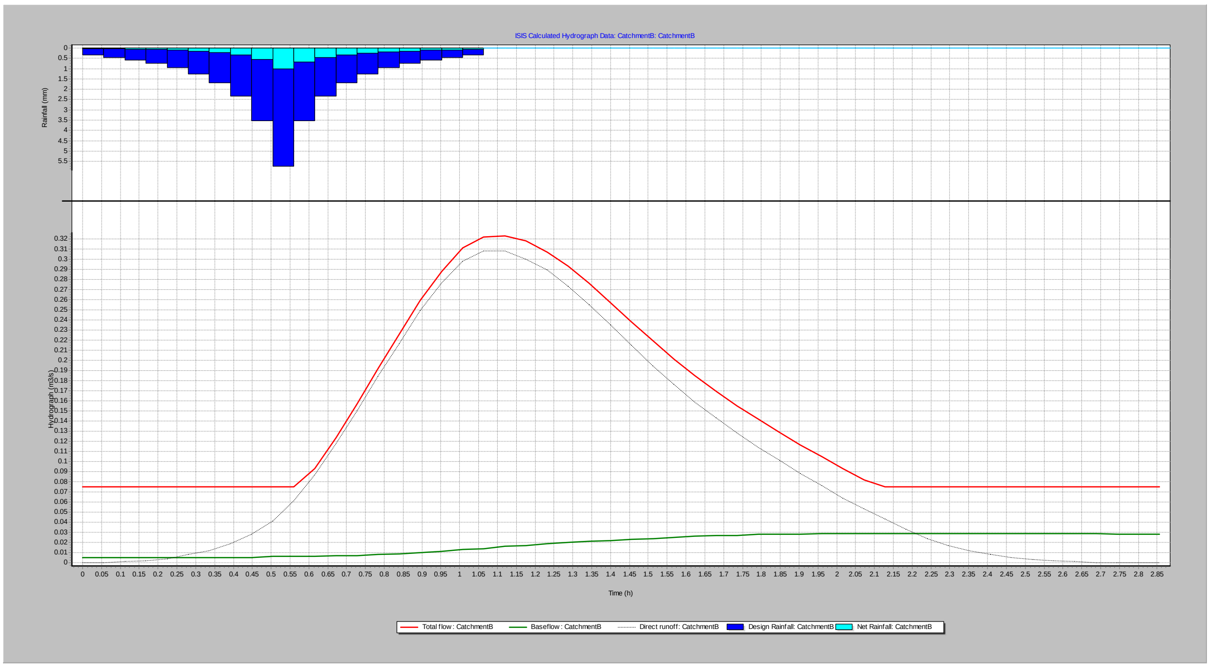

Figure D.5 Sub-catchment B 1 in 30 year (3.3% AEP) flow hydrograph

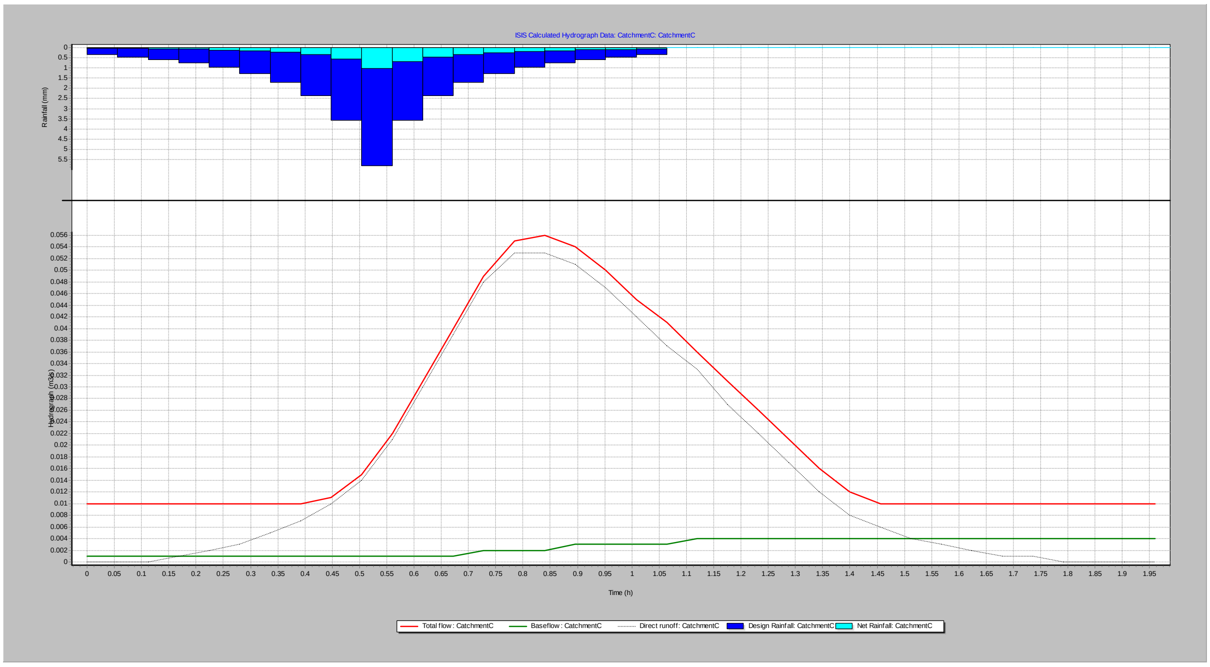

Figure D.6 Sub-catchment C 1 in 30 year (3.3% AEP) flow hydrograph

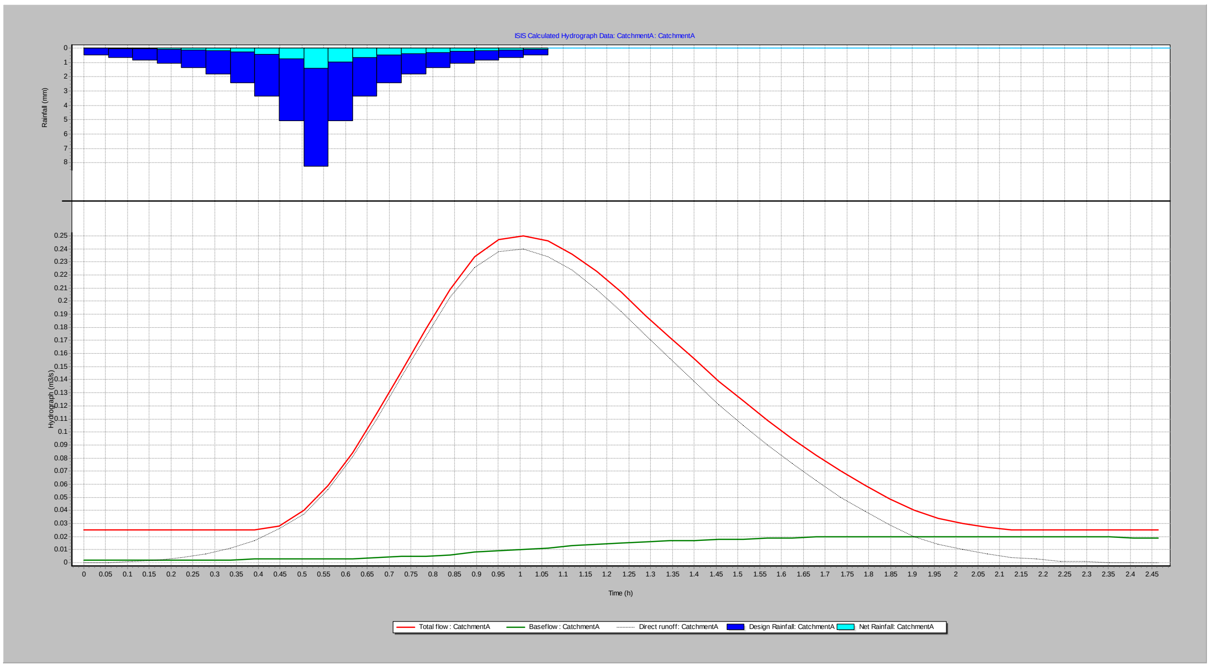

Figure D.7 Sub-catchment A 1 in 100 year (1% AEP) flow hydrograph

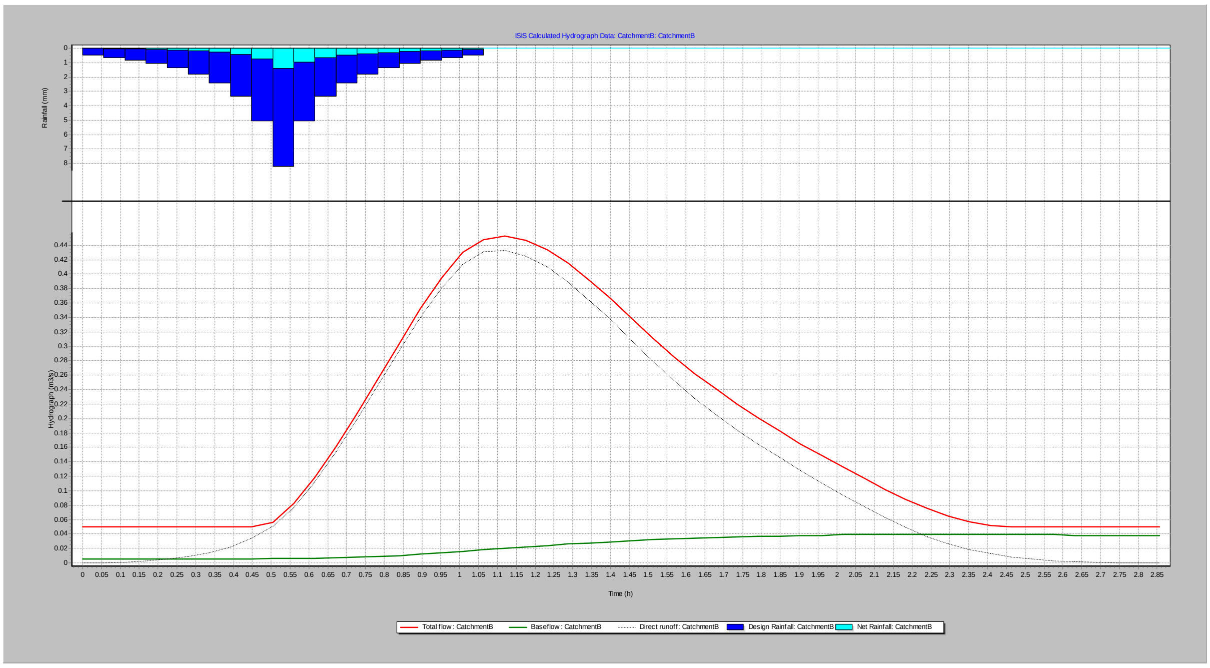

Figure D.8 Sub-catchment B 1 in 100 year (1% AEP) flow hydrograph

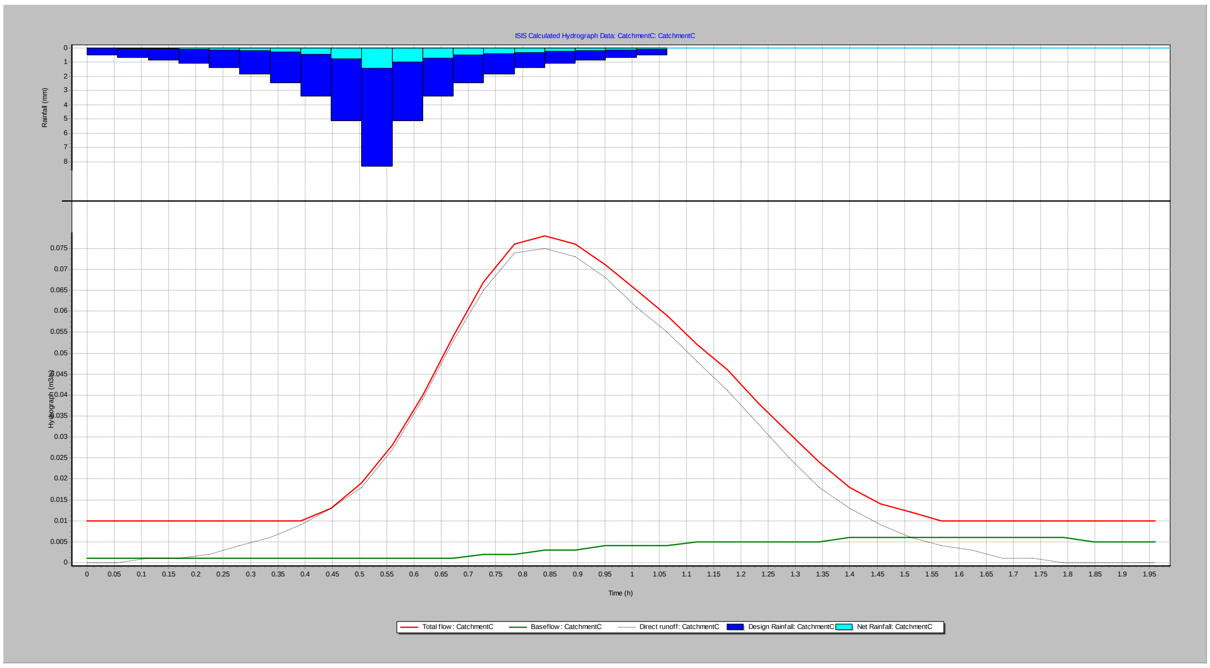

Figure D.9 Sub-catchment C 1 in 100 year (1% AEP) flow hydrograph

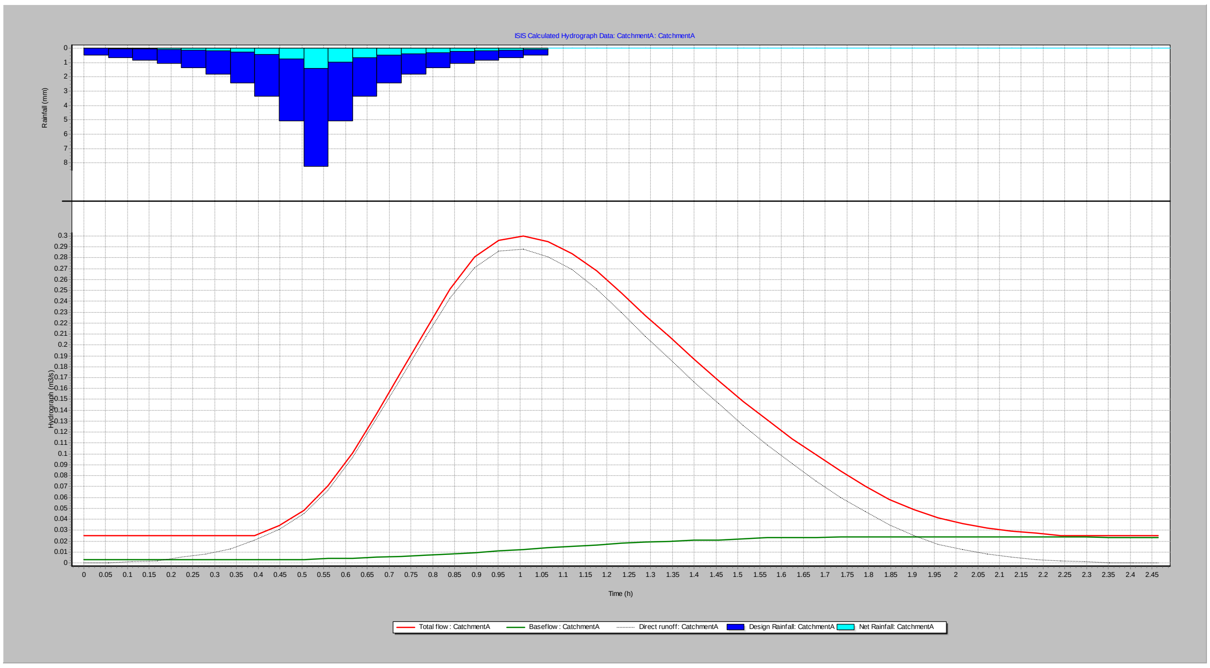

Figure D.9 Sub-catchment A 1 in 100 year (1% AEP) plus climate change flow hydrograph

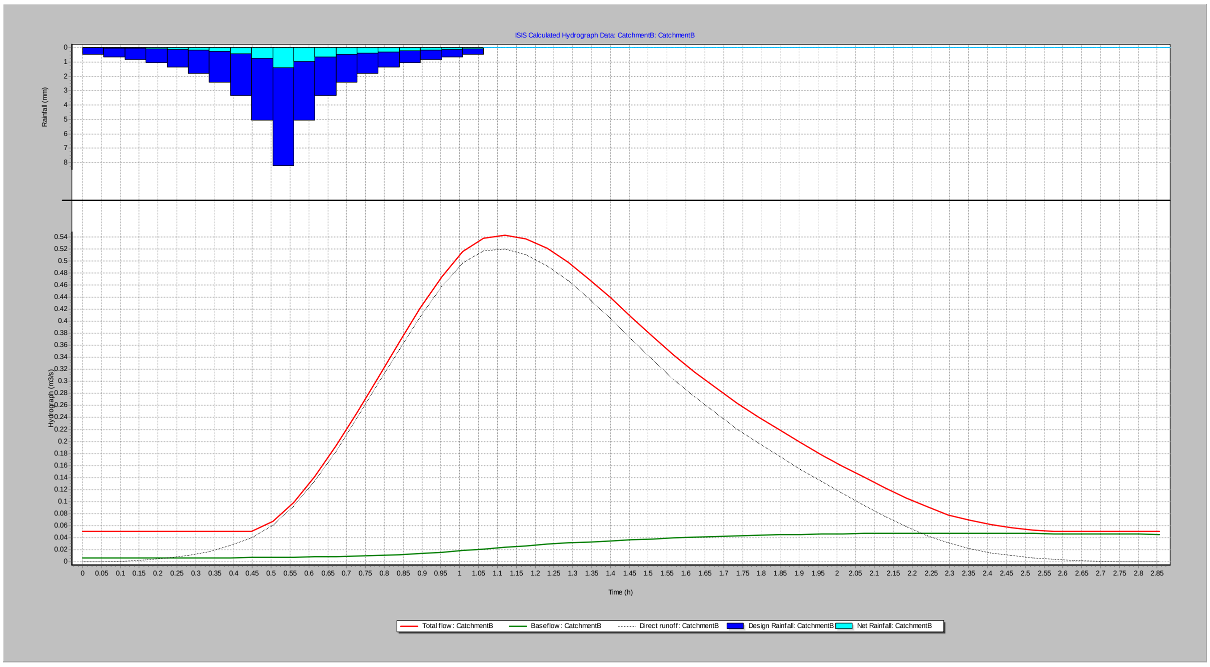

Figure D.9 Sub-catchment B 1 in 100 year (1% AEP) plus climate change flow hydrograph

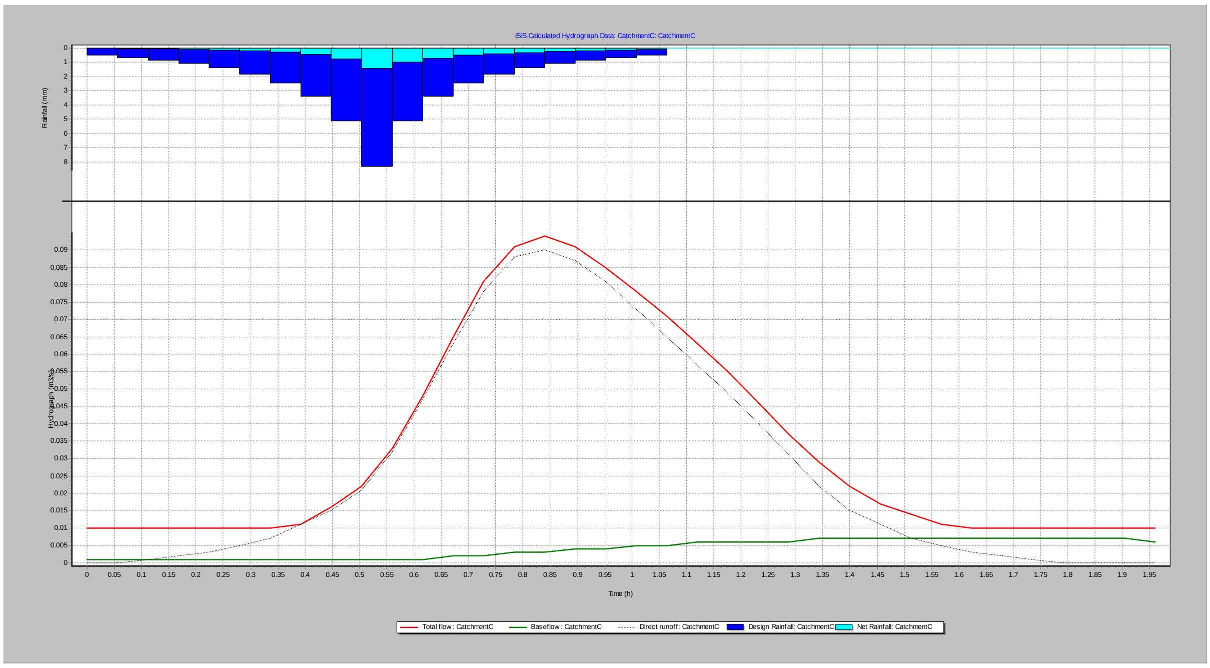

Figure D.10 Sub-catchment C 1 in 100 year (1% AEP) plus climate change flow hydrograph

APPENDIX E: ISIS OUTPUTS: EXISTING SCENARIO SCHEMATIC, LONG-SECTION AND CROSS-SECTIONS

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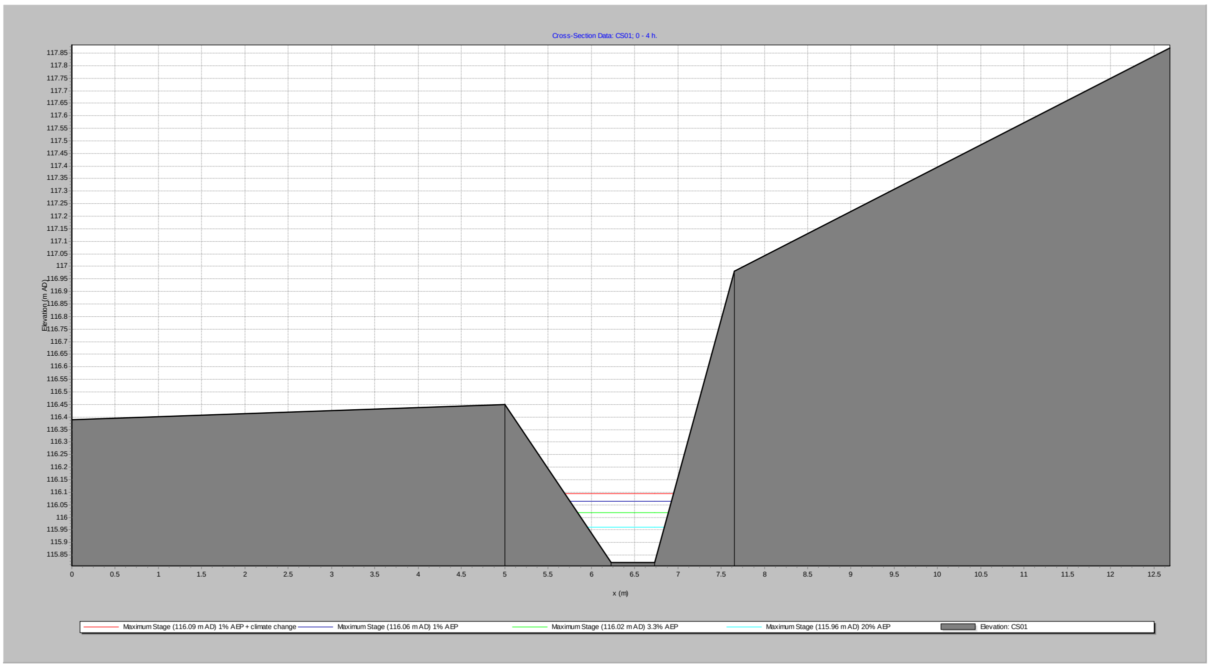

Figure E.1 Peak levels at cross section CS01

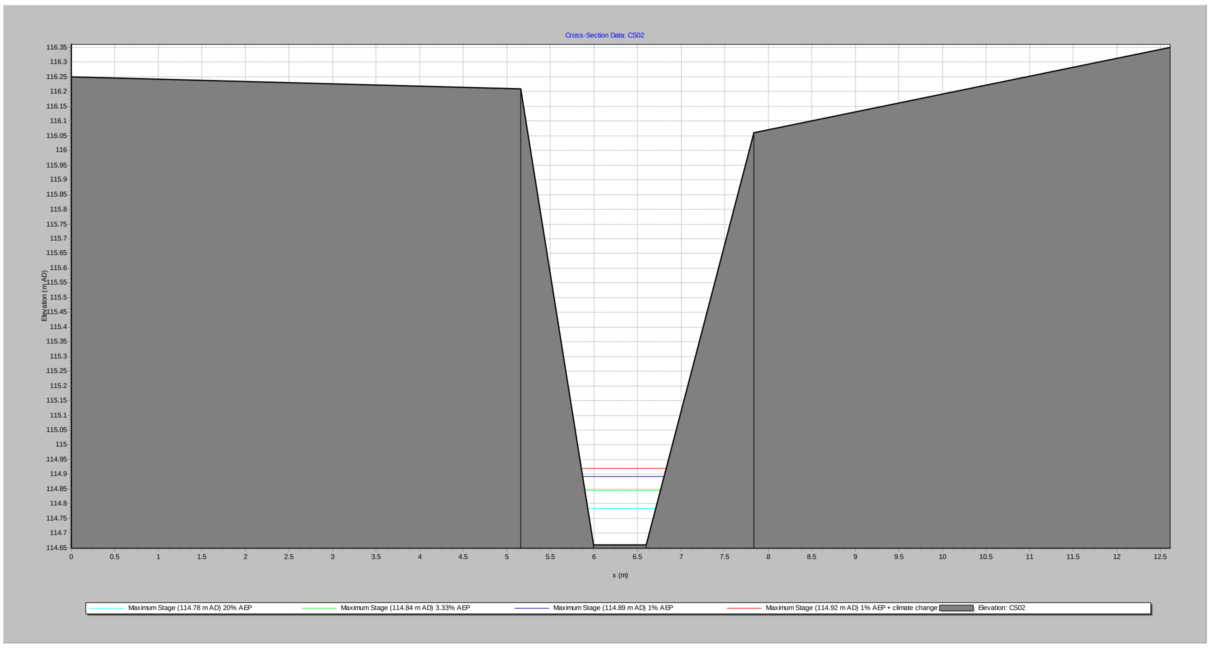

Figure E.2 Peak levels at cross section CS02

Figure E.3 Peak levels at cross section CS03

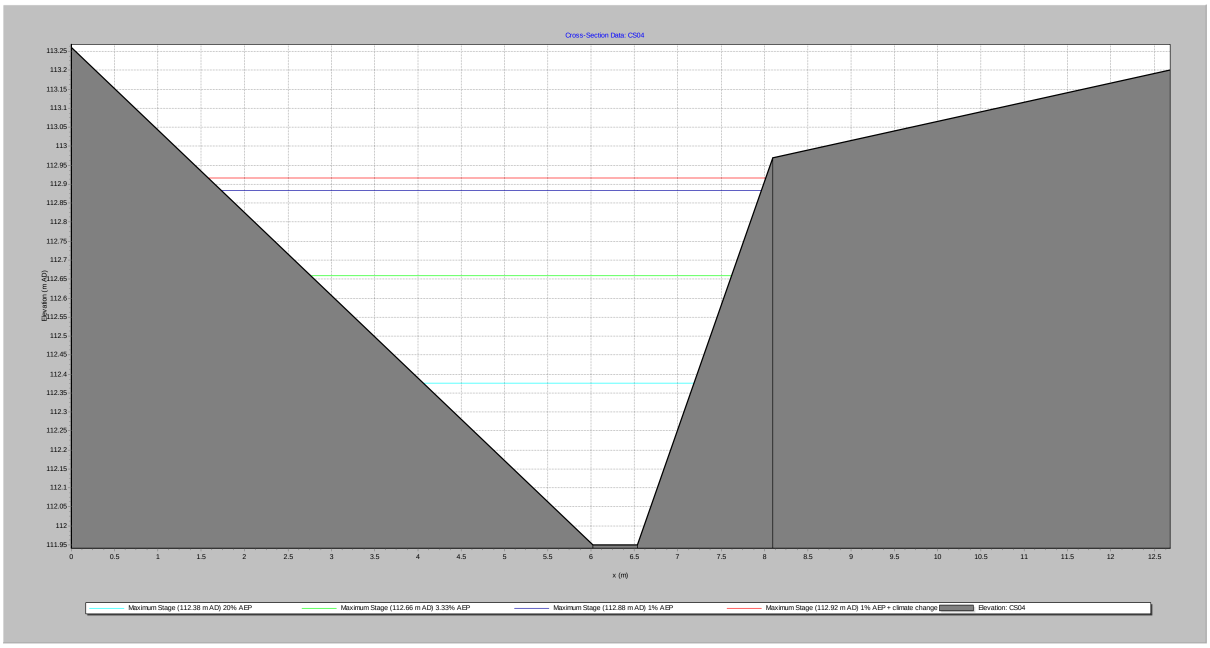

Figure E.4 Peak levels at cross section CS04

Figure E.5 Peak levels at cross section CS05

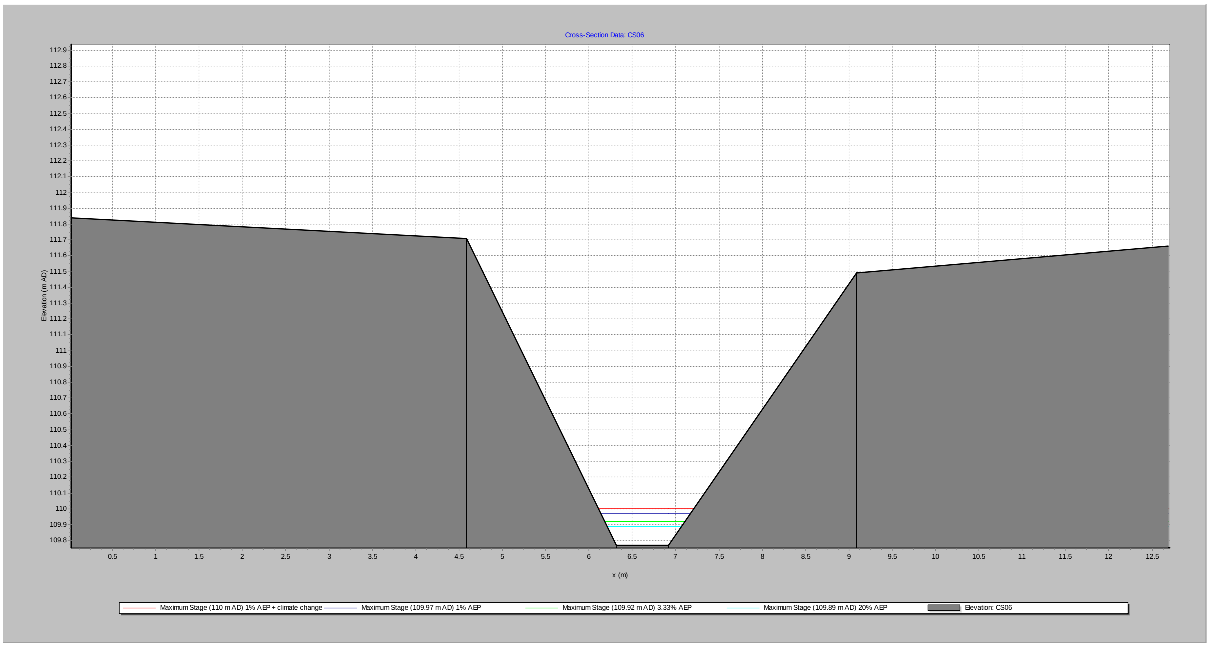

Figure E.6 Peak levels at cross section CS06

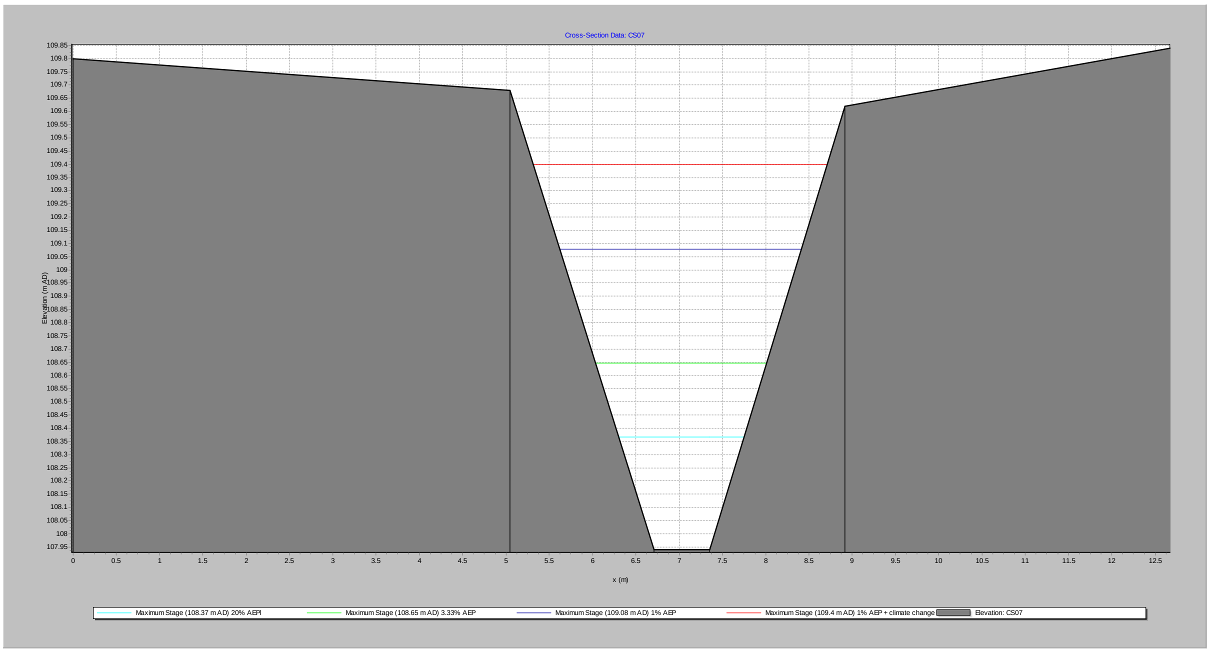

Figure E.7 Peak levels at cross section CS07

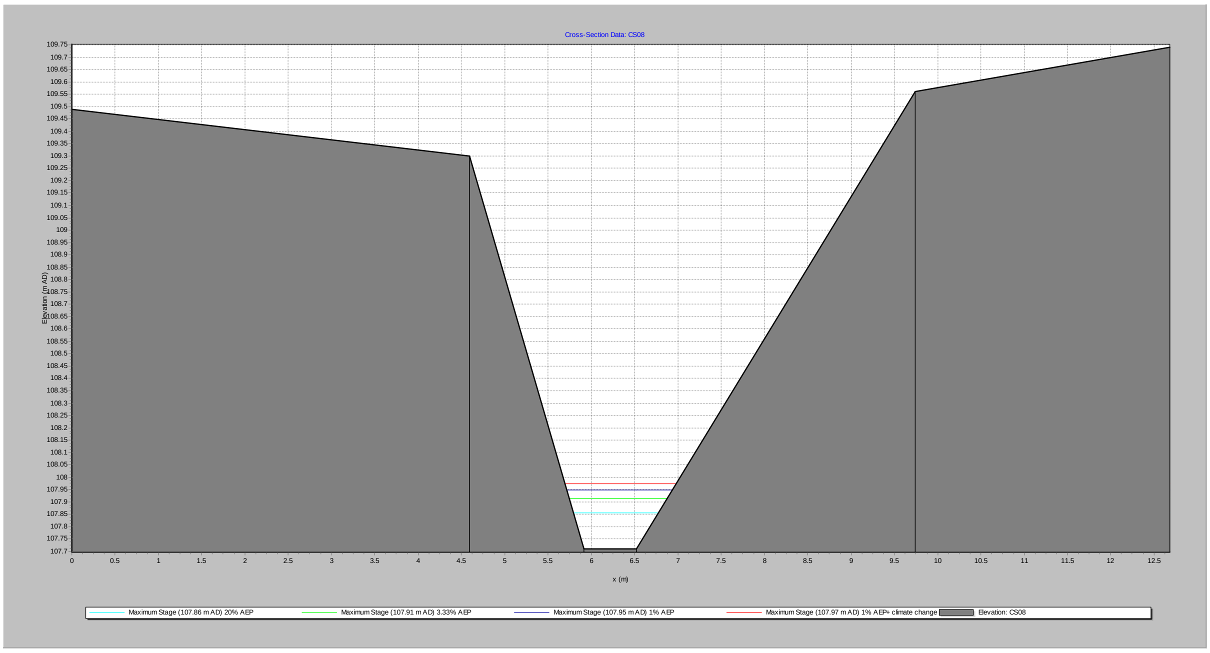

Figure E.8 Peak levels at cross section CS08

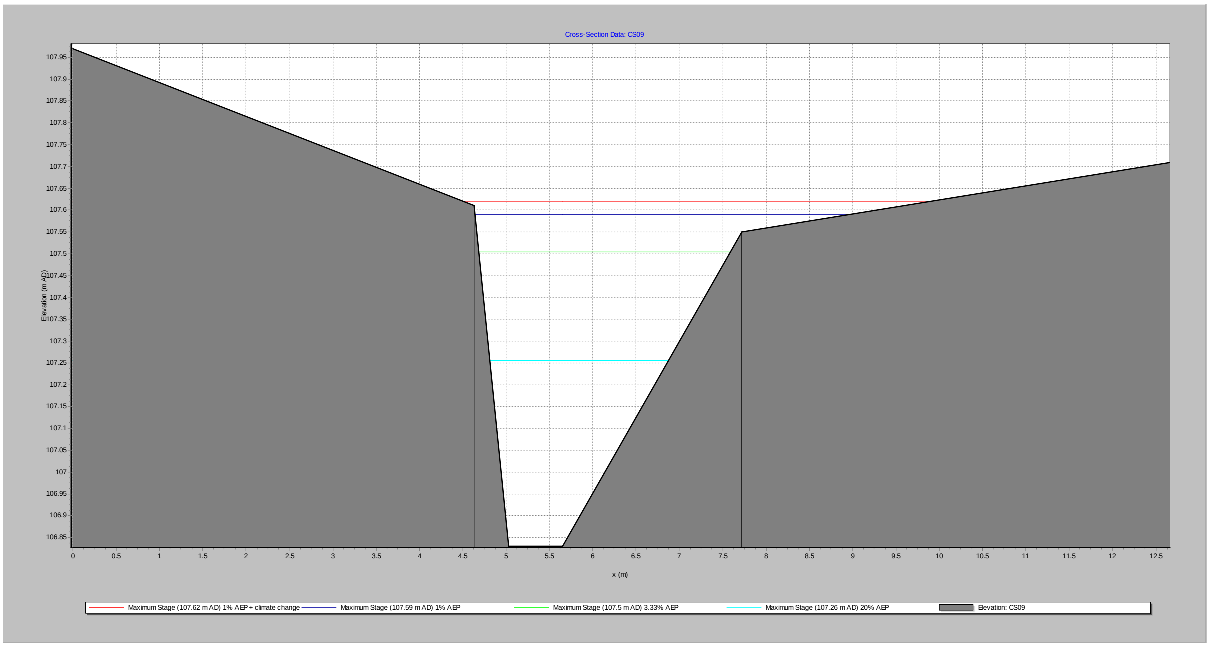

Figure E.9 Peak levels at cross section CS09

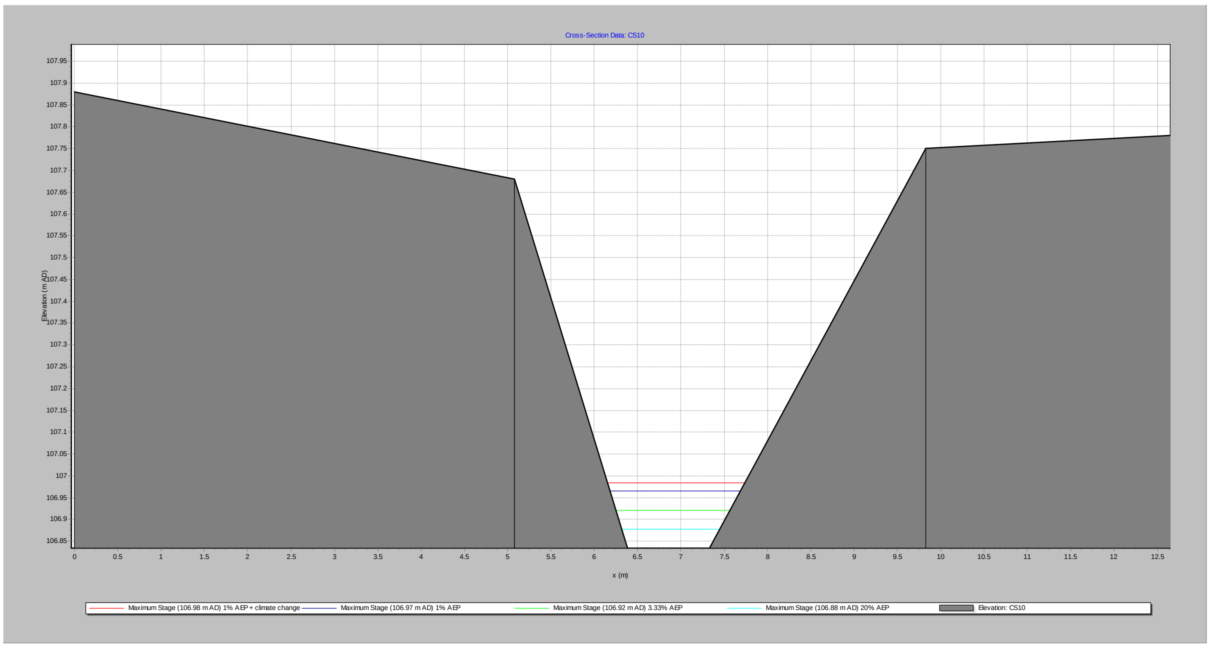

Figure E.10 Peak levels at cross section CS10

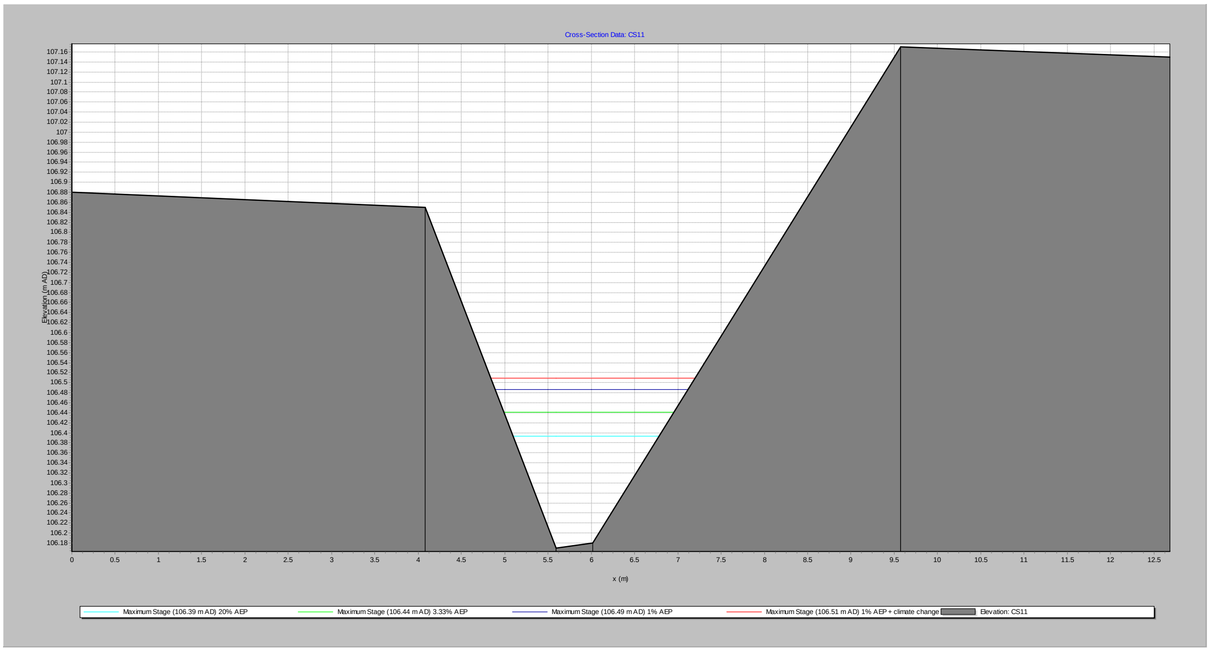

Figure E.11 Peak levels at cross section CS11

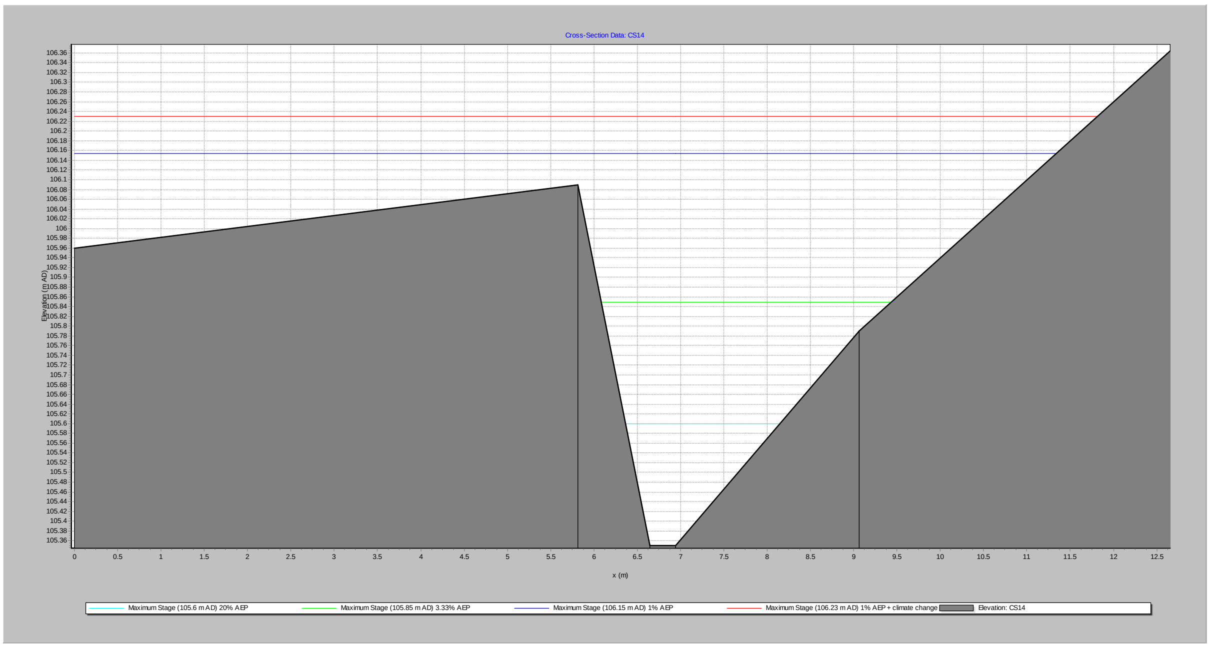

Figure E.12 Peak levels at cross section CS14

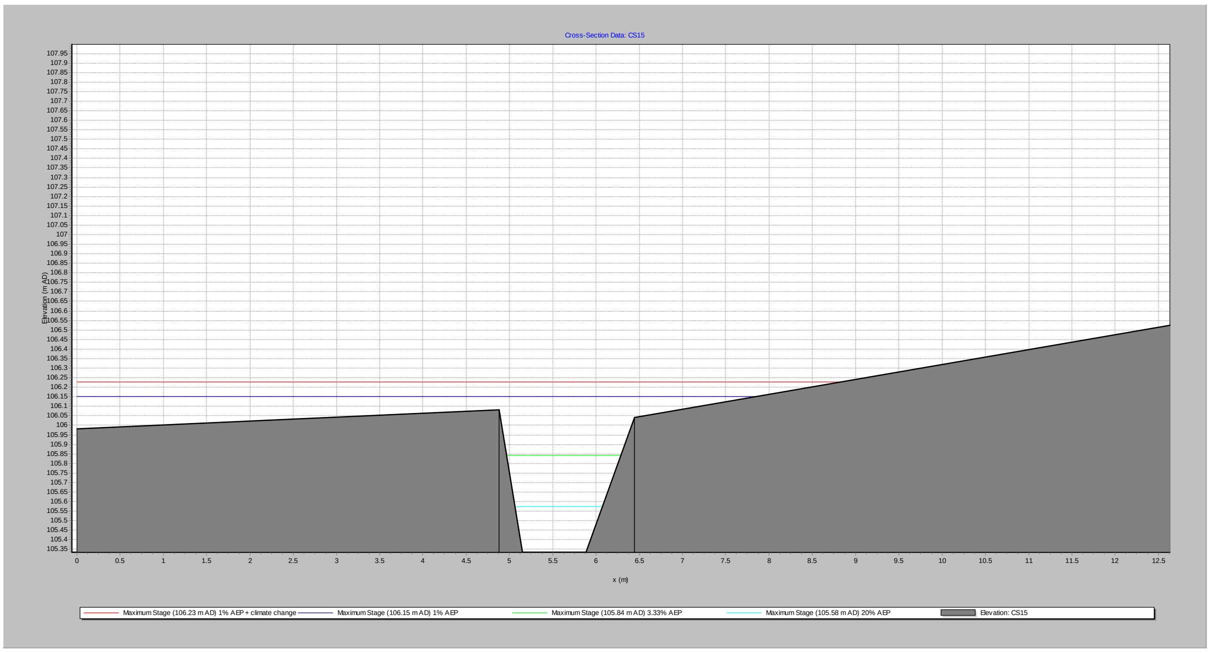

Figure E.13 Peak levels at cross section CS15

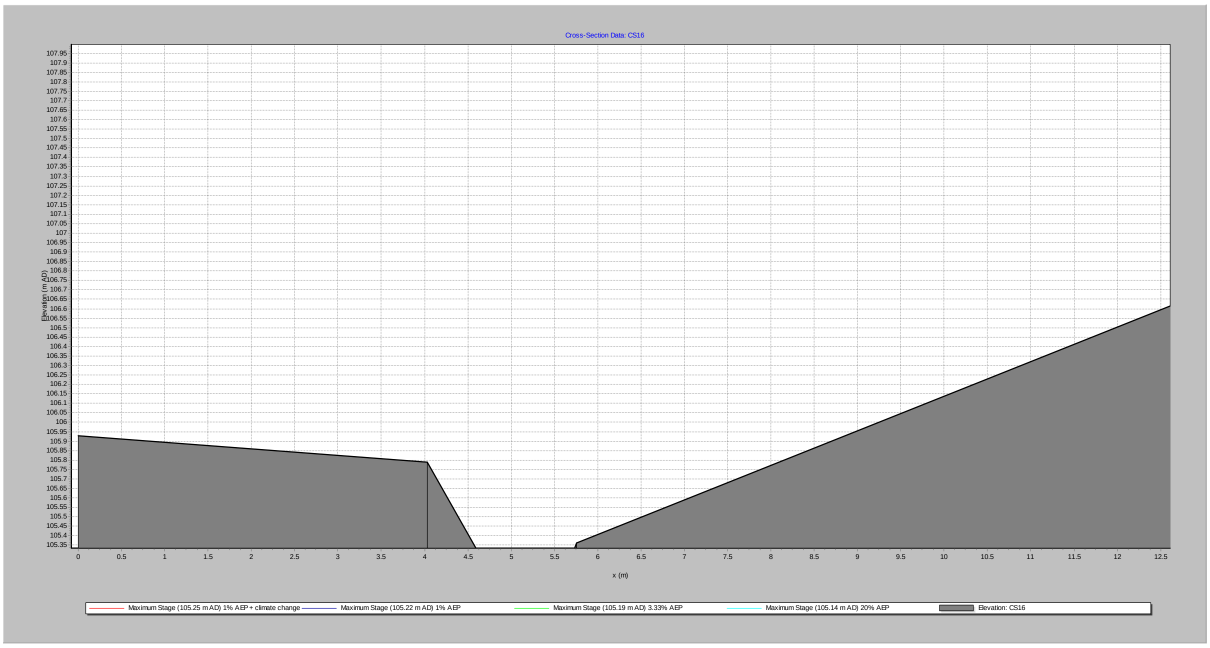

Figure E.14 Peak levels at cross section CS16

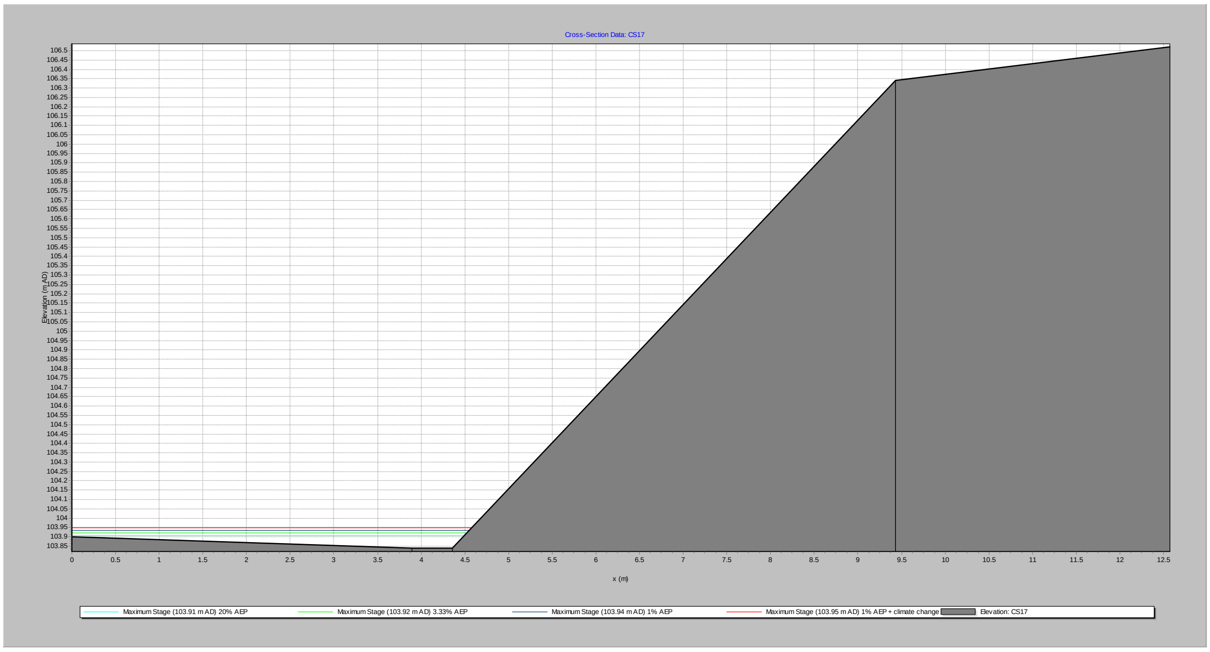

Figure E.15 Peak levels at cross section CS17

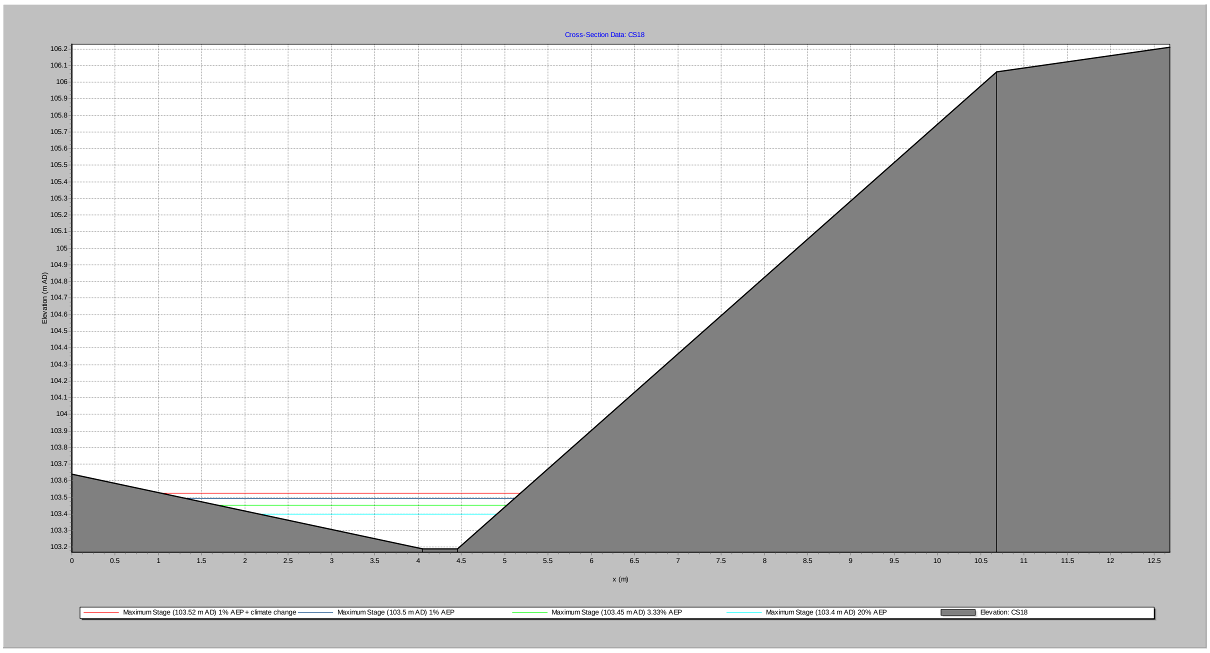

Figure E.16 Peak levels at cross section CS18

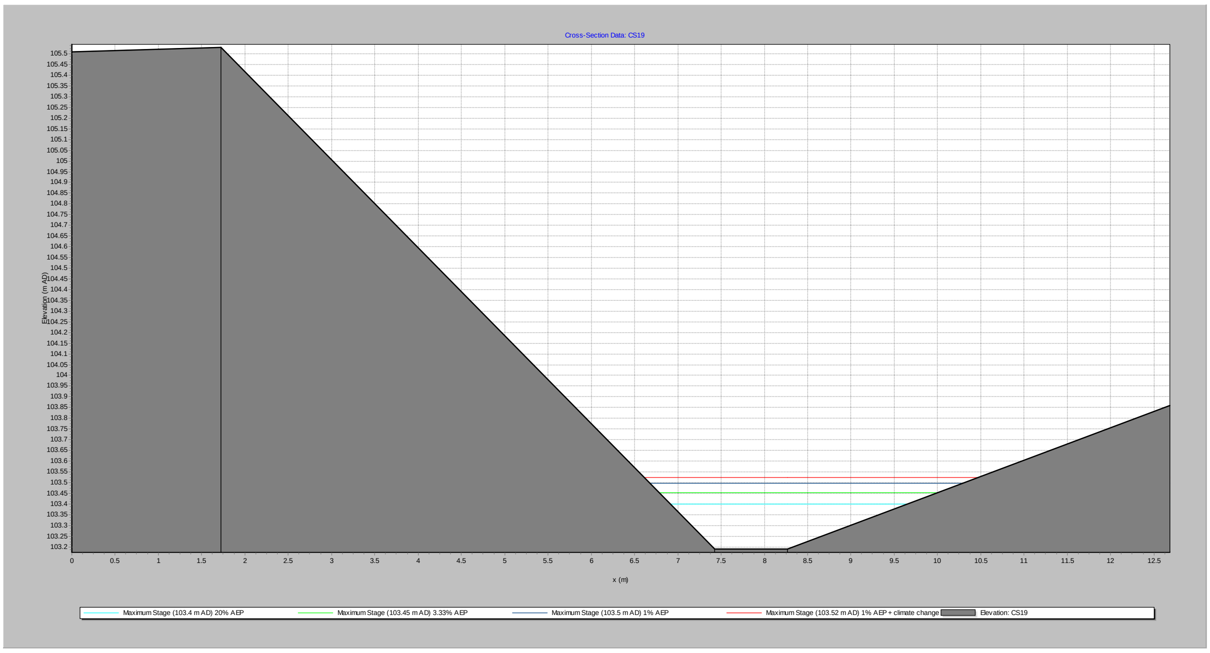

Figure E.17 Peak levels at cross section CS19

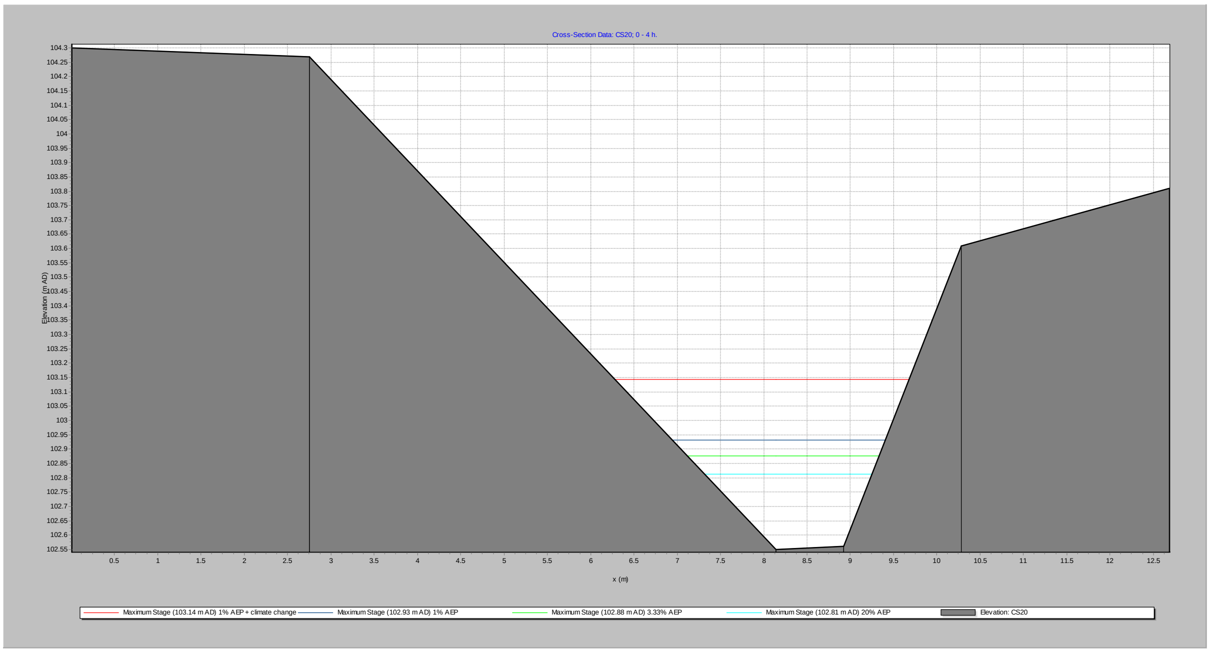

Figure E.18 Peak levels at cross section CS20

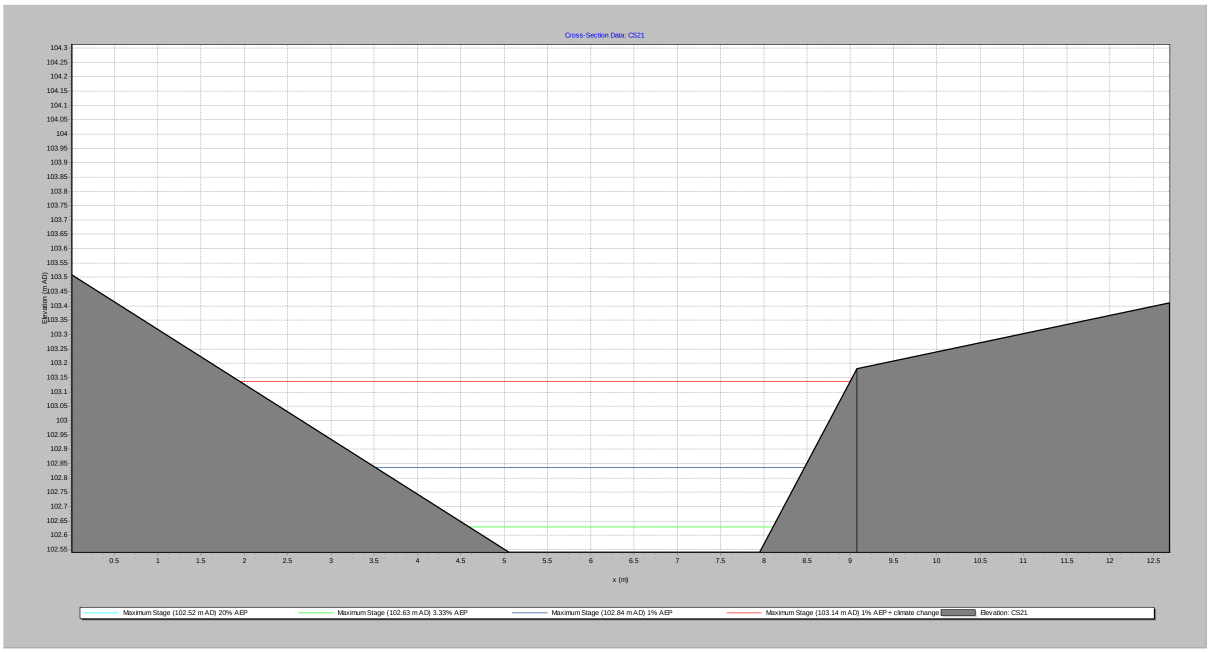

Figure E.19 Peak levels at cross section CS21

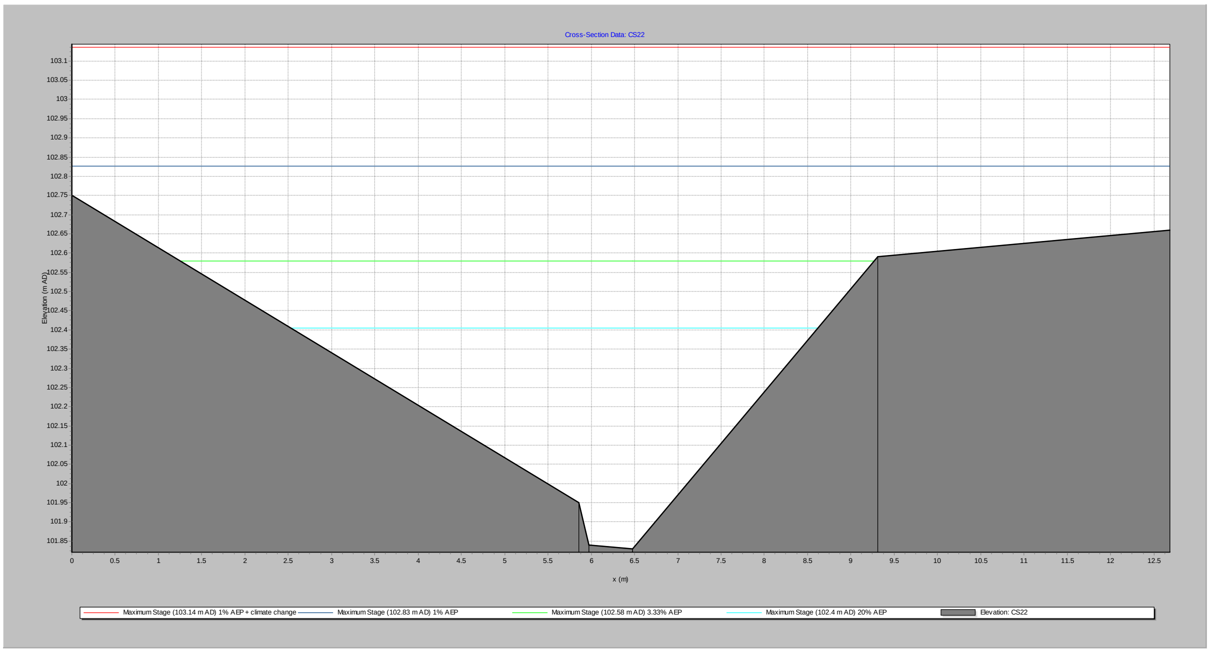

Figure E.20 Peak levels at cross section CS22

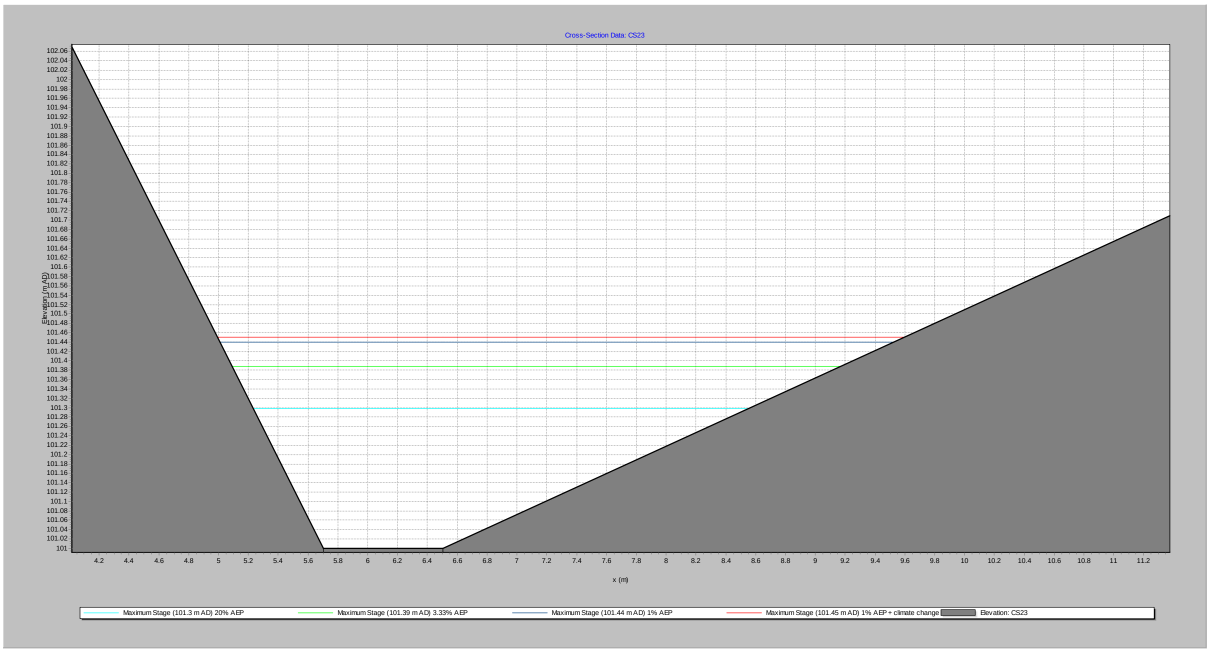

Figure E.21 Peak levels at cross section CS23

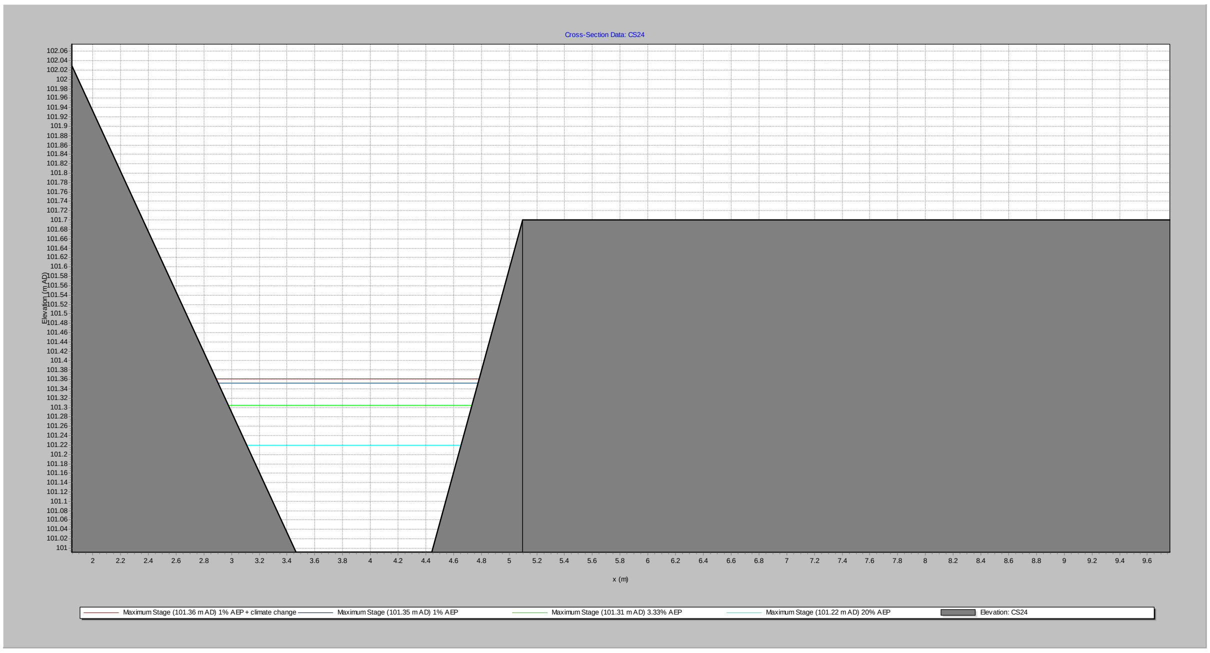

Figure E.22 Peak levels at cross section CS24

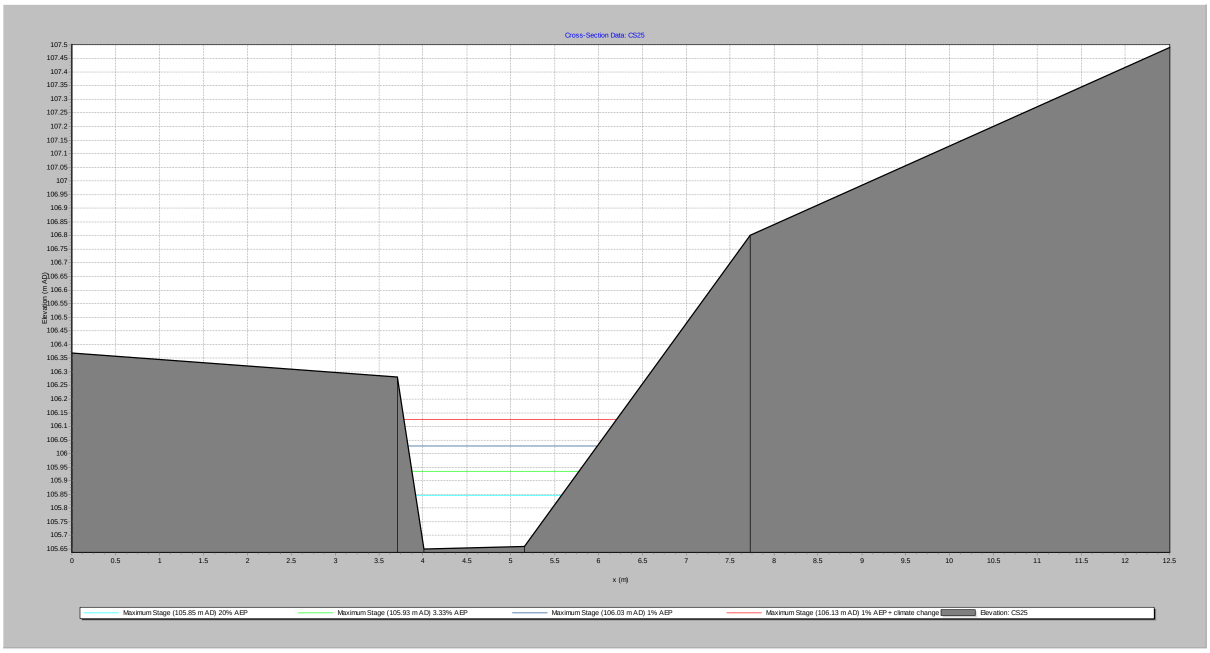

Figure E.23 Peak levels at cross section CS25

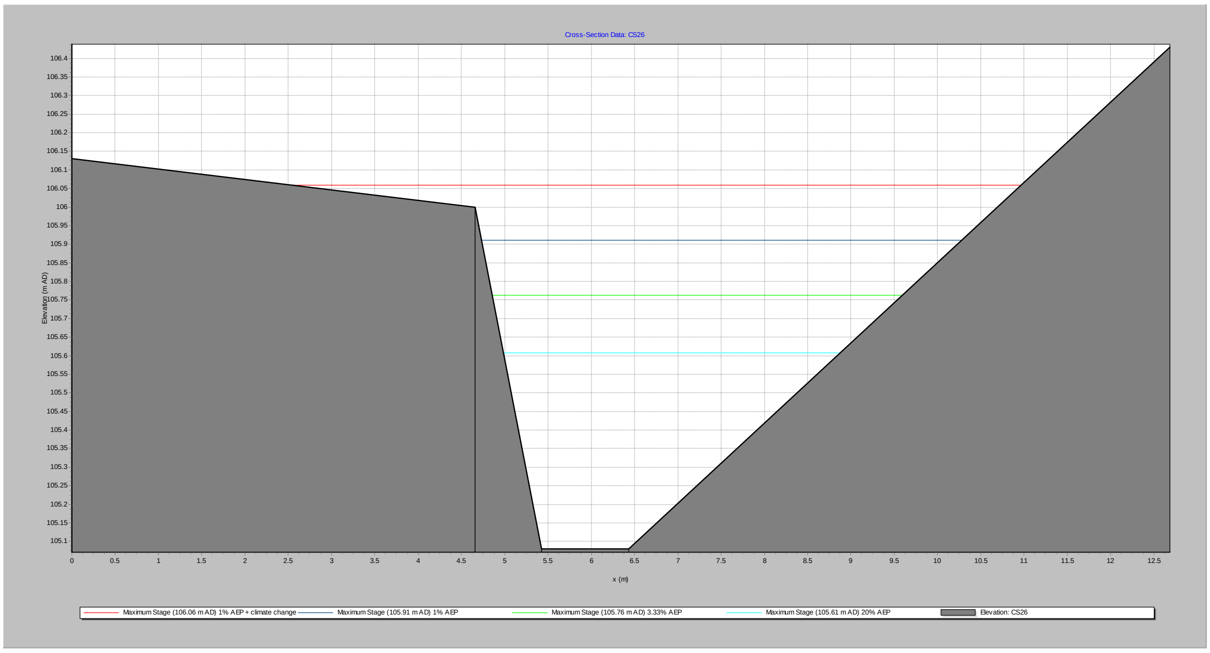

Figure E.24 Peak levels at cross section CS26

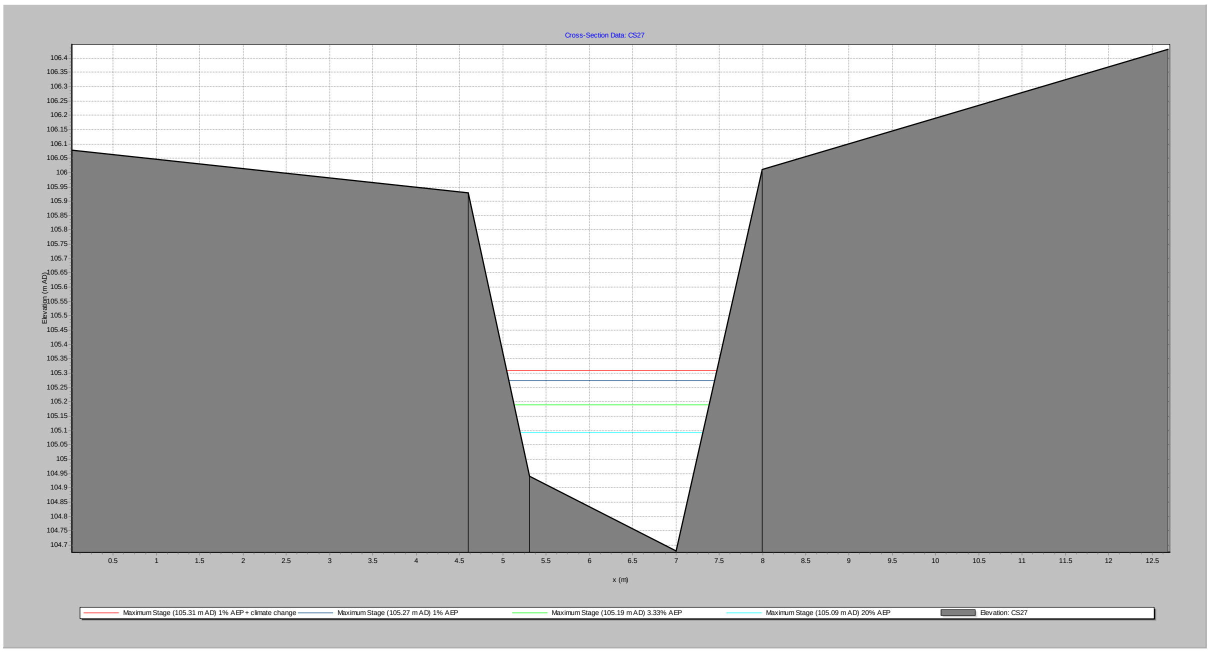

Figure E.25 Peak levels at cross section CS27

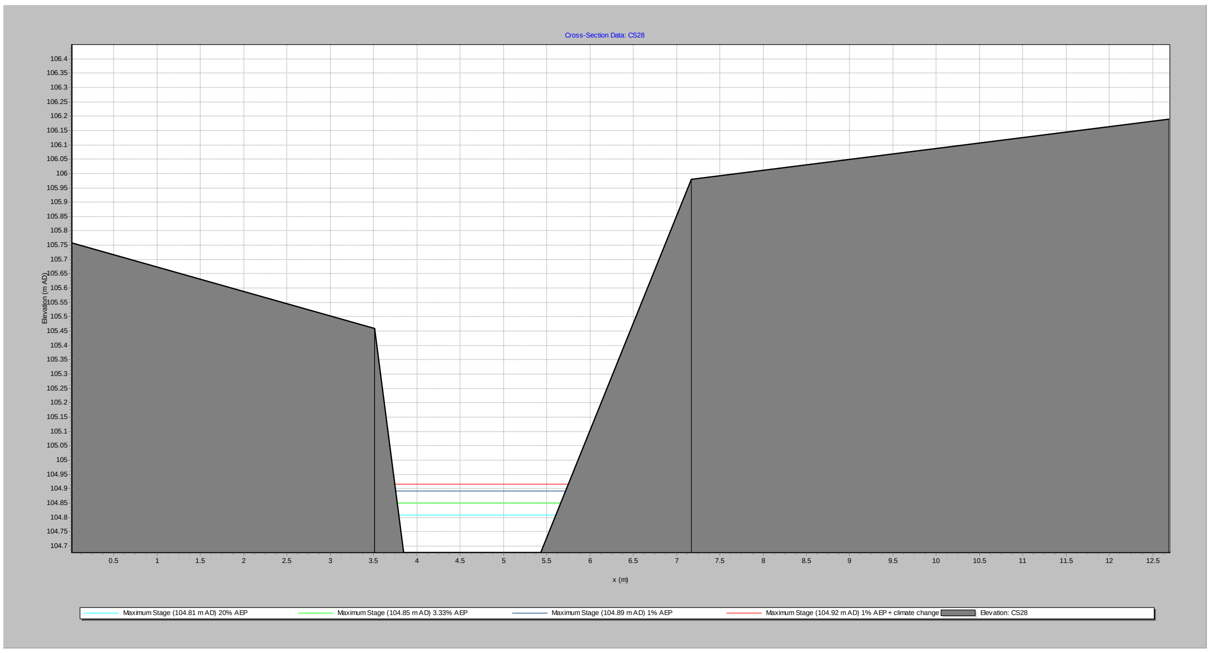

Figure E.26 Peak levels at cross section CS28

Figure E.27 Peak levels at cross section CS29

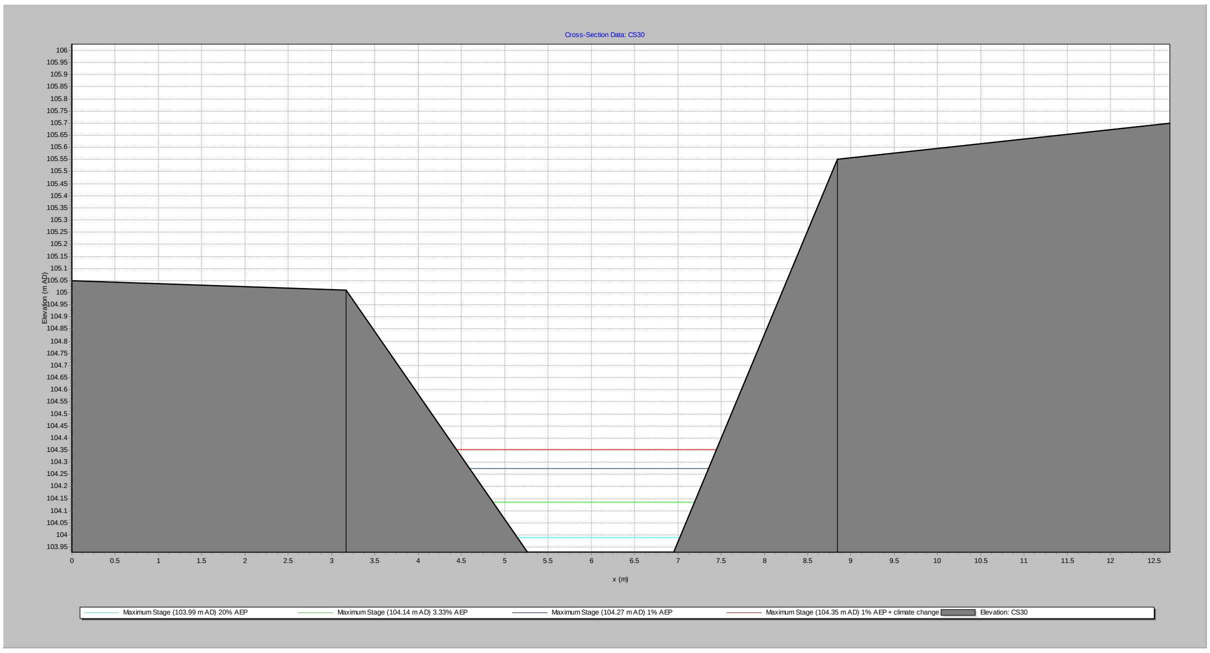

Figure E.28 Peak levels at cross section CS30

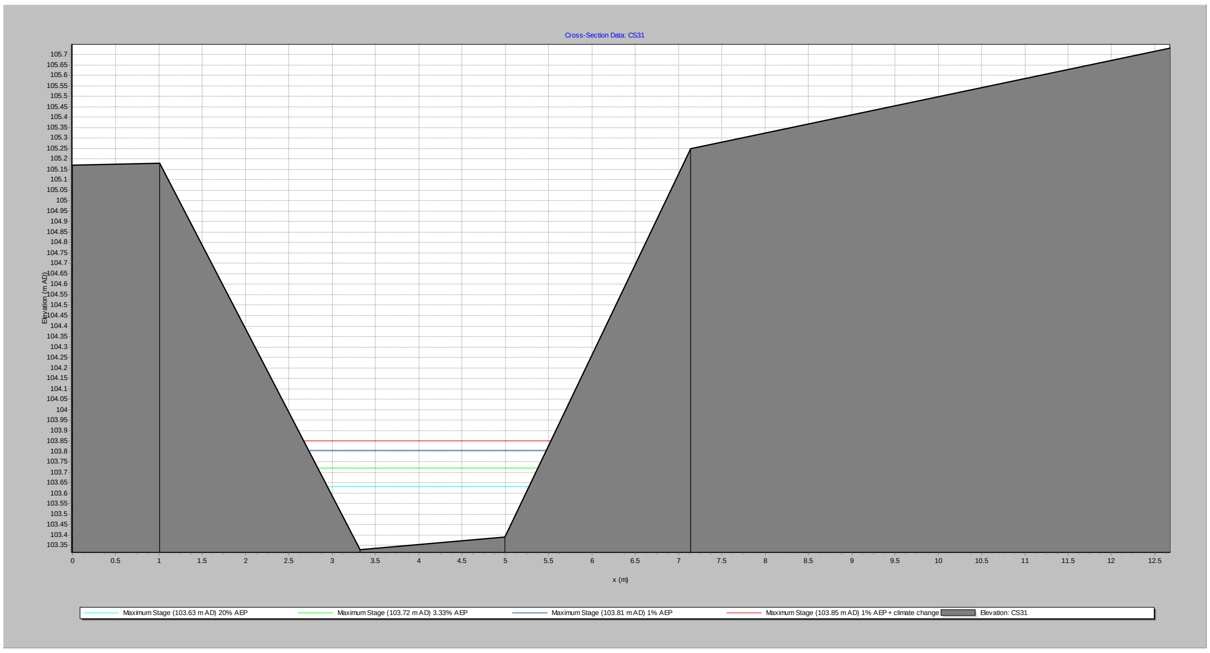

Figure E.29 Peak levels at cross section CS31

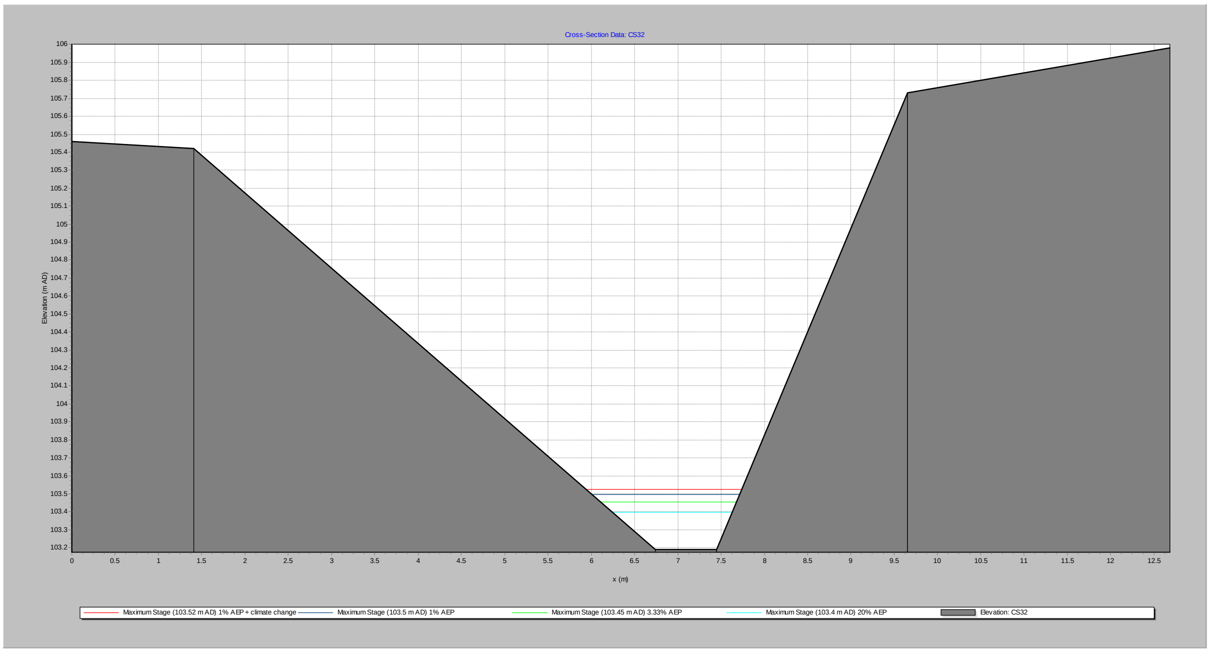

Figure E.30 Peak levels at cross section CS32

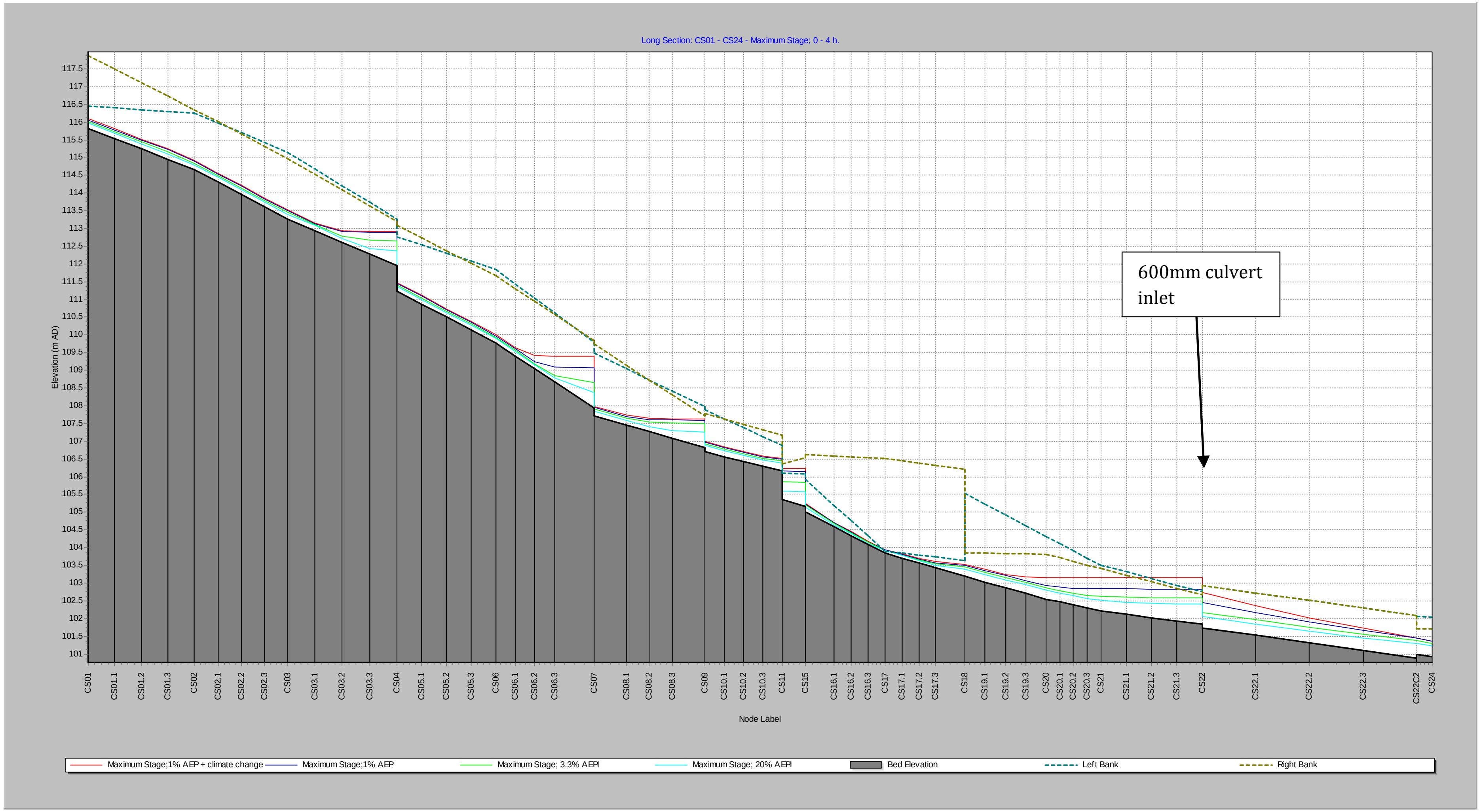

Figure E.15 Long section CS01 to CS24

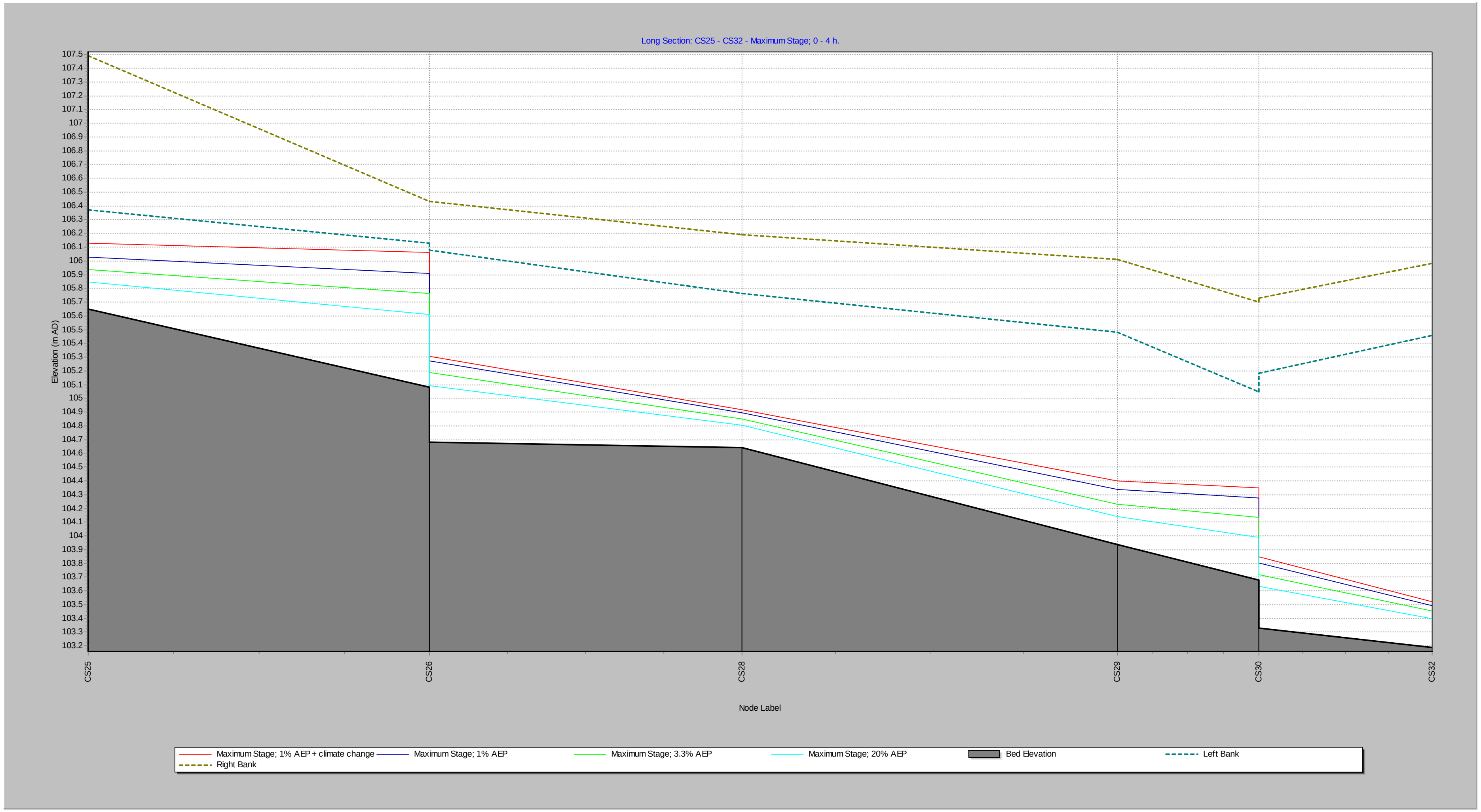

Figure E.15 Long section CS25 to CS32

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APPENDIX F: ISIS OUTPUTS: PROPOSED SCENARIO SCHEMATIC, LONG-SECTION AND CROSS-SECTIONS

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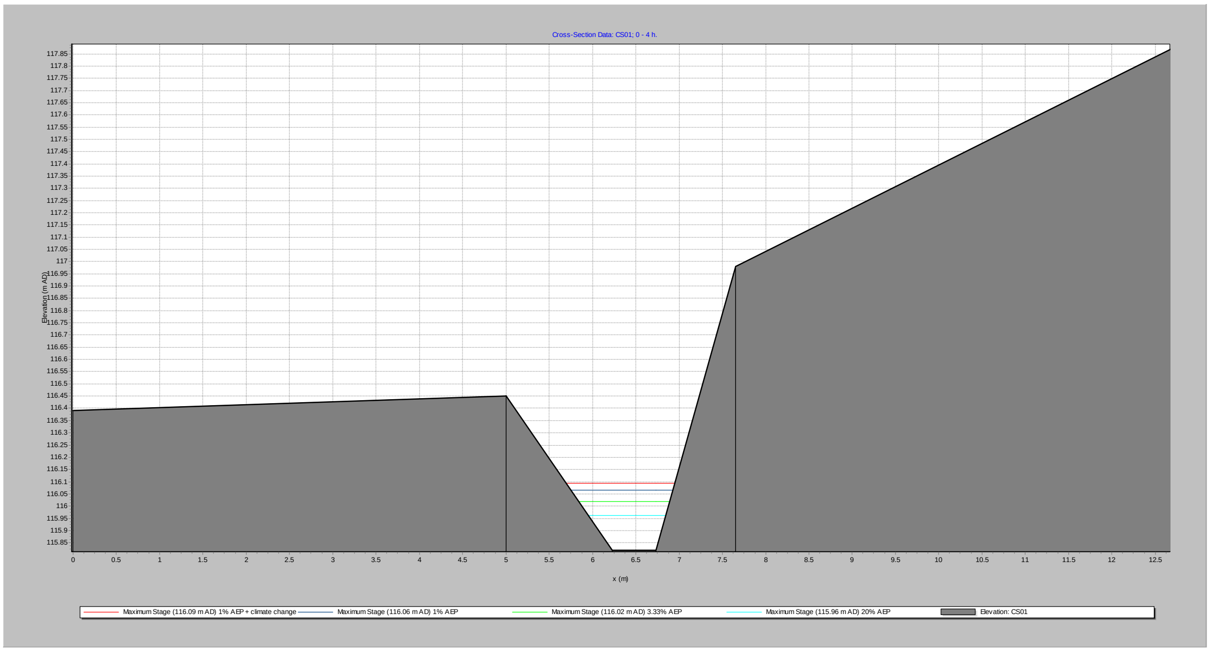

Figure F.1 Peak levels at cross section CS01

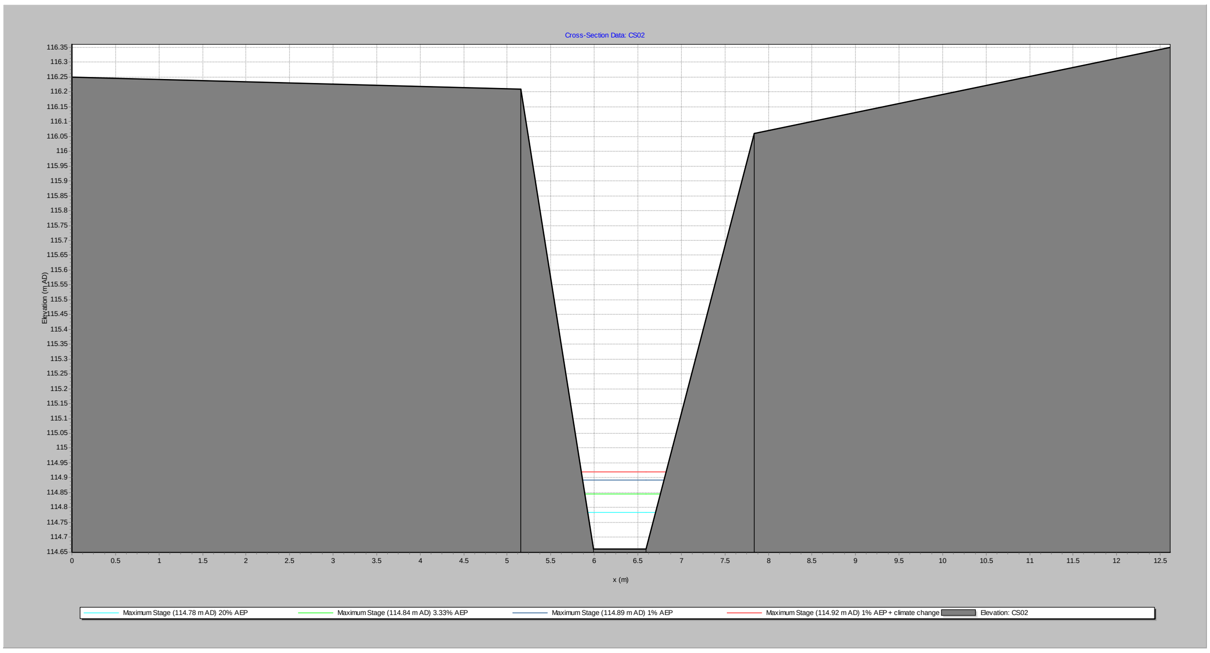

Figure F.2 Peak levels at cross section CS02

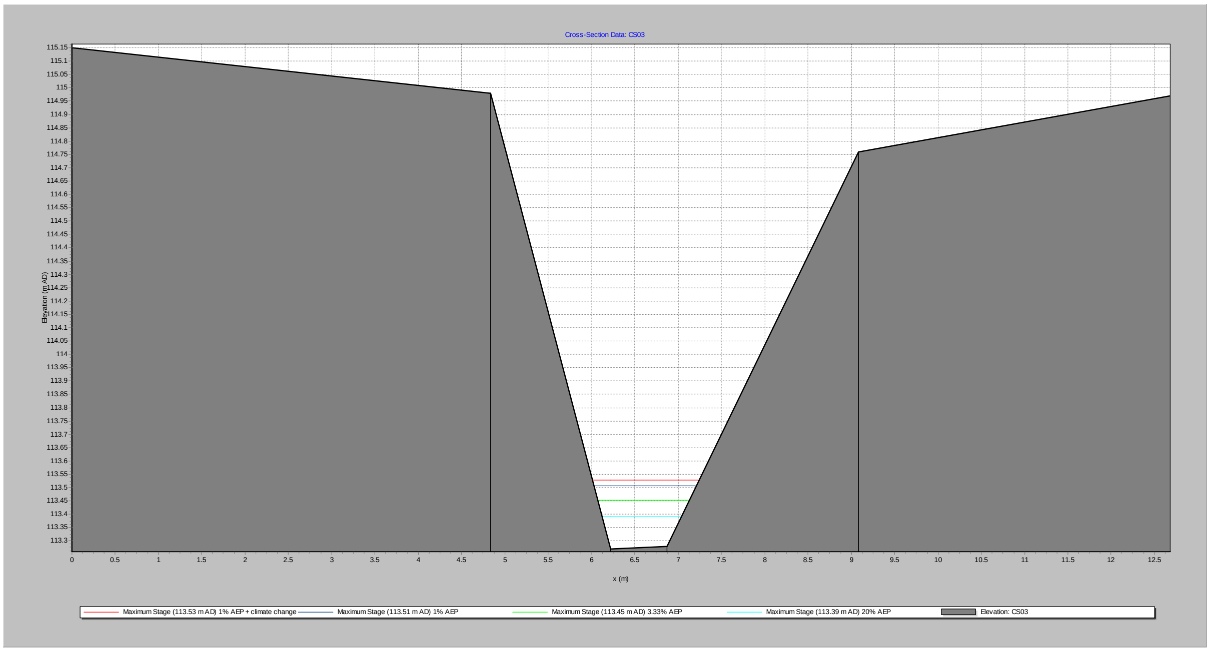

Figure F.3 Peak levels at cross section CS03

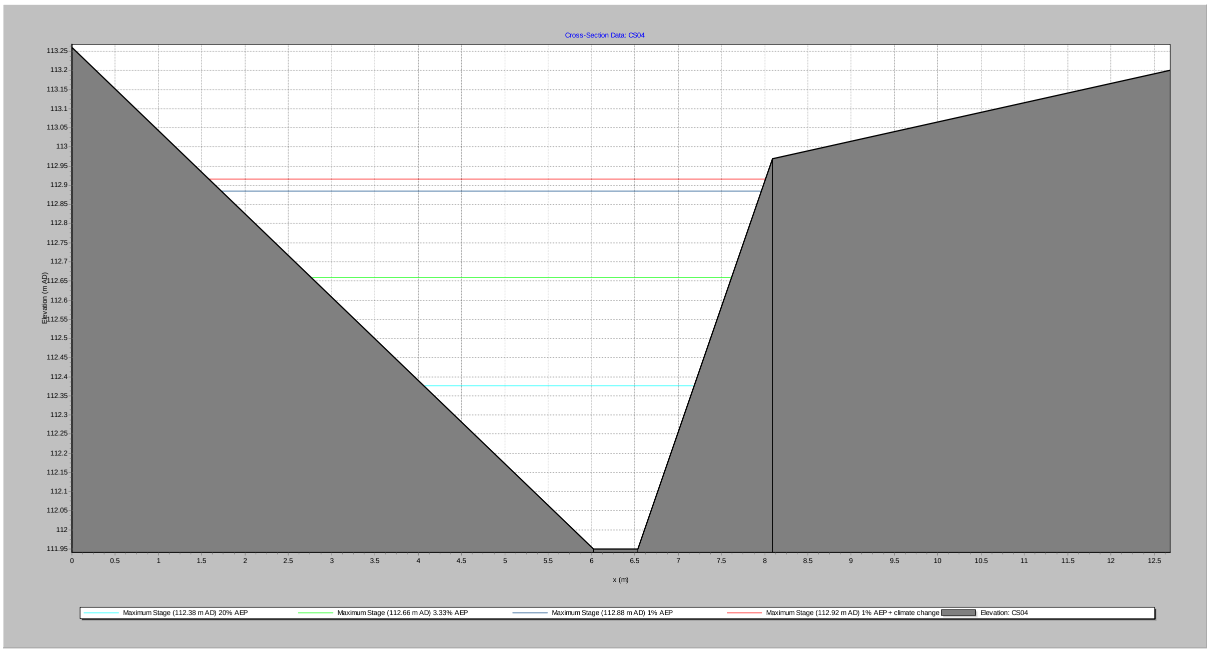

Figure F.4 Peak levels at cross section CS04

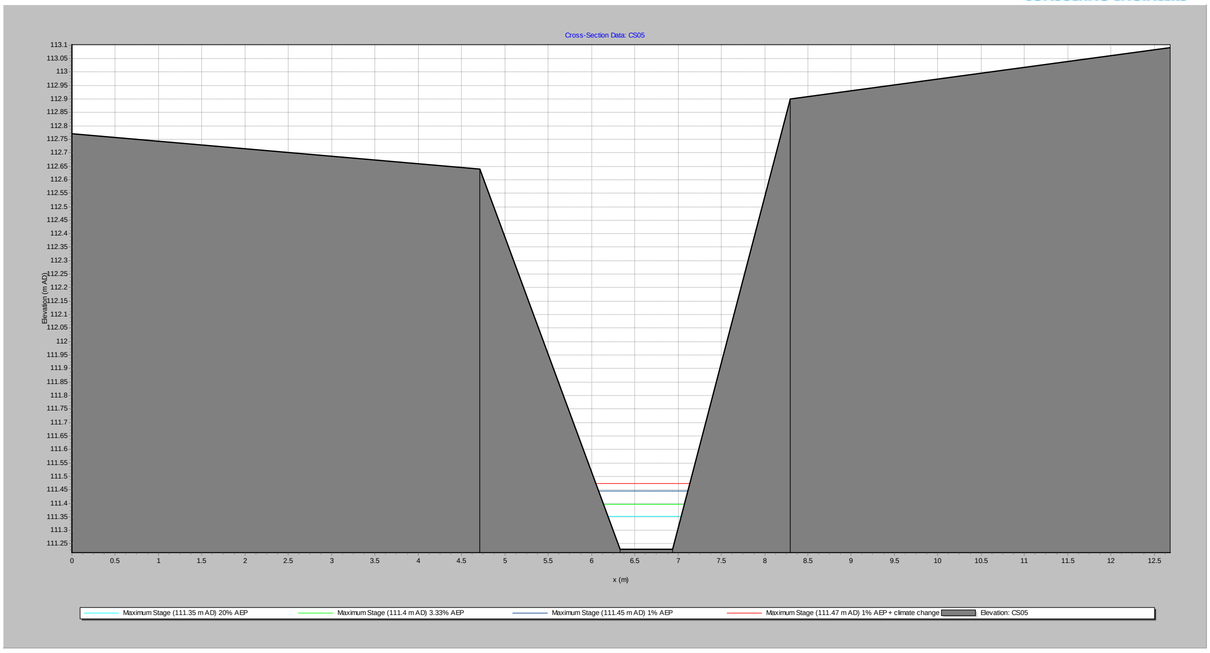

Figure F.5 Peak levels at cross section CS05

Figure F.6 Peak levels at cross section CS06

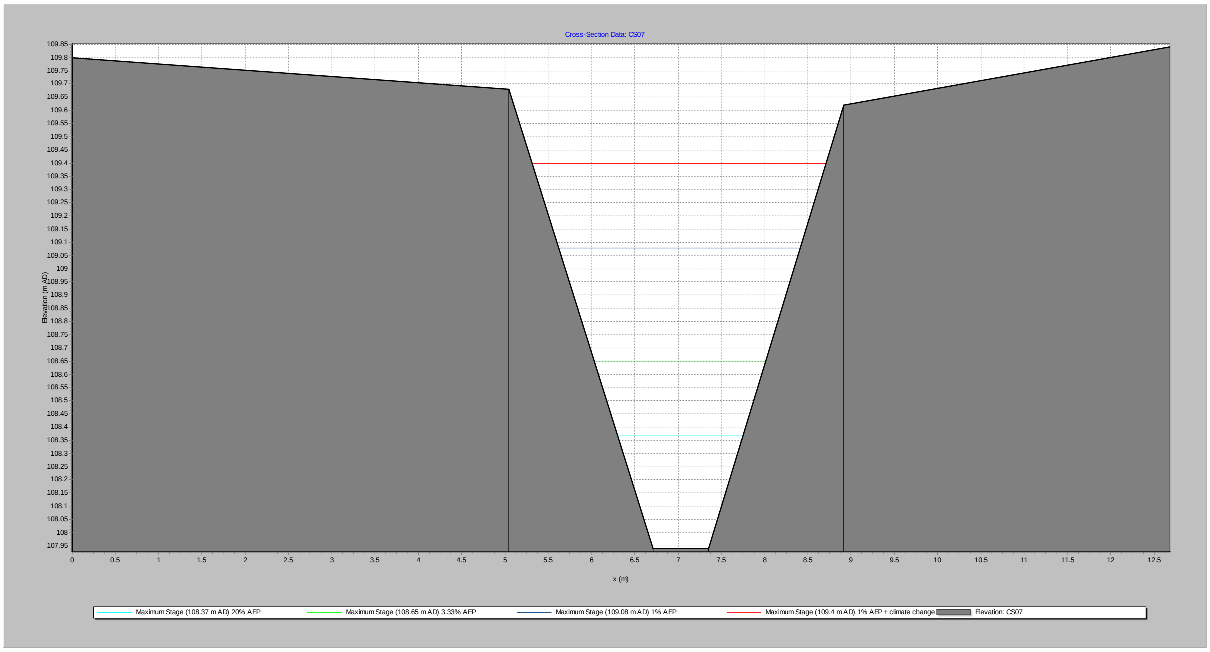

Figure F.7 Peak levels at cross section CS07

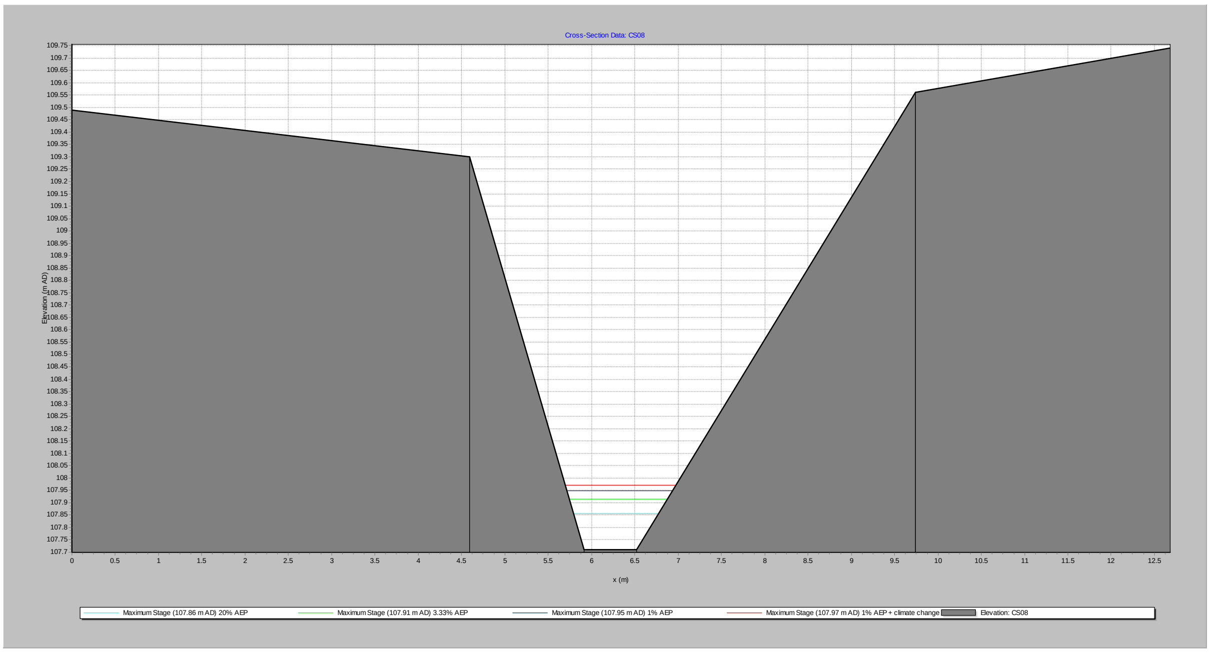

Figure F.8 Peak levels at cross section CS08

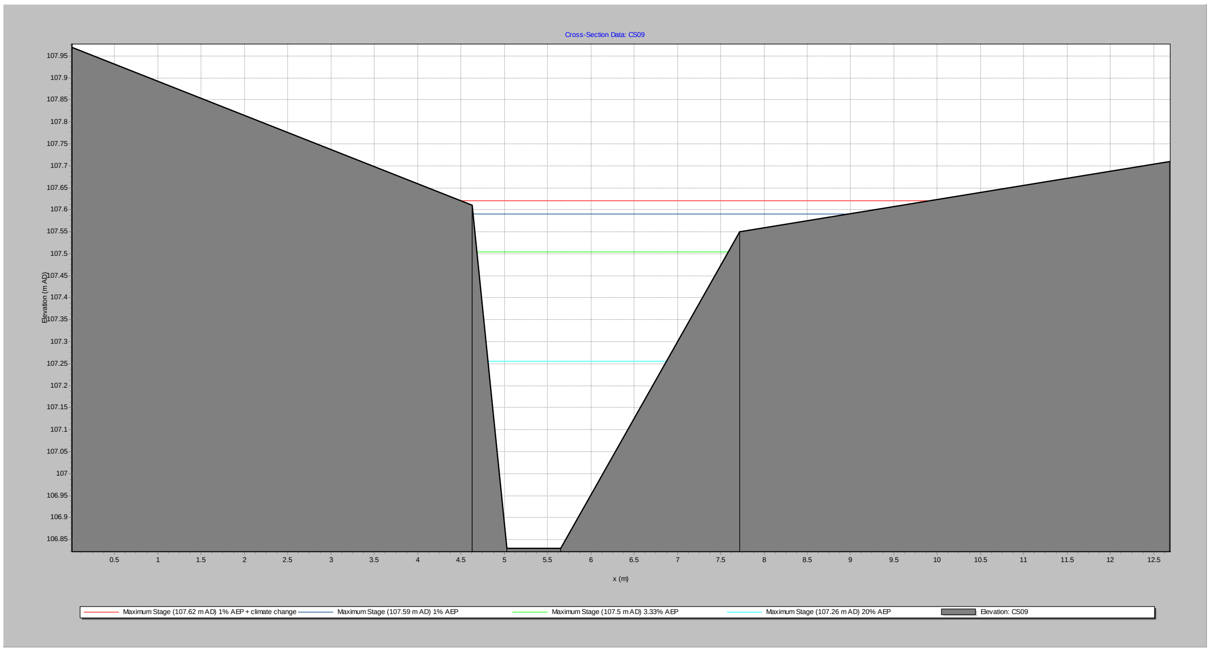

Figure F.9 Peak levels at cross section CS09

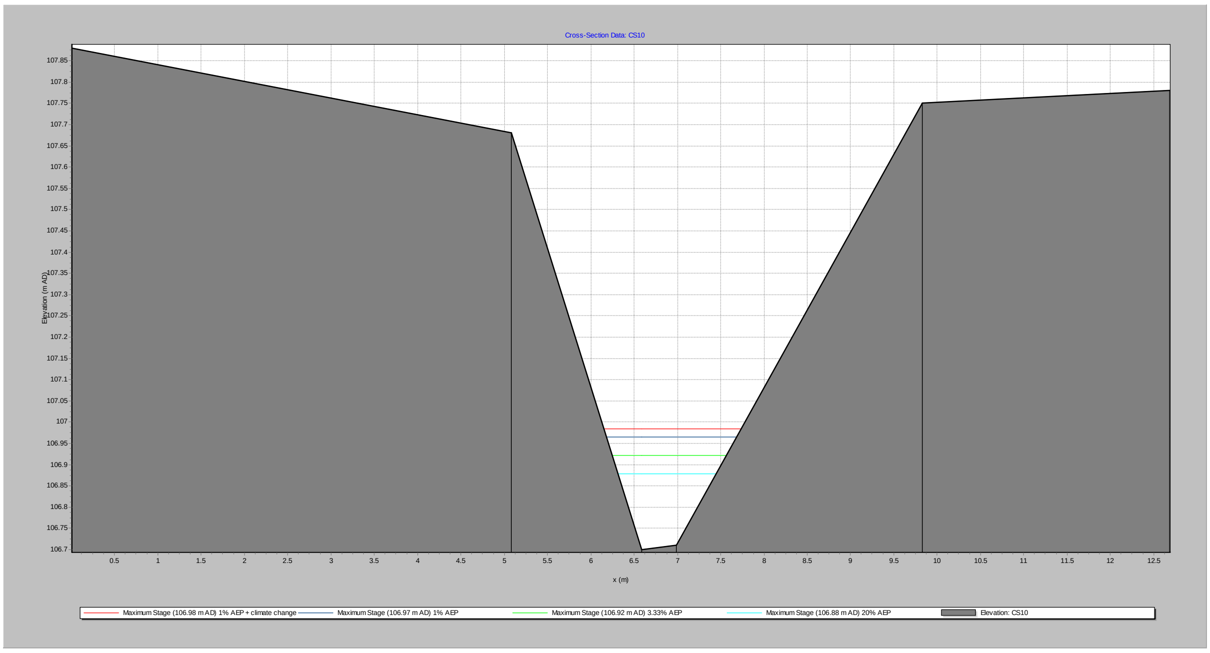

Figure F.10 Peak levels at cross section CS101

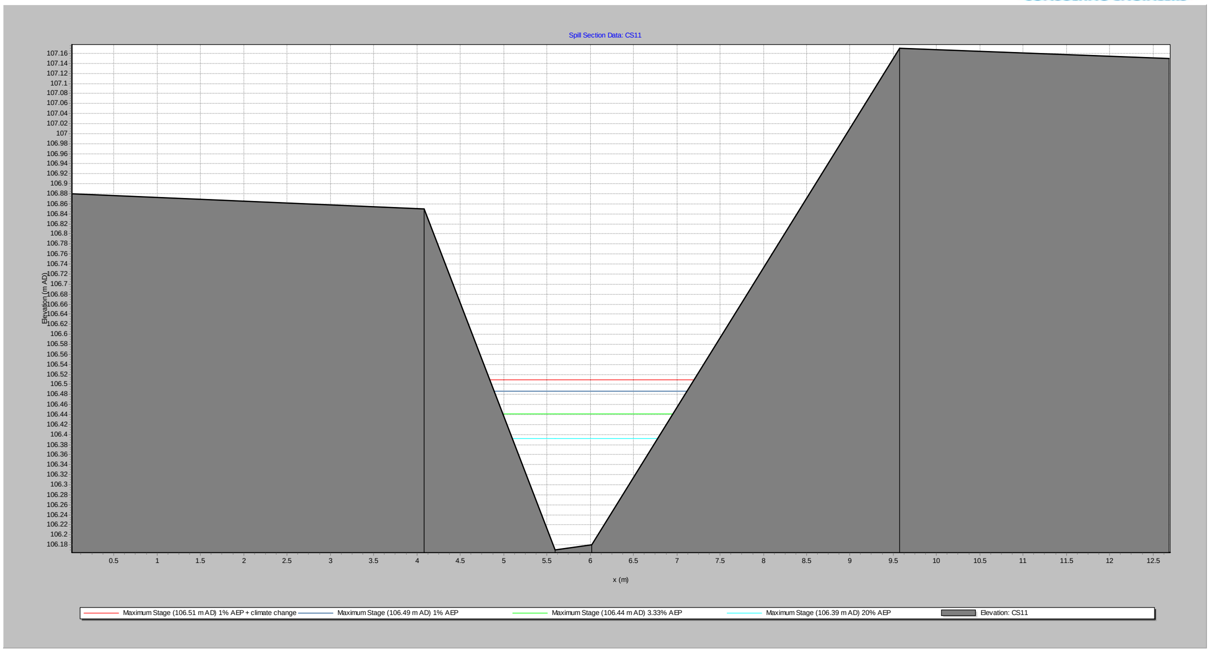

Figure F.11 Peak levels at cross section CS11

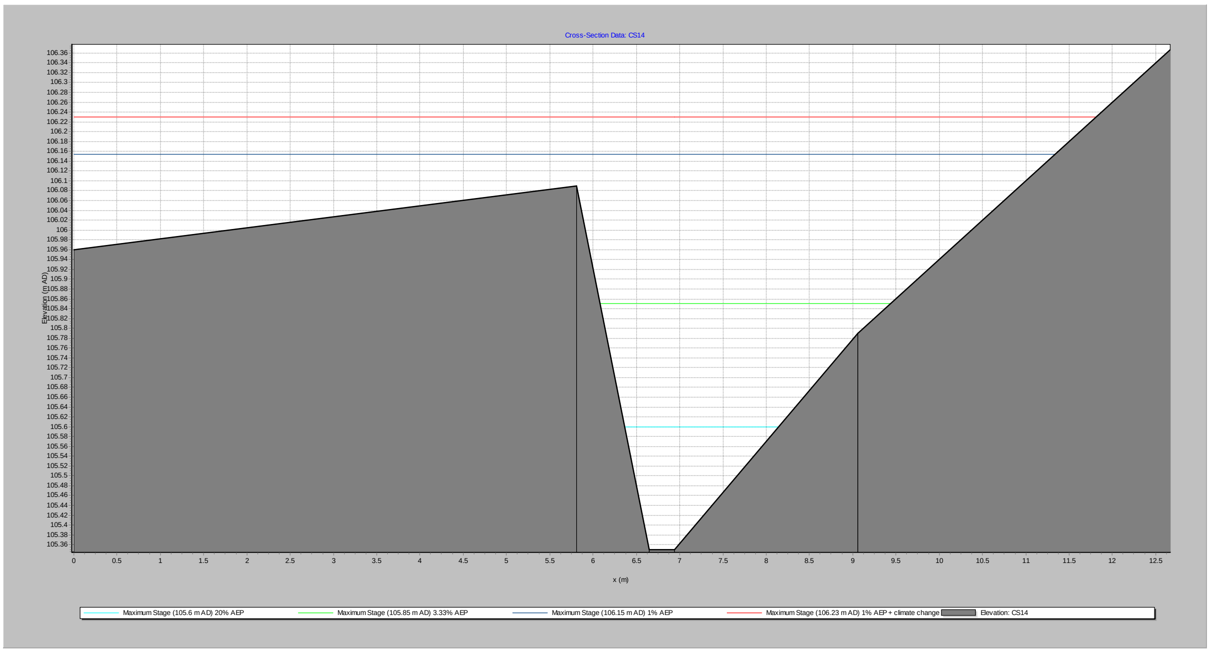

Figure F.12 Peak levels at cross section CS14

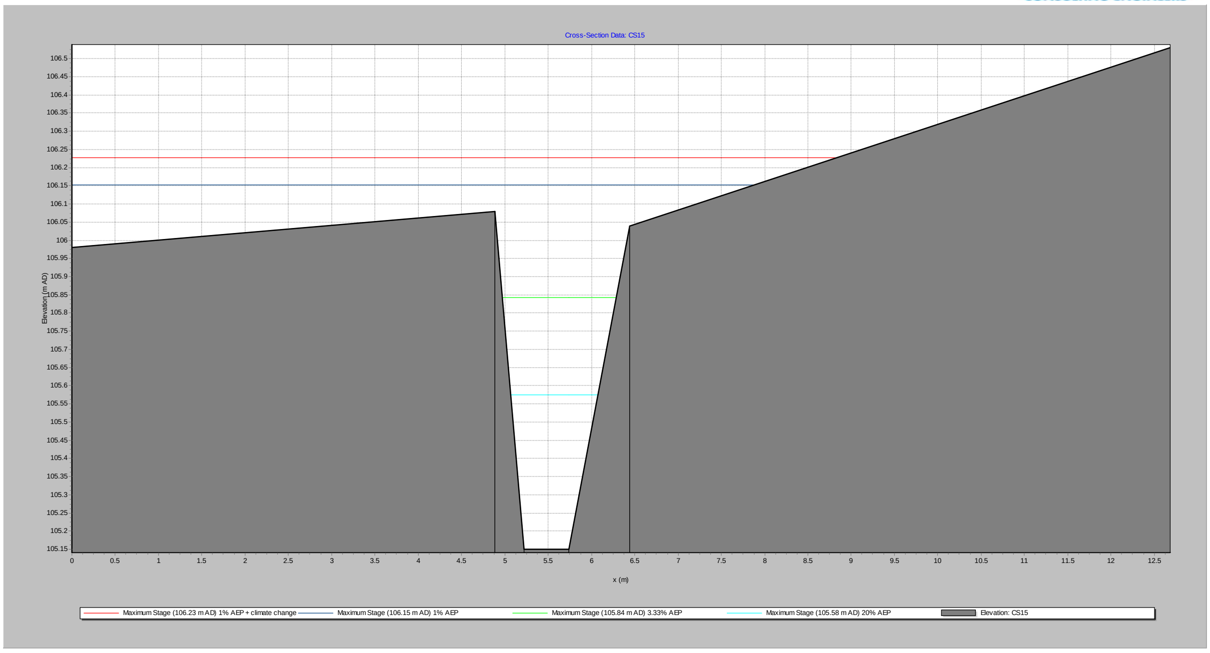

Figure F.13 Peak levels at cross section CS15

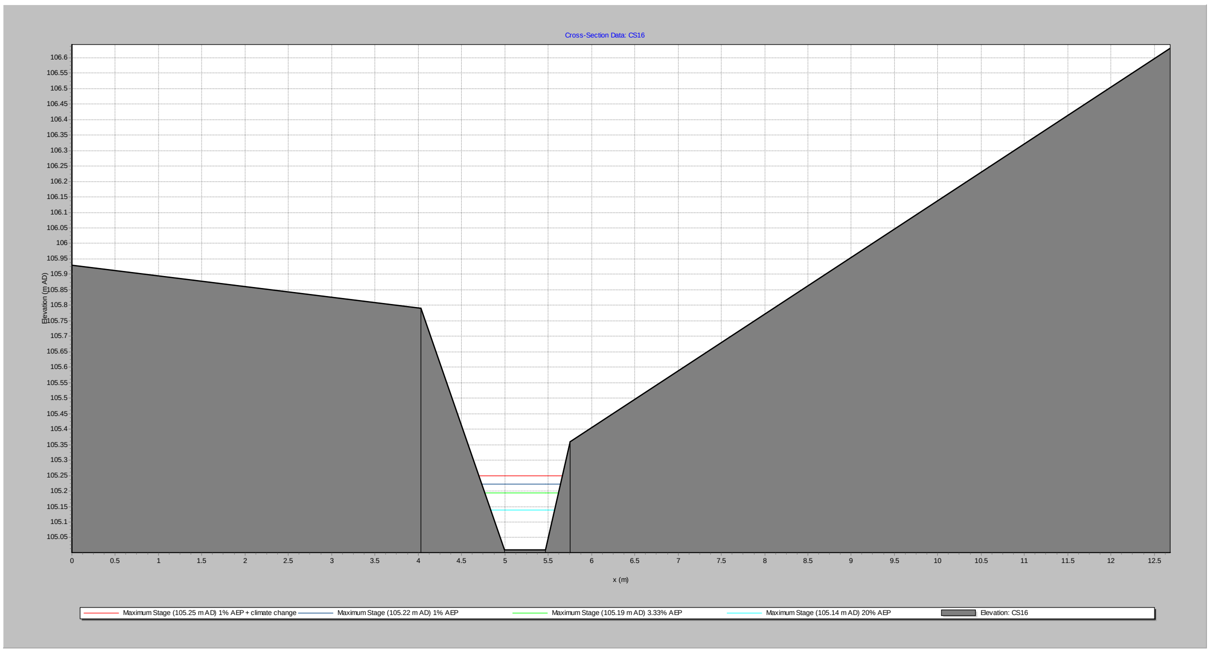

Figure F.14 Peak levels at cross section CS16

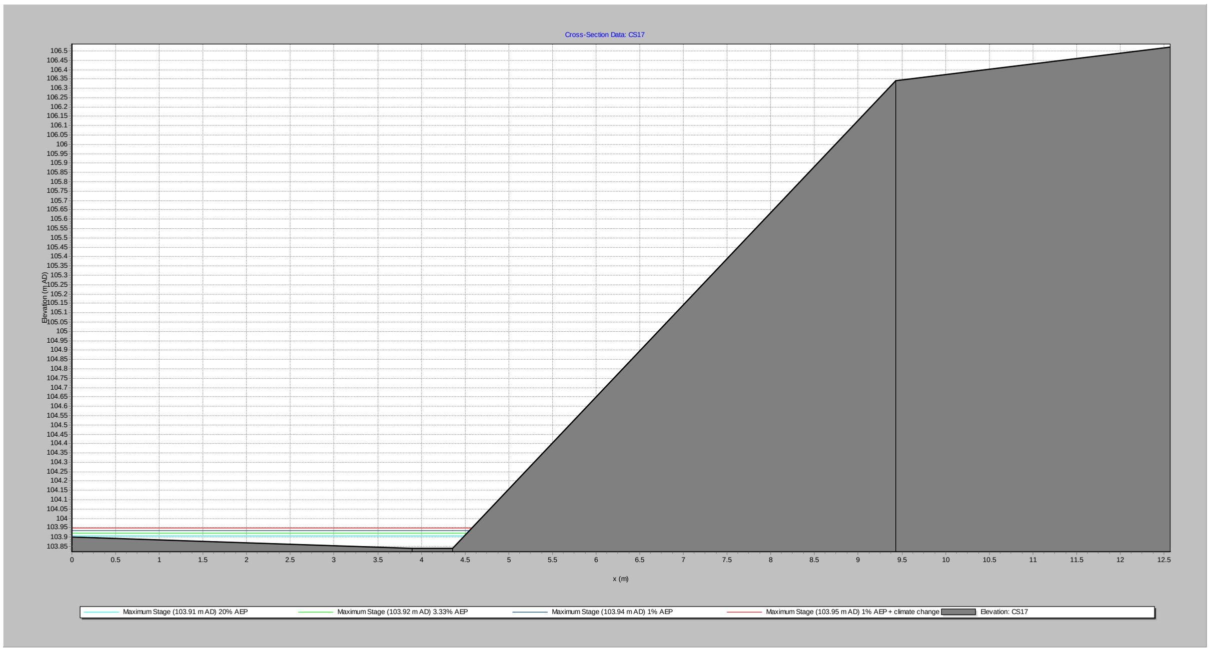

Figure F.15 Peak levels at cross section CS17

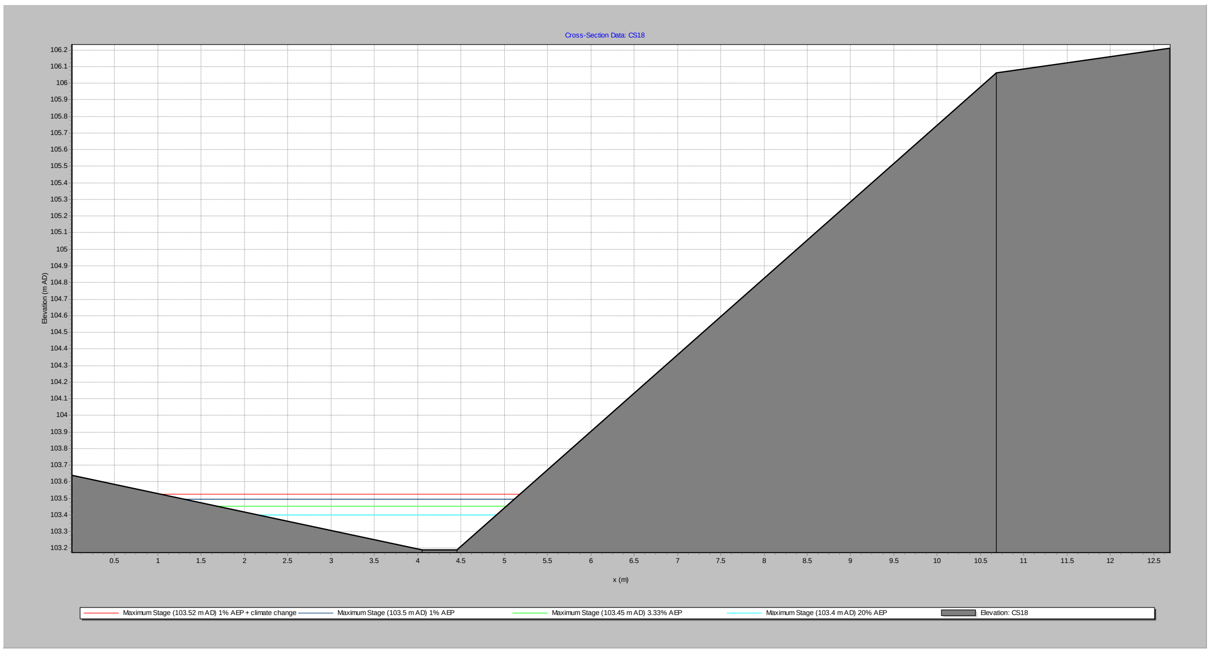

Figure F.16 Peak levels at cross section CS18

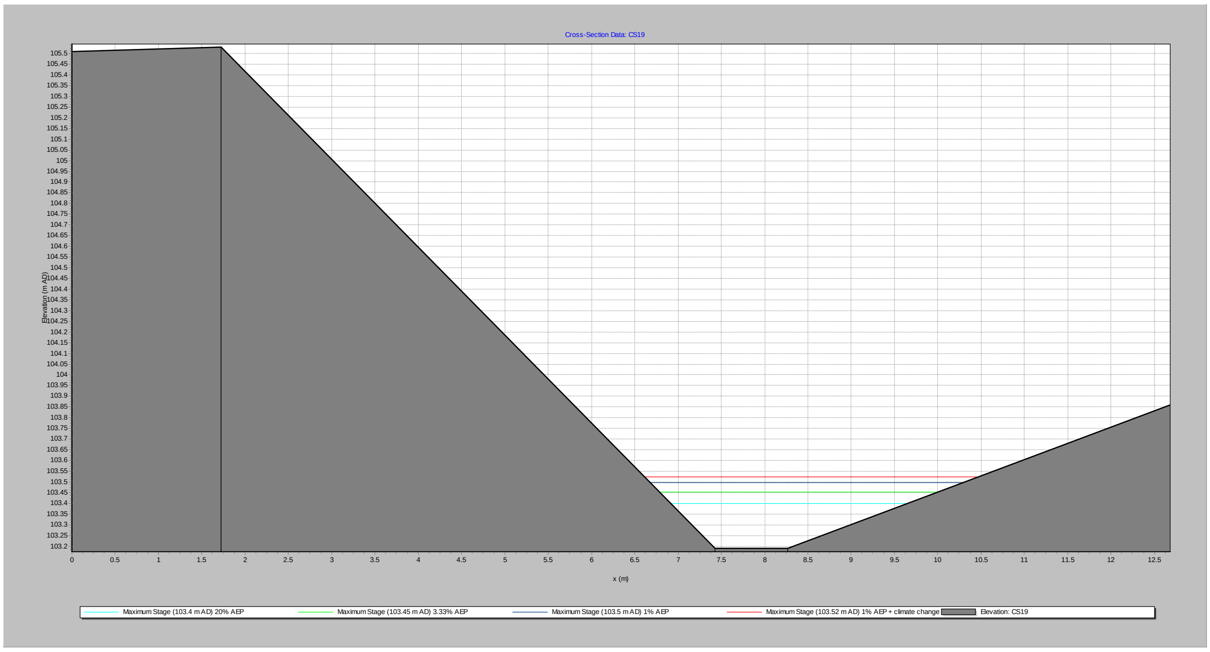

Figure F.17 Peak levels at cross section CS19

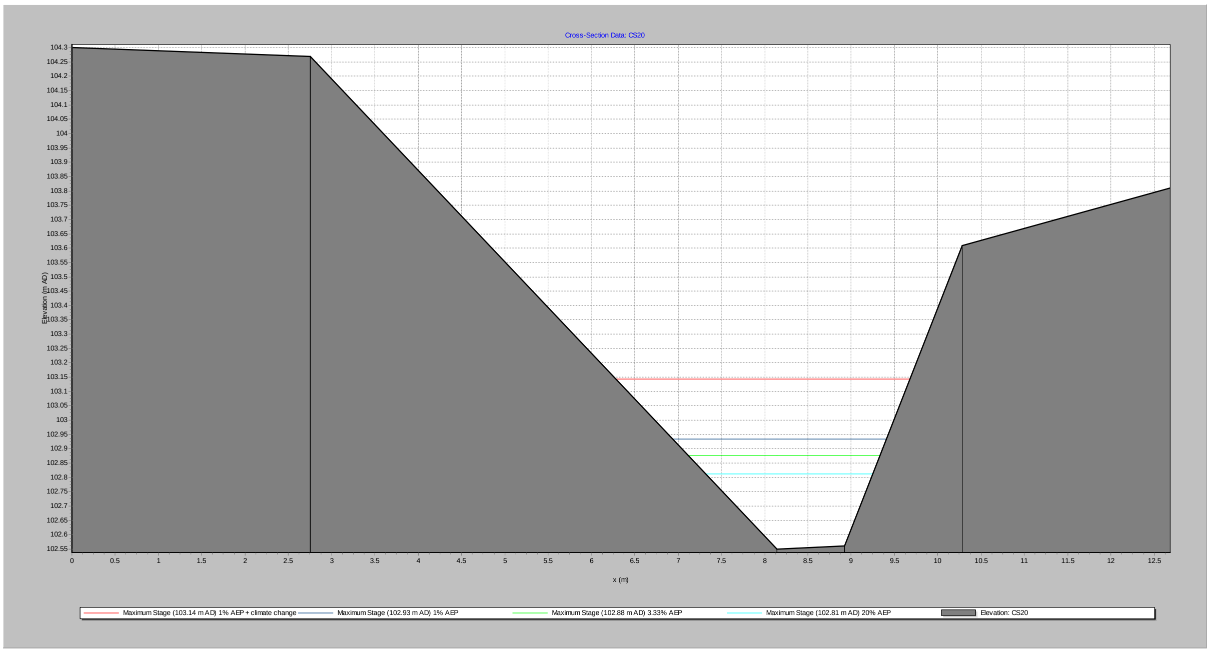

Figure F.18 Peak levels at cross section CS20

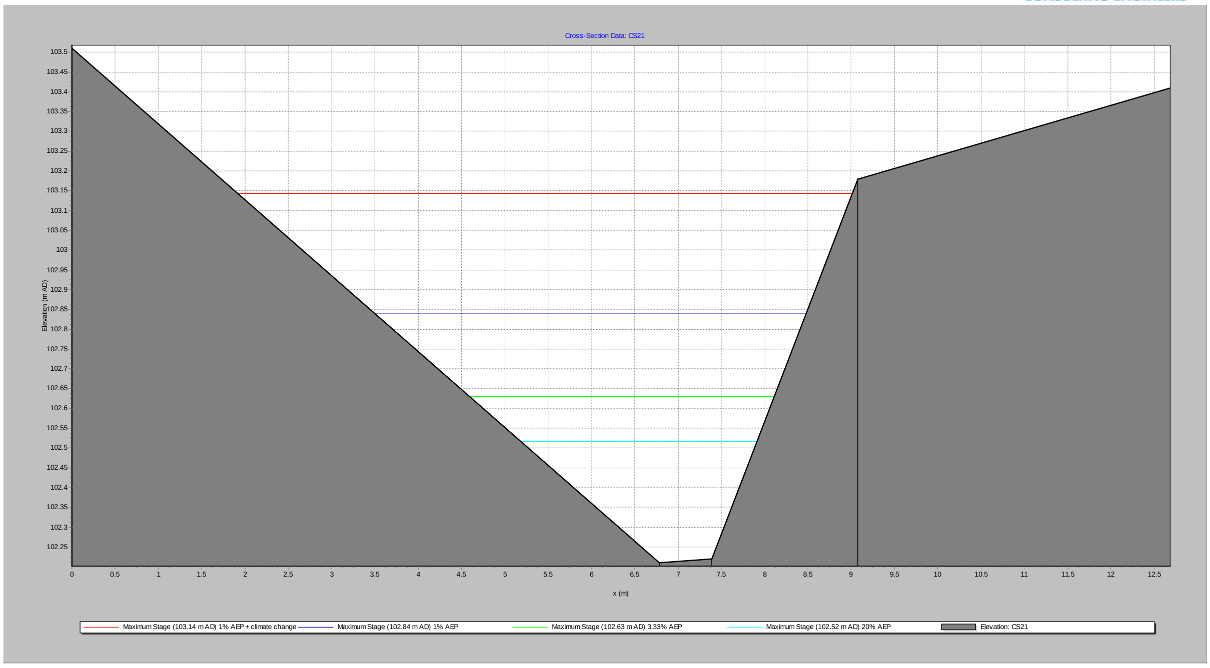

Figure F.19 Peak levels at cross section CS21

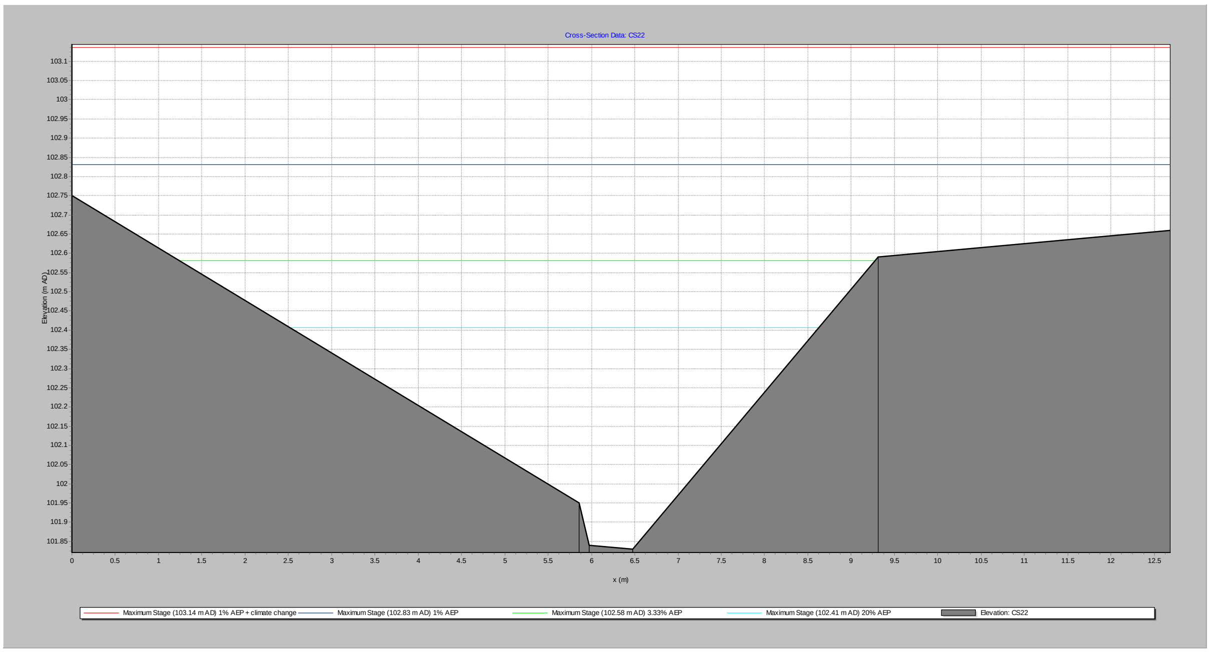

Figure F.20 Peak levels at cross section CS22

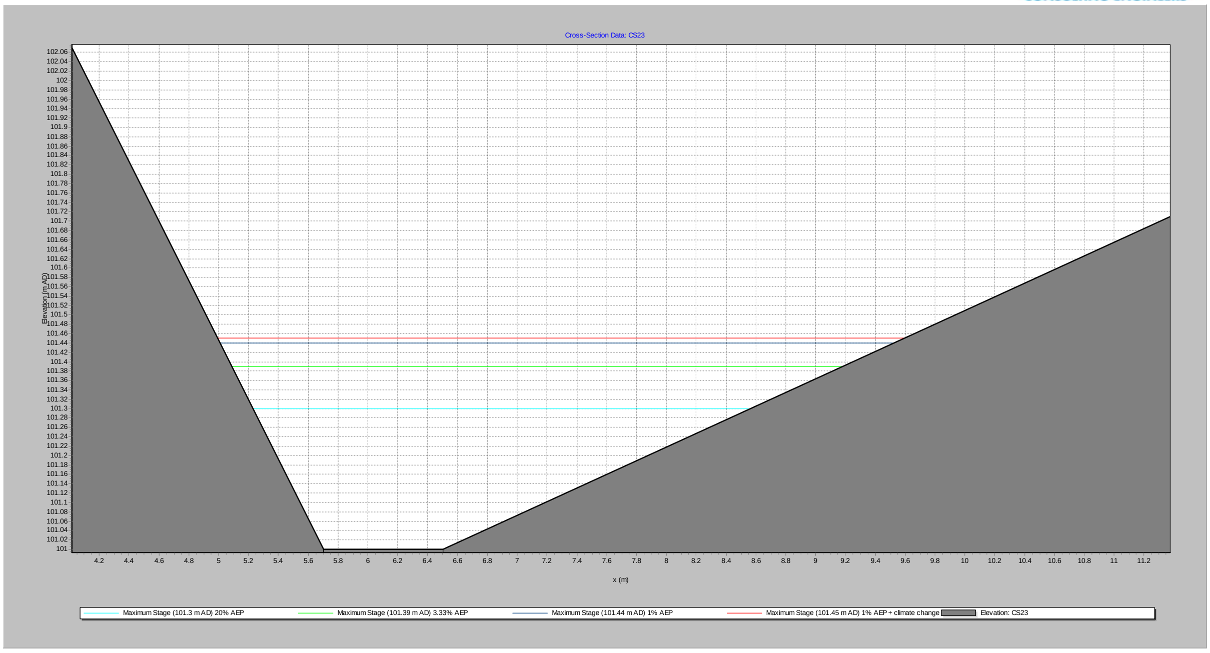

Figure F.21 Peak levels at cross section CS23

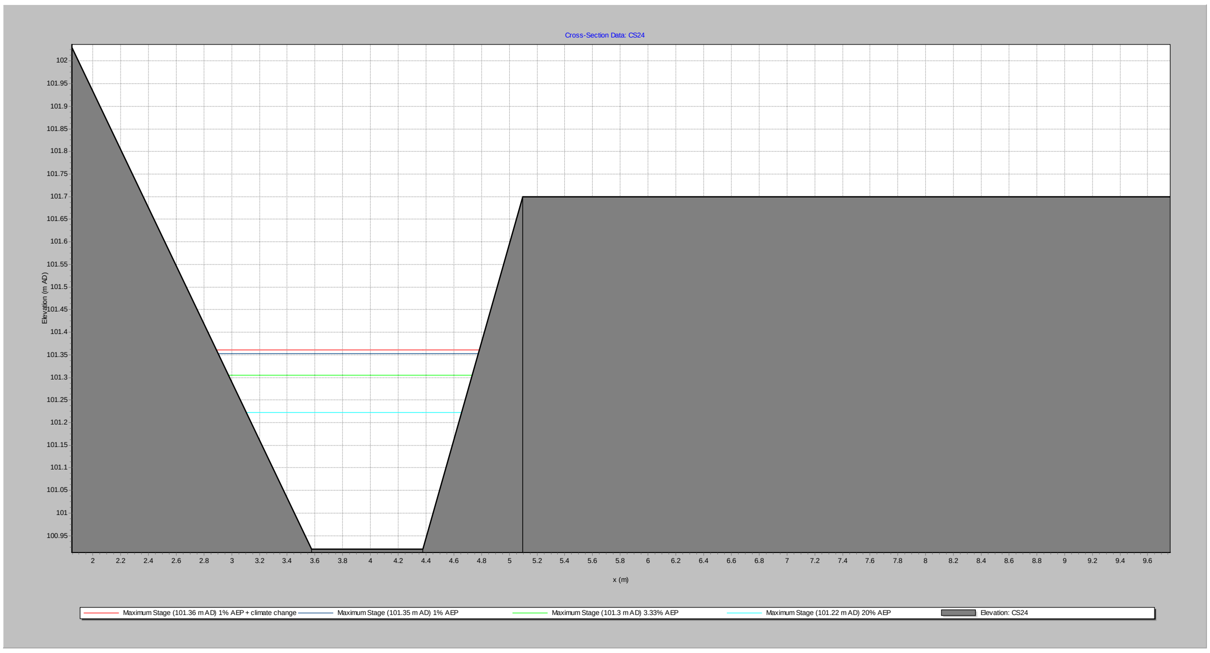

Figure F.22 Peak levels at cross section CS24

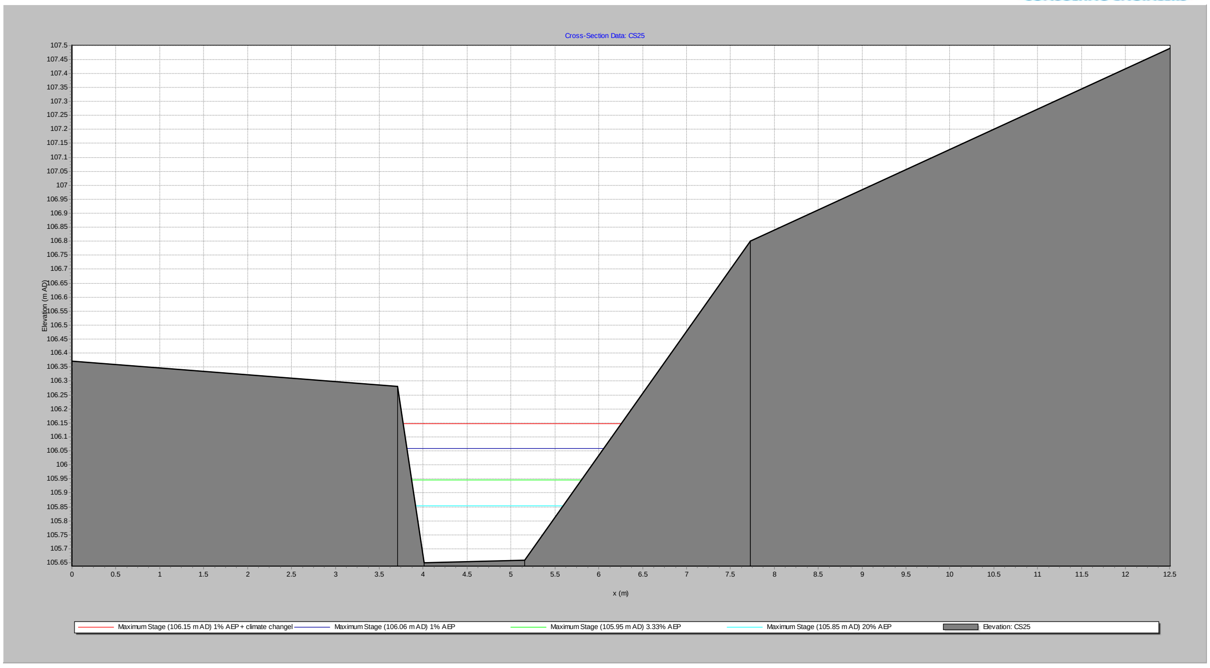

Figure F.23 Peak levels at cross section CS25

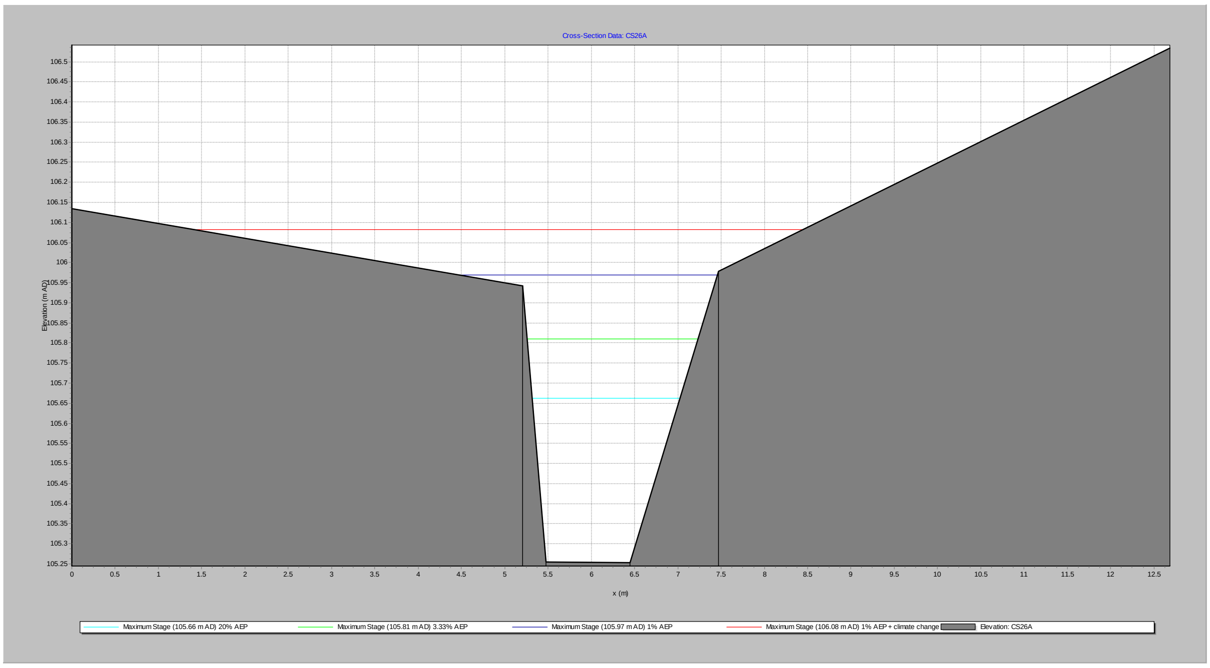

Figure F.24 Peak levels at cross section CS26

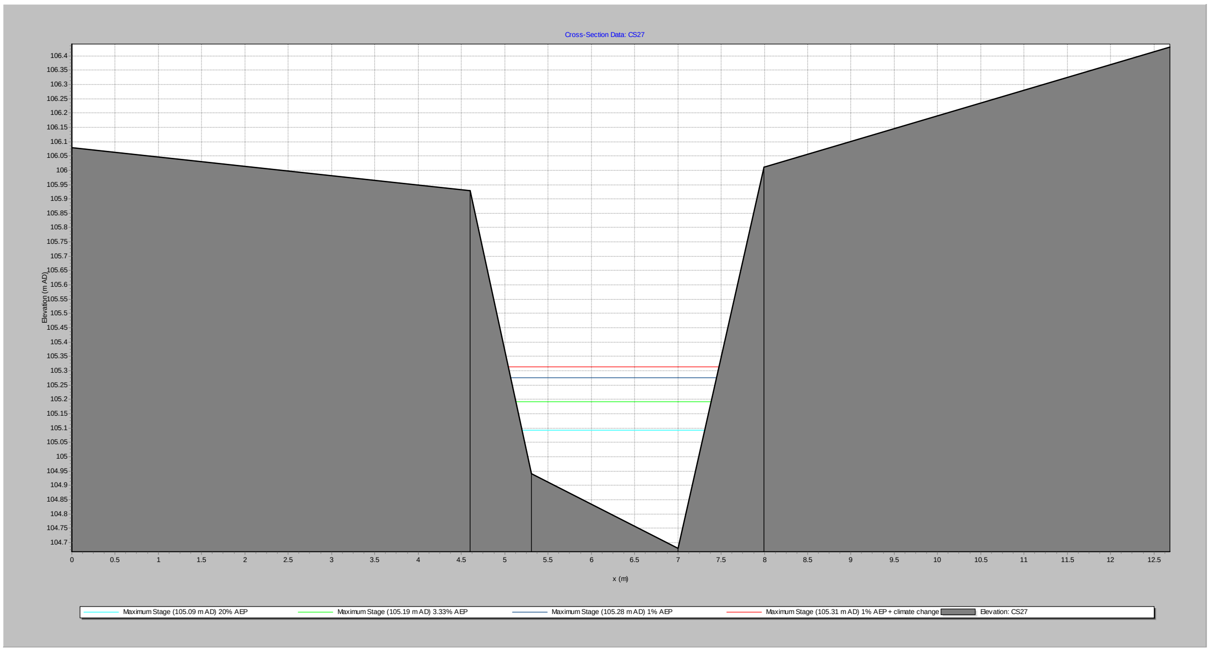

Figure F.25 Peak levels at cross section CS27

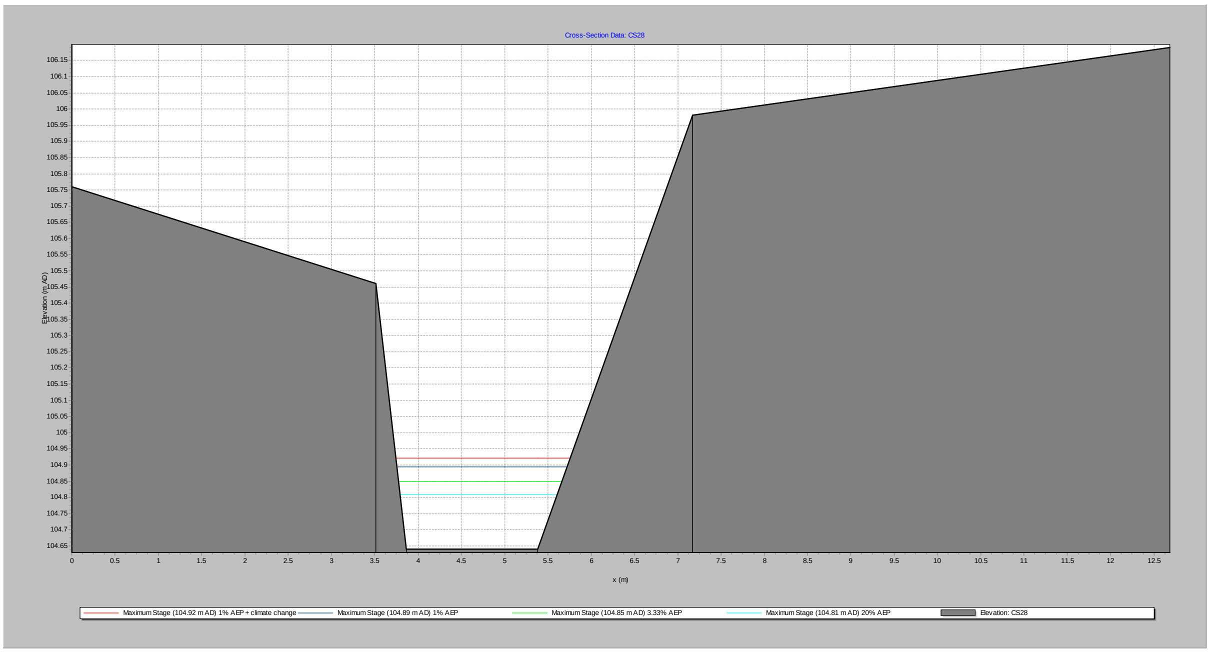

Figure F.26 Peak levels at cross section CS28

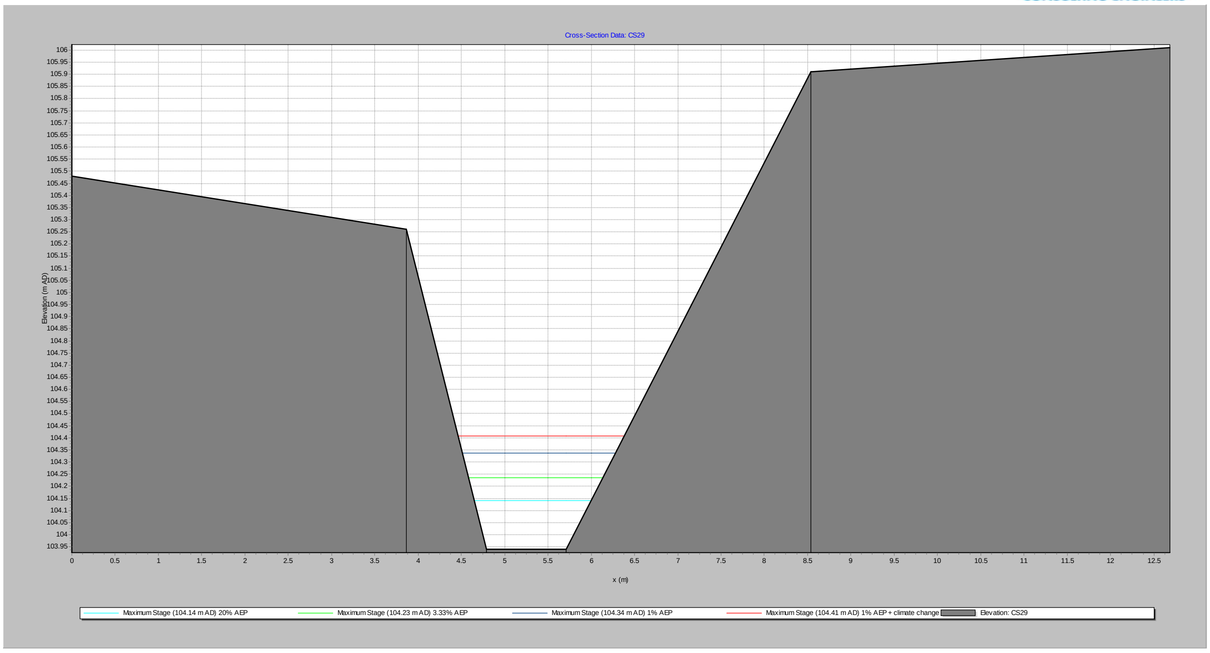

Figure F.27 Peak levels at cross section CS29

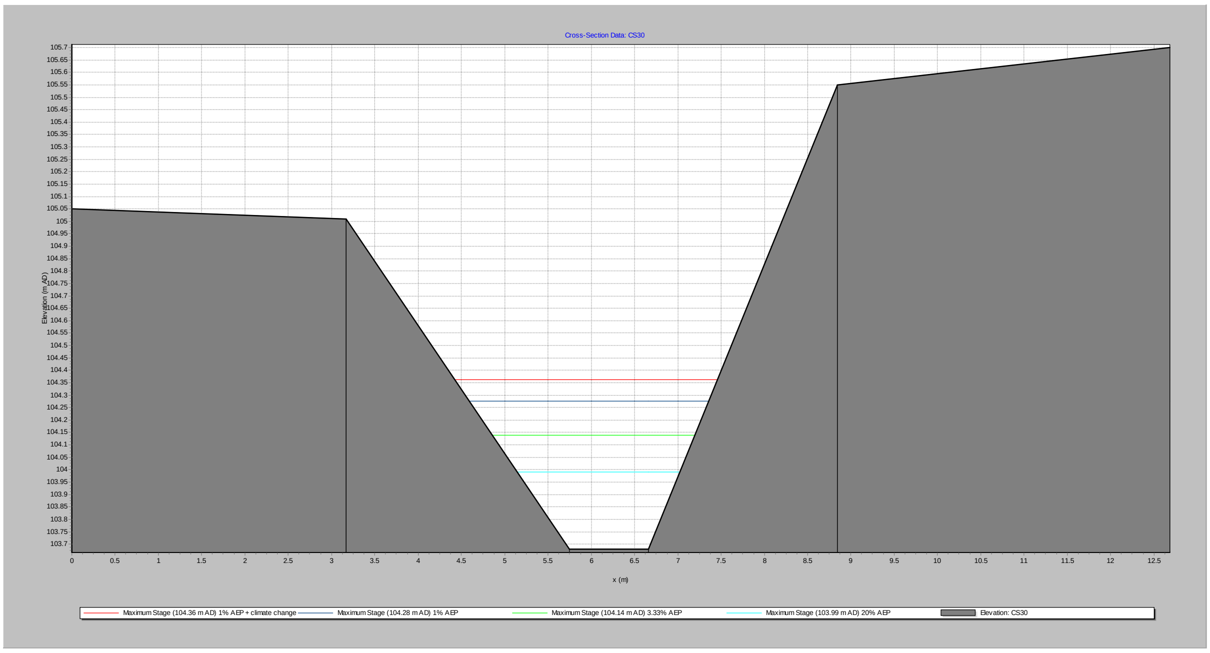

Figure F.28 Peak levels at cross section CS30

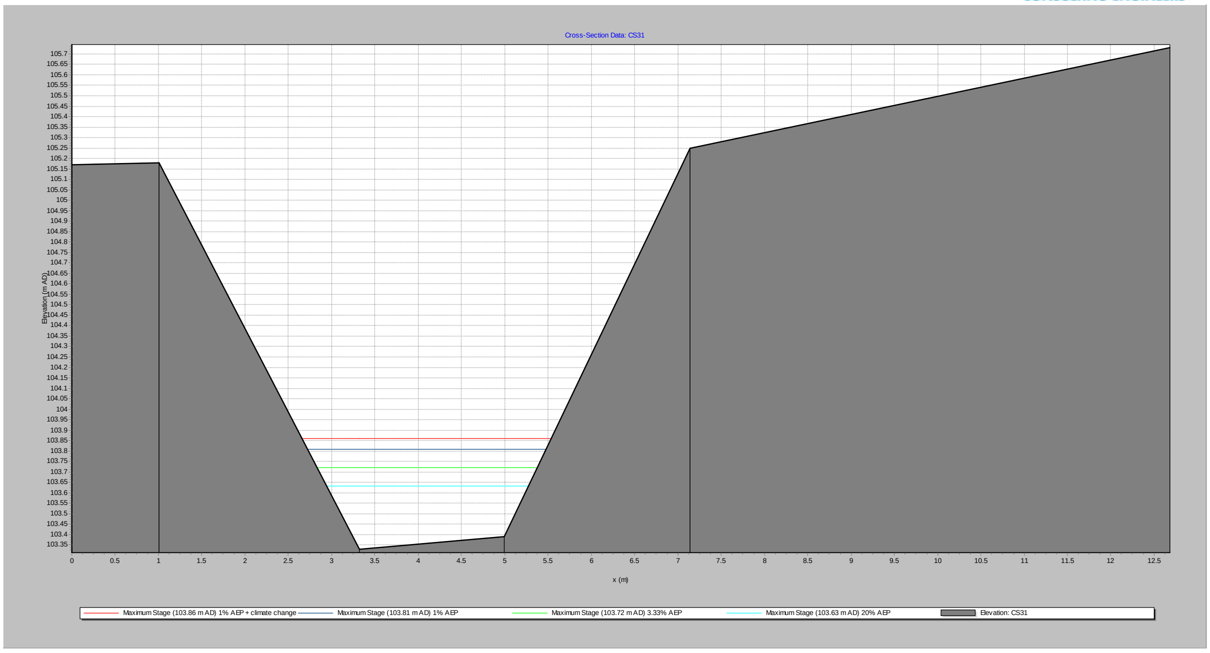

Figure F.29 Peak levels at cross section CS31

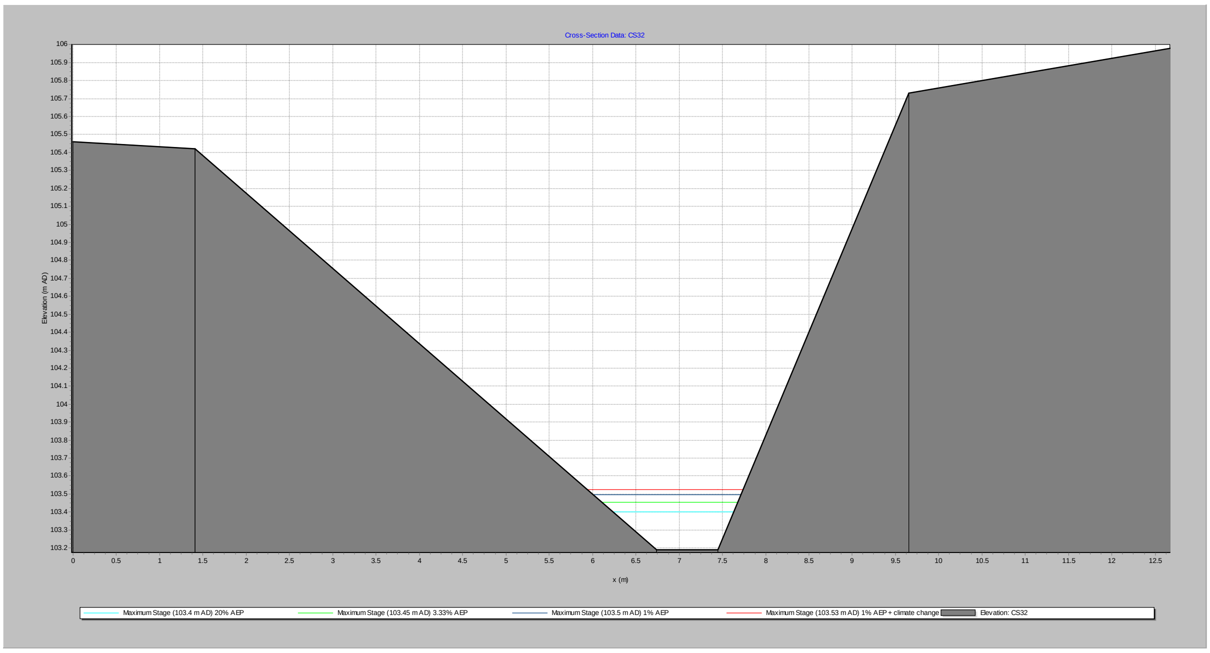

Figure F.30 Peak levels at cross section CS32

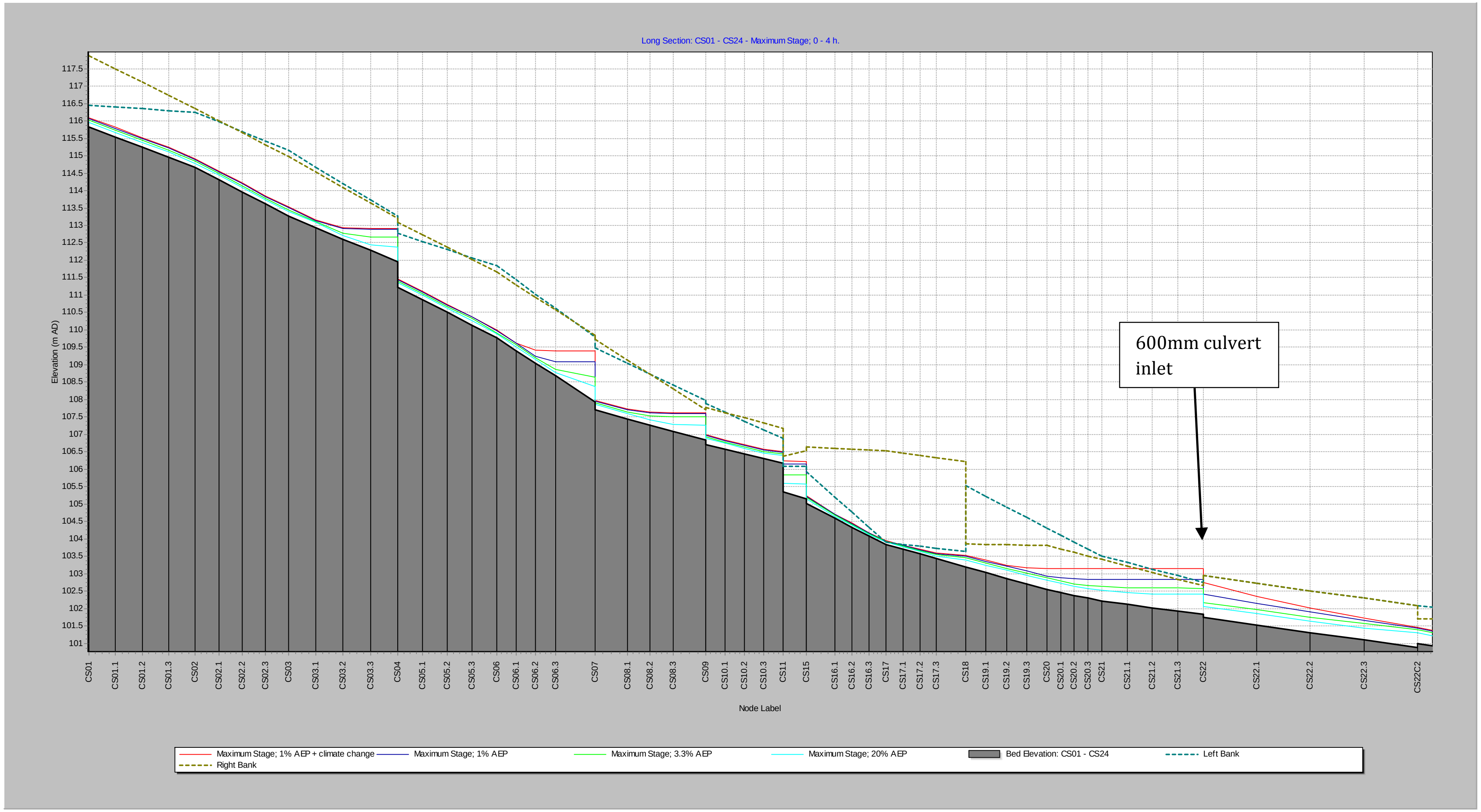

Figure F.31 Long section CS01 to CS24

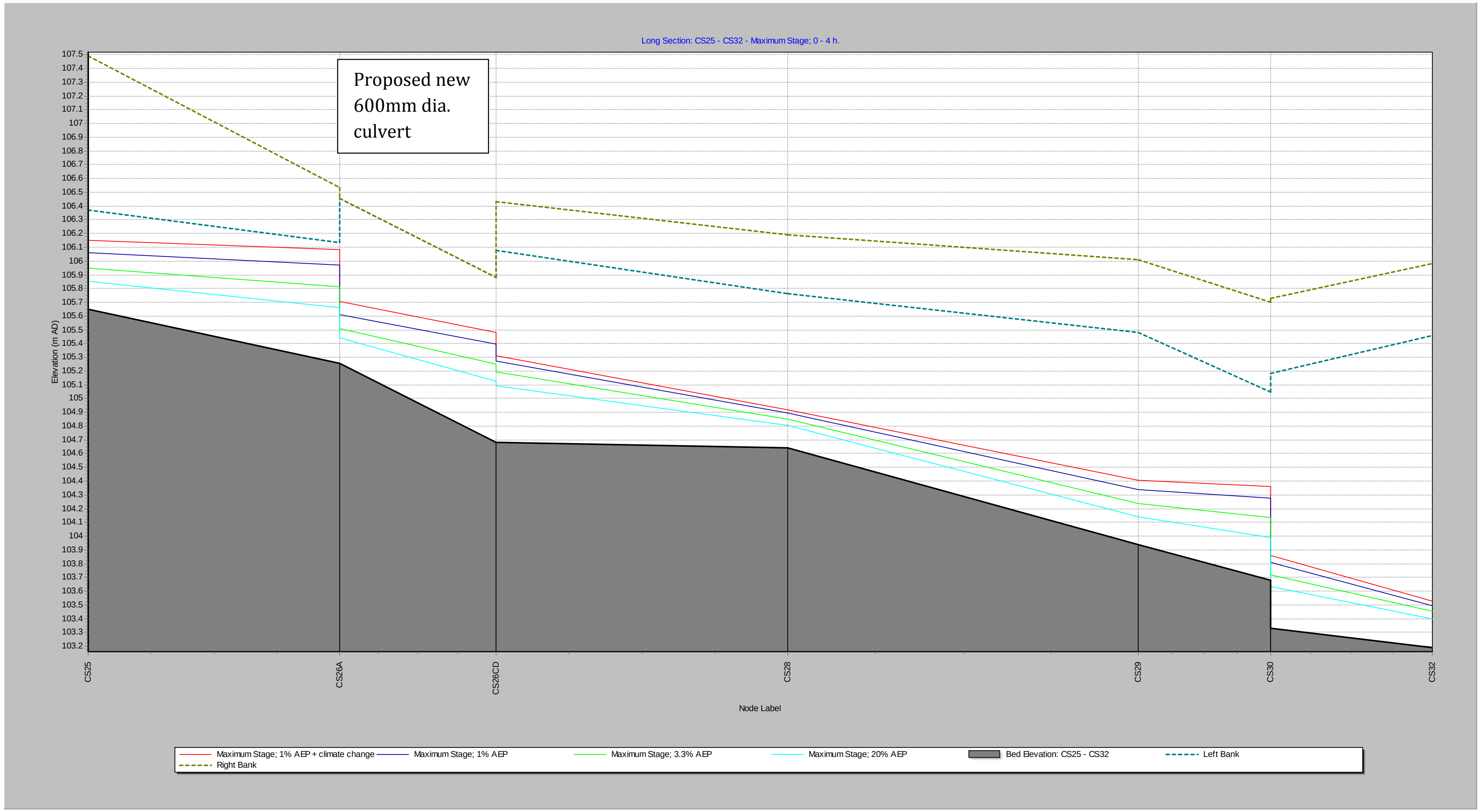

Figure F.32 Long section CS25 to CS32

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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.

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Appendix C
Site Investigation

soiltechnics

environmental and geotechnical consultants

Proposed residential development
Land east of Chipping Lane
Longridge, Preston

Ground Investigation Report
(Phase 2)

Ivy Mill Business Centre, Crown Street, Failsworth, Manchester M35 9BG

t: 0161 9470270 e: mail@soiltechnics.net w: www.soiltechnics.net

soiltechnics
environmental and geotechnical consultants

Proposed residential development
Phase 2
Land East of Chipping Lane
Longridge
Preston
PR3 2NA

GROUND INVESTIGATION REPORT

Soiltechnics Ltd. Ivy Mill Business Centre, Crown Street, Failsworth, Manchester, M35 9BG
Tel: (0161) 9470270 E-mail: mail@soiltechnics.net

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RAILWAY INDUSTRY SUPPLIER QUALIFICATION SCHEME RISQS AUDITED

Aerial photograph of site

Approximate Phase 2 site boundaries edged in pink

Report status and format

Report section	Principal coverage	Report status	
		Revision	Comments
1	Executive summary		
2	Introduction		
3	Desk study information and site observations		
4	Fieldwork		
5	Ground conditions encountered		
6	Laboratory testing		
7	Engineering assessment		
8	Chemical contamination		
9	Gaseous contamination		
10	Effects of ground conditions on building materials		
11	Landfill Issues		
12	Further investigations		
13	Remediation statement		
14	Drawings		

List of drawings

Drawing	Principal coverage	Status	
		Revision	Comments
01	Site location plan		
02a	Plan showing existing site features and location and extent of development phases		
02b	Plan showing existing site features and location of exploratory points		
03	Plan showing site development proposals and location of exploratory points		
04	Plot summarising results of pocket penetrometer determinations		
05	Plot summarising results of hand held shear vane determinations		
06	Plot summarising results of Dynamic Cone Penetration (DCP) testing		

List of appendices

soiltechnics
environmental and geotechnical consultants

1 Executive summary

General

We recommend the following executive summary is not read in isolation to the main report which follows.

Site description, history and development proposals

The site comprised three open grassed fields separated by mature hedgerows and sporadic trees, positioned on the north-western outskirts of Longridge, Preston. It is understood that the land is currently used by livestock for grazing. Localised ponding of surface water was evident across the site. Higgin Brook is also recorded adjacent to the north-western boundary. Historically the site has remained undeveloped farm land. We understand the scheme in its entirety will comprise the construction of up to 363 dwellings within what is termed Phases 1 and 2 (refer to Drawing 02a for details), with associated landscaping, gardens, hardstanding and access roads. This report refers to the Phase 2 area only in which 245 dwellings are proposed.

Ground conditions encountered

Near surface soils generally comprised Topsoil (to depths of between 0.2m and 0.4m) overlaying cohesive Devensian Till deposits to beyond depths of investigation (>3.2m). Till comprised low to very high strength brown mottled grey and orange brown/grey, slightly silty to silty, slightly sandy, slightly gravelly clay in the initial 1m-1.5m below surface level. Below such depths deposits generally exhibit an increase in shear strength and trend towards a brown mottled grey, dark brown and reddish brown colour with varying amounts of silt, sand and gravel. Made Ground was also present in four locations and extended to depths between 1.2m and 2.0m. It is considered possible these soils are associated with some general infilling of depressions on the site and possibly historic ponds.

Foundation solution

Traditional strip/trench fill type foundations considered suitable for the site, located at a minimum depth of 0.9m. Foundations will require deepening locally due to the presence of Made Ground, extending to depths of between 1.5m and 2.3m in such areas. CBR value of 2.17% considered representative of near surface soils. Buried concrete at the site would be classified as DS-1 AC-1s based on to sulphate levels in Made Ground and Devensian Till. Infiltration testing indicates that the near surface Devensian Till deposits are impermeable. Severe instability in foundation/service trenches is unlikely. No groundwater recorded at the site. Refer to Section 7 for further details and recommendations on additional investigations.

Chemical and gaseous contamination

We have not identified any significant chemical or gaseous contamination at the subject site, therefore, remediation is not considered necessary. We recommend that hardness values within surface waters of Higgin Brook are determined to enable a more detailed risk assessment to be completed in relation to water receptors. It is unlikely that protected water supply pipes will be required at the site.

2 Introduction

2.1 Objectives

2.1.1 This report describes a ground investigation carried out for the Phase 2 area of a proposed residential development located on land east of Chipping Lane, Longridge, Preston PR3 2NA.

2.1.2 The objective of the ground investigation was to establish ground conditions at the site, sufficient to identify possible foundation solutions for the development and provide parameters necessary for the design and construction of foundations.

2.1.3 The investigation included an evaluation of potential chemical and gaseous contamination of the site leading to the production of a risk assessment in relation to contamination.

2.1.4 A Phase 1 Desk Study Assessment has been previously undertaken for the site by Curtins Consulting Ltd (ref EB1355/GL/3692 Revision A dated April 2014). A copy of their report is presented in Appendix L. We understand that we have the benefit of using such information and have provided a summary of the data in Section 3 of this report. This will also form a basis for our interpretative chemical and gaseous contamination assessments presented in Sections 8 and 9 respectively.

2.1.5 The investigation has also been produced to support a planning application for the site (ref 3/2014/0764) by satisfying National Planning Policies Framework sections 120 and 121.

2.2 Client instructions and confidentiality

2.2.1 The investigation was carried out in February 2016 and reported in April 2016 acting on instructions received from our client Barratt Homes (Manchester).

2.2.2 This report has been prepared for the sole benefit of our above named instructing client, but this report, and its contents, remains the property of Soiltechnics Limited until payment in full of our invoices in connection with production of this report.

2.2.3 Our original investigation proposals were outlined in our correspondence to Barratt Homes of 20th January 2016. The investigation generally followed our original investigation proposals. The investigation process was also determined to maintain as far as possible the original investigation budget costs.

2.3 Site location and scheme proposals

2.3.1 The National Grid reference for the site is 360447, 437970. A plan showing the location of the site is presented on Drawing 01, with the extent of the development phases presented on Drawing 02a.

2.3.2 We understand the scheme in its entirety will comprise the construction of up to 363 dwellings within what is termed Phases 1 and 2 (refer to Drawing 02a for details), with associated landscaping, gardens, hardstanding and access roads. This report refers to the Phase 2 area only in which 245 dwellings are proposed.

2.3.3 We have received layout drawings of the proposed scheme with the layout presented on Drawing 03.

2.4 Report format and investigation standards

2.4.1 Sections 2 to 6 of this report describe the factual aspects of the investigation with Section 7 presenting an engineering assessment of the investigatory data. Section 8 provides a risk assessment of chemical contamination based on readily available historic records, inspection of the soils and laboratory testing. Section 9 provides a similar risk assessment in relation to gaseous contamination with Section 10 providing a risk assessment relating to construction materials likely to be in contact with the ground. Section 11 discusses issues relating to classification of waste soils for disposal and reuse.

2.4.2 This investigation integrates both contamination and geotechnical aspects. The investigation was carried out generally, and where practical following the recommendations of BS EN 1997:2 2007 '*Eurocode 7 – Geotechnical Design – Part 2: Ground Investigation and Testing*'. The investigation process also followed the principles of BS10175: 2011 *'Investigation of potentially Contaminated Sites – Code of Practice'*. The following elements, defined in BS10175, have been completed and incorporated in this report.

a) Phase I — Preliminary investigation (desk study) – review of existing Phase 1 report undertaken by Curtins Consulting Ltd and site reconnaissance undertaken by Soiltechnics Ltd
b) Phase II — Exploratory and main (intrusive) investigations

2.4.3 The extent and result of the preliminary investigation (desk study) undertaken by Curtins Consulting Ltd, in addition to site reconnaissance undertaken by Soiltechnics Ltd, is reported in Section 3. Fieldwork combined the exploratory investigation and main investigation stages into one phase with the extent of these works described in Sections 4 and 6 of this report. Any supplementary investigations deemed necessary are identified in Section 12. Section 13 provides information on any remedial strategy and specification if required.

2.5 Status of this report

2.5.1 This report is final based on our current instructions.

2.5.2 This investigation has been carried out and reported based on our understanding of best practice. Improved practices, technology, new information and changes in legislation may necessitate an alteration to the report in whole or part after publication. Hence, should the development commence after expiry of one year from the publication date of this report then we would recommend the report be referred back to Soiltechnics for reassessment. Equally, if the nature of the development changes, Soiltechnics should be advised and a reassessment carried out if considered appropriate.

2.6 Report distribution

2.6.1 This report has been prepared to assist in the design and planning process of the development and normally will require distribution to the following parties, although this list may not be exhaustive:

Table summarising parties likely to require information contained in this report

Party	Reason
Client	For information/reference and cost planning.
Developer/Contractor/project manager	To ensure procedures are implemented, programmed and costed.
Planning department	Potentially to discharge planning conditions.
Environment Agency	If ground controlled waters are affected and obtain approvals to any remediation strategies.
Independent inspectors such as NHBC/Building Control	To ensure procedures are implemented and compliance with building regulations.
Project design team	To progress the design.
Principal Designer (PD)	To advise in construction risk identification and management under the Construction (Design and Management) Regulations.

Table 2.6

3 Desk study information and site observations

3.1 General

3.1.1 A Phase 1 Detailed Desk Top Study has been previously undertaken for the site by Curtins Consulting Ltd (reference EB1355/GL/3692, revision A, issue 01, dated 14th April 2014). A copy of their report is presented in Appendix L. We understand that we have the benefit of using such information and have provided a summary of the data in following paragraphs, together with our own site observations. It should be noted that we have tailored the information to suite the current site boundary for the Phase 2 development area, which is shown in a slightly different position in the Curtins report.

3.2 Description of the site

3.2.1 The site is positioned on the north-western outskirts of Longridge, Preston, at an elevation of between approximately 106m and 117m AOD and with the topography of the site falling in a north-westerly direction. The site, approximately 7.7Ha in size, comprised three open grassed fields separated by mature hedgerows and sporadic trees between approximately 2m and 15m in height. It is understood that the land is currently used by livestock for grazing. Localised ponding of surface water was evident across the site. Higgin Brook is recorded along part of the north-western site boundary and flows in a north-easterly direction. Each parcel of land onsite was accessed via a gate within the hedge line. Manhole covers were also present in south-western corner of the site. An underground services access area was also located along the southern boundary.

3.2.2 The site was bound to the north, west (Phase 1 area) and east by further open grassed fields. Residential housing bordered the site to the south. A supermarket was located off the south-western corner of the site.

3.2.3 A plan showing existing site features and location of exploratory points is presented as Drawing 02b.

3.3 Injurious and invasive weeds and asbestos

3.3.1 Injurious and invasive weeds

3.3.1.1 The following weeds are controlled under the Weeds Act 1959:

- Common ragwort
- Spear thistle
- Creeping (or field) thistle
- Broad-leaved dock
- Curled dock

3.3.1.2 Whilst it is not an offence to have the above weeds growing on your land, you must:

- Stop them spreading to agricultural land, particularly grazing areas or land used for forage, like silage and hay
- Choose the most appropriate control method for the your site
- Not plant them in the wild

3.3.1.3 Should you allow the spread of these weeds to another parties land, Natural England could serve you with an Enforcement Notice. You can also be prosecuted if you allow animals to suffer by eating these weeds.

3.3.1.4 In addition to the above, you must not plant in the wild or cause certain invasive and non-native plants to grow in the wild as outlined in the Wildlife and Countryside Act 1981. It is an offence under section 14(2) of the act to *'plant or otherwise cause to grow in the wild'* any plants listed in schedule 9, part II. This can include moving contaminated soil or plant cuttings. The offence carries a fine or custodial sentence of up to two years. The most commonly found invasive, non-native plants include:

- Japanese knotweed
- Giant hogweed
- Himalayan balsam
- Rhododendron ponticum
- New Zealand pigmyweed

3.3.1.5 You are not legally obliged to remove these plants or to control them. However, if you allow Japanese knotweed to spread to another party's land, you could be prosecuted for causing a private nuisance.

3.3.1.6 The presence of such weeds on site may have considerable effects on the cost/ timescale in developing the site. Japanese knotweed can cause significant damage to buildings, roads and pavements following development, if untreated prior to development.

3.3.1.7 Our investigations exclude surveys to identify the presence of injurious and invasive weeds. We did not observe any obvious evidence the above species; however, we recommend specialists in the identification and procedures to deal with injurious and invasive weeds are appointed prior to commencement of any works on site.

3.3.2 Asbestos

3.3.2.1 Our investigations exclude surveys to identify the presence or absence of asbestos on site. It should be noted, however, that where intrusive investigations were undertaken we did not observe any obvious evidence of potential asbestos containing materials. This information does not constitute a site-specific risk assessment and we recommend specialists in the identification and control/disposal of asbestos are appointed prior to commencement of any works on site.

3.3.2.2 The presence of asbestos on site may have considerable effects on the cost/timescale in developing the site. There is good guidance in relation to asbestos available on the Health and Safety Executive (HSE) website.

3.4 History of the site

3.4.1 The recent pertinent history of the site, updated from the Curtins summary to reflect the current site boundary, is presented in the following table:

Summary description of site history

Date	On site	Off site
1847	Open fields including a number of small ponds and marshy areas.	Surrounding land predominantly agricultural. A road is located to the south-west of the site. Quarrying works recorded between 500m and 1000m east of the site.
1893 to 1914	No significant change	Higgin Brook partially borders the site to the north-west. Some development to the west and south of the site including Pitt Street Mills (Corn & Bone) and a smithy are some 90m to the west. An iron and brass foundry was present c.440m to the west of the site.
1932 to 1956	No significant change	The Pitt Street Mills (Corn & Bone) and smithy buildings recorded as a Bobbin works.
1961 to 1967	No significant change	The Bobbin works is no longer recorded and the site has been redeveloped as Ashley Dairy, which borders the site to the south-west. Some residential development has also occurred to the west.
1968 to 1975	No significant change	The iron and brass foundry was labelled as a works. Significant development is occurring to the south of the site.
1975 to 1996	No significant change	No significant changes
2001 to 2013	No significant change	Ashley Dairy has been redeveloped as a superstore.

Table 3.4.1

3.5 Geology and geohydrology of the area

3.5.1 Geology of the area

3.5.1.1 The geology of the area, updated from the Curtins summary to reflect the current site boundary, is presented in the following table:

Summary of geology and likely aquifer-containing strata					
Stratum	**Bedrock or superficial**	**Approximate thickness**	**Typical soil type**	**Likely permeability**	**Aquifer designation**
Devensian Till	Superficial	>5m	Clay with silt and sand	Low	Unproductive strata (r)
Pendleside Sandstone Member	Bedrock	Up to 50m	Sandstone with mudstone and siltstones	Low to moderate	Secondary A aquifer (r)
Bowland Shale Formation	Bedrock	Up to 200m	Mudstone, siltstone with sandstones	Low to moderate	Secondary A and secondary undifferentiated aquifers (r)

Table 3.5.1

(r) recorded aquifer designation
(a) assumed aquifer designation

3.5.1.2 Unproductive strata are defined as deposits exhibiting low permeability with negligible significance for water supply or river base flow. Unproductive strata are generally regarded as not containing groundwater in exploitable quantities.

3.5.1.3 Secondary A aquifers are predominantly permeable layers capable of supporting water supplies at a local, rather than strategic, scale. In some cases, Secondary A aquifers can form an important source of base flow to rivers.

3.5.1.4 Secondary undifferentiated aquifer is a designation used when it is not possible to attribute fully one of either Secondary A or Secondary B, due to the variable nature of the soils. The unit will therefore be a mix of both, which are defined as follows:

- Secondary A can be defined as: Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.
- Secondary B can be defined as: layers which may store limited amounts of ground water. These groundwater stores are generally the water bearing parts of former aquifers.

3.5.2 Water abstractions

3.5.2.1 There are no potable groundwater abstraction licences within 2km of the site. The only surface water abstraction within a 2km radius of the site is associated with field drains located approximately 445m to the south of the site. Details of the water's use are not supplied. There are two groundwater abstractions within a 2km radius of the site.

They are both associated with Singletons Dairy (Mill Farm, Preston) and are located approximately 890m and 975m to the south of the site. The abstracted water is used for general purposes.

3.5.2.2 The site is not located within a zone protecting a potable water supply abstracting from a principal aquifer (i.e. a source protection zone).

3.5.3 Coal mining and brine extraction

3.5.3.1 The site is not recorded to be within an area affected by past or present coal mining, minerals worked in association with coal, or brine extraction (within the Cheshire Brine Compensation District). The site does not lie within a coal mining referral area and, as such, a Coal Authority report is not required.

3.5.4 Shallow mining and natural subsidence hazards

3.5.4.1 The British Geological Survey presents hazard ratings for shallow mining and natural subsidence hazards. The site has the following ratings:

Table summarising mining and subsidence hazards	
Hazard	**Rating**
Mining hazard in non-coal mining areas	Highly unlikely
Potential for collapsible ground stability hazard	Very low / no hazard
Potential for compressible ground stability hazard	Moderate / no hazard
Potential for ground dissolution stability hazard	Low / very low
Potential for landslide ground stability hazard	Very low
Potential for running sand ground stability hazard	Low / very low
Potential for shrinking or swelling clay ground stability hazard	Very low
Table 3.5.4	

3.5.4.2 The moderate potential for compressible ground stability hazards is likely to be associated with the deposits of Alluvium recorded in northern part of the original site boundary that the Envirocheck encompasses. It should be noted that this area is located approximately 150m to the north-west of the Phase 2 development area.

3.5.5 Borehole records

3.5.5.1 The British Geological Survey (BGS) retains records of boreholes formed from ground investigations carried out on a nationwide basis. However, there are no BGS borehole records in the vicinity of the site.

3.6 Landfill and infilled ground

3.6.1 Within a 2km radius of the site, there are no BGS recorded or historical landfill sites; however, there are two registered landfill sites. Lords Delph (Forty Acre Lane, Longridge) is located approximately 645m to the east of the site and has been accepting non-biodegradable waste since at least 1982. Chapel Hill Quarry is located approximately 960m to the south of the site and accepted non-biodegradable waste; in 1992, the site was recorded as dormant.

3.6.2 In addition, we have reviewed old Ordnance Survey maps and there is no obvious evidence of significant quarrying in the area, other than a small number of BGS mineral sites, recorded between 400m and 850m of the subject site which exploited the underlying clays and grits. The geological map of the area indicates areas of infilled ground which approximately coincide with such areas.

3.7 Radon

3.7.1 Envirocheck uses the British Geological Survey database to review reported radon levels in the area in which the site is located, to establish recommended radon protection levels for new dwellings. The database presented in the Curtins report indicates that the site is located in an area where no protection is considered necessary.

3.7.2 Building Research Establishment (BRE) publication BR211 '*Radon: guidance on protective measures for new buildings*' (2007) applies to all new buildings, conversions and refurbishments, whether they be for domestic or non-domestic use.

3.7.3 It is noteworthy that the BRE information is based on statistical analysis of measurements made in dwellings, in combination with geological units which are known to emit radon. Therefore there is a risk that actual radon levels at the site will exceed the levels assessed by the BRE. Currently, the only true method of checking actual radon levels is by measurement within a building on the site over a period of several months. It should be noted that it is not currently a requirement of the Building Regulations to test new buildings for radon; however, the BRE recommends testing on completion or occupation of all new buildings (domestic and non-domestic), extensions and conversions. Should you wish to undertake radon monitoring following completion of the development, we can provide proposals.

3.8 Flood risk

3.8.1 Based on the information provided within the Curtins report, the site is not located within a fluvial or tidal flood plain. It should be noted that this information does not constitute a site-specific Flood Risk Assessment (FRA) and that a full FRA may be required for the development to support a planning application or to satisfy planning conditions.

3.9 Enquiries with Statutory Undertakers

3.9.1 We have been provided with the following Statutory Undertaker (SU) records in order to avoid damaging their apparatus during our fieldwork activities:

a) BT Openreach
b) Electricity North West
c) ESP Utilities Group
d) National Grid Gas
e) United Utilities

3.9.2 Copies of these records are presented in Appendix J. These records have been obtained solely for the purposes described above.

3.9.3 Normally Statutory Undertakers' drawings record the approximate location of their services. We recommend further on-site investigations be undertaken to confirm the position of the apparatus and thus establish the effect on the proposed development and the necessity or otherwise for the permanent or temporary diversion of the service to allow the construction of the development to safely and successfully proceed.

3.9.4 It should be noted that a United Utilities surface water sewer crosses the south-western part of the site and discharges into Higgin Brook. We are not aware that the supply to such services has been capped off-site and, as such, they should be treated as live until further information indicates otherwise.

3.9.5 It should be noted that Statutory Undertakers' records normally exclude private services.

3.10 Enquiries with Local Authority Building Control and Environmental Health Officers

3.10.1 We have contacted the Local Authority Building Control and are awaiting a response. We will update this report if anything of concern arises.

3.10.2 We have contacted the Local Authority Environmental Health Officer, who has confirmed that no gas monitoring is required on this site, due to the limited number of sources and pathways in the area (refer to Section 9 for further details). A copy of their correspondence is presented in Appendix K.

4 Fieldwork

4.1 General

4.1.1 Fieldwork was carried out between the 16th and 18th February 2016 and comprised the following activities:

- Excavation of twenty five exploratory trial pits.
- Excavation of eight exploratory boreholes using driven tube sampler drilling techniques.
- Dynamic cone penetration testing in three locations.
- Infiltration testing undertaken in two trial pits.

4.1.2 A plan of the site showing observed/existing site features and position of exploratory points is presented on Drawing 02b. The position of exploratory points relative to site development proposals is presented on Drawing 03. The position of exploratory points shown on these plans is approximate only and confirmation of these positions is subject to dimensional surveys, which is considered outside our brief.

4.1.3 The extent of fieldwork activities and position of exploratory points were determined by Soiltechnics Limited.

4.1.4 Exploratory points were positioned to avoid known locations of underground services, to avoid possible location of proposed foundations and to provide a reasonable coverage of the site. Prior to commencement of exploratory excavations an electronic cable locating tool was used to scan the area of the excavation. If we received a response to this equipment then the excavation would be relocated.

4.1.5 All soils exposed in excavations were described in accordance with BS EN ISO 14688 *'Identification and Classification of soil'*.

4.2 Site restrictions

4.2.1 No significant site restrictions were encountered during investigations with the exception that trial pit excavations were undertaken using tracked plant due to waterlogged nature of the site and care was taken to avoid the 375mm diameter surface water sewer which cuts across the southern most parcel of land and outfalls into Higgin Brook.

4.3 Exploratory trial pits

4.3.1 Trial pits TP101 to TP125 were excavated to a maximum depth of 3.3m using a 360° tracked excavator. The excavations were backfilled with excavated material compacted using the back of the excavator bucket. Whilst we attempted to reinstate the excavation to its original condition the soils could not be fully compacted into the trial pit and thus the soils were left proud of the ground surrounding the pit to allow for short-term settlement of the backfill. A Geotechnical Engineer supervised the excavations.

4.3.2 Sampling and logging was carried out as trial pit excavations proceeded but trial pits were not entered at depths exceeding 1.2m, or where sides were deemed unstable. The density of granular soils encountered in excavations was gauged by the ease of excavation by spade or penetration of a geological pick.

4.3.3 Soil samples for subsequent laboratory determination of concentration of chemical contaminants were taken from the sides of trial pits and stored in new plastic containers, which were labelled and sealed. Samples from below access depth into trial pits were taken as a sub sample from soil contained in the excavator bucket, discarding any soil, which may have been in contact with the bucket. If as a consequence of visual or olfactory evidence, a sample was suspected to be contaminated by organic material, the sample was stored in an amber glass jar with a PTFE sealing washer.

4.3.4 Soil samples for subsequent 'classification' laboratory testing were taken from the side of trial pits or from bulk samples taken from the excavator bucket. The sample was placed in a plastic bag and subsequently sealed and labelled. Samples for moisture content determination were placed in sealable tubs and appropriately labelled.

4.3.5 Soil samples were obtained to meet quality class 3 to 5 as described in BS EN I997-2:2007. Sample sizes were appropriate for the laboratory test being considered.

4.3.6 A hand held shear vane was used where possible to provide a measure of the undrained shear strength of cohesive soils exposed in excavations. The vane test was carried out in the sides and floor of trial pits by access into the trial pit to depths of 1.2 metres. At depths in excess of 1.2 metres the tests were undertaken using extension rods to a maximum depth of 3.4 meters or by carrying out tests on intact clods of cohesive soils (exceeding 0.3m x 0.3m x 0.3m) removed from the trial pit using the excavator bucket. The apparatus reads to a maximum shear strength of 213kN/m^2 following conversion of the readout or 'division' taken from the instrument. Conversion is either undertaken using the calibration chart or by multiplying the division by the shear strength constant supplied with the instrument. The results are reported in columns to the right of the trial pit record. The shear vane is not a reliable tool for assessing insitu shear strength of stony or sandy cohesive soils.

4.3.7 A pocket penetrometer was also used in the cohesive soils encountered. This tool is deemed to measure the apparent ultimate bearing capacity of the soil under test. The pocket penetrometer is calibrated in kg/cm^2. The reading can be approximately converted to equivalent undrained shear strength by multiplying the results by a factor of 50. Tests were carried out in the sides of trial pits when access can be safety achieved otherwise testing was carried out on excavated intact clods. The results are reported in columns to the right of trial pit results. The pocket penetrometer is not covered by British Standards. This tool has the advantage that it can be used to determine the approximate insitu undrained shear strength of stony cohesive soils.

4.3.8 A summary of pocket penetrometer and hand held shear vane results obtained from the cohesive soils encountered in exploratory excavations are presented in graphical format on Drawings 04 and 05 respectively.

4.3.9 Trial pit records are presented in Appendix C.

4.3.10 Soil infiltration tests were carried out in trial pits TP107 and TP114 at depths of between 1.3m and 2.8m. Infiltration tests were carried out following the procedures described in the Building Research Establishment (BRE) Digest 365 (2007) "*Soakaway Design*", with records of test results presented in Appendix E. Water placed in each trial pit did not dissipate and soils are considered to be effectively impermeable.

4.4 Driven tube sampling

4.4.1 Boreholes DTS101 to DTS108 were formed using driven tube sampling equipment. Driven tube sampling comprises driving 1m long steel sample tubes which are screw coupled together or coupled to extension rods and fitted with a screw on cutting edge. The sample tubes are of various diameters, generally commencing with 100mm and reducing, with depth, to 50mm and include a disposable plastic liner which is changed between sampling locations in order to limit the risk of cross contamination. On completion of excavation the liner containing the sample is cut open and the soil sample logged by a geo-environmental engineer.

4.4.2 Samples for determination of the concentration of chemical contaminants are taken from samples obtained in the disposable tubes as sub-samples using stainless steel sampling equipment, which is cleaned with de-ionised water.

4.4.3 The driven tube sampler obtains samples under category A allowing laboratory test quality classes 3 to 5 as described in BS EN ISO 22475-1:2006.

4.4.4 A pocket penetrometer was used in the cohesive soils retrieved from the boreholes. This tool is deemed to measure the apparent ultimate bearing capacity of the soil under test. The pocket penetrometer is calibrated in kg/cm^2. The reading can be approximately converted to an equivalent undrained shear strength by multiplying the results by a factor of 50. The results are reported on borehole records. The pocket penetrometer is not covered by British Standards.

4.4.5 A summary of pocket penetrometer results obtained from the cohesive soils retrieved from the boreholes are presented in graphical format on Drawing 04.

4.4.6 Records of boreholes formed using driven tube sampling techniques are presented in Appendix D.

4.5 Dynamic cone penetration testing

4.5.1 Dynamic Cone Penetration (DCP) testing was carried out in three locations. Dynamic Cone Penetration testing consists of driving a 50mm diameter, 90^{o} cone into the ground, via an anvil and extension rods with successive blows of a freefall hammer. The number of blows required to drive the cone each successive 100mm (N100) is recorded.

4.5.2 Dynamic Cone Penetration testing was carried out following BS EN ISO 22476-2:2005 and the apparatus used was categorised as 'super heavy' (DPSH-B) in accordance with the standard.

4.5.3 Dynamic cone penetration test data is presented in graphical format on Drawing 06.

4.6 Sampling strategies

4.6.1 Geotechnical

4.6.1.1 In general we adopted a judgemental sampling strategy in relation to geotechnical aspects of the investigation. The location and frequency of sampling was carried out in consideration of the following:

- i) Topography
- ii) Geology (including Made Ground)
- iii) Nature of development proposals

4.6.2 Environmental

4.6.2.1 Details of sampling with respect to contamination issues are described in Section 8.

4.6.3 Sample retention

4.6.3.1 Samples are stored for a period of one month following issue of this report unless otherwise required.

5 Ground conditions encountered

5.1 Soils

5.1.1 Each exploratory excavation encountered a similar profile of soils considered to be Topsoil overlying Devensian Till deposits. Locally, deposits of Made Ground were also encountered.

5.1.2 **Topsoil** deposits were generally encountered as soft dark brown slightly sandy to sandy slightly gravelly organic clay with frequent rootlets. The gravel comprised quartzite and sandstone. Topsoil was encountered to depths between 0.2m and 0.4m below existing surface levels.

5.1.3 **Made Ground** deposits were encountered in four locations (TP101, TP103, TP108 and TP125) and generally comprised firm high strength brown sandy gravelly clay and medium dense grey and brown clayey sand. The gravel included sandstone, quartzite, brick with localised timber, ceramic, wire and glass. The Made Ground extended to depths between 1.2m and 2.0m.

5.1.4 **Devensian Till** deposits were encountered as cohesive soils across the site, comprising low to very high strength brown mottled grey and orange brown/grey, slightly silty to silty, slightly sandy, slightly gravelly clay in the initial 1m-1.5m below surface level. Below such depths deposits generally exhibit an increase in shear strength and trend towards a brown mottled grey, dark brown and reddish brown colour with varying amounts of silt, sand and gravel.

5.2 Topsoil

5.2.1 As a practice we have adopted the following policy for description of Topsoil. If surface soils exhibit a visually significant organic content and darker colour than the soils it overlies (which are considered to be naturally deposited) then we will describe the soil as Topsoil. In some cases it is difficult to visually distinguish the interface between Topsoil and subsoils below, which may also exhibit an organic content, and in such cases we will adopt an estimate of the interface but may also use the terms 'grading into' with some defining depths.

5.2.2 If 'Topsoil' deposits include materials such as ash, brick and other man made materials, or the Topsoil overlies Made Ground deposits we will term the material 'Made Ground', even though it may still be able to support vegetable growth, and potentially be reused as Topsoil.

5.2.3 Topsoil can be classified following a number of test procedures as described in BS3882: 2007 *'Specification for Topsoil and Requirements for use'*, to allow its uses to be determined. We do not carry out such testing unless specifically instructed to do so.

5.3 Groundwater

5.3.1 A slight seepage of groundwater was observed within TP121 at a depth between 0.5-0.7m. No groundwater inflows were observed in any of the other excavations.

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6 Laboratory testing

6.1 Classification testing

6.1.1 Laboratory testing was carried out in accordance with BS1377: 1990 "*Methods of Test for Soils for Civil Engineering Purposes"* and limited to determination of:

i) the liquid limit (one point cone penetrometer, method 4.4)
ii) the plastic limit and plasticity index (method 5)

6.1.2 Laboratory testing was carried out by an independent specialist testing house, which operates a quality assurance scheme. Copies of laboratory test result certificates are presented in Appendix F.

6.2 Chemical testing

6.2.1 Laboratory testing was carried out as deemed necessary and carried out using the following techniques:

- Using inductively coupled plasma mass spectrometry (ICP-MS), determination of concentration of metals, semi-metals and soluble sulphate.
- Using gas chromatography flame ionisation detection methods (GC–FID), determination of concentration of petroleum hydrocarbons (TPH).
- Using gas chromatography flame ionisation detection methods (GC–FID), determination of concentration of polycyclic aromatic hydrocarbons (PAH).
- Using gas chromatography mass spectrometry (GS–MS), determination of the concentration of Volatile Organic Compounds (VOCs) and Semi-Volatile Organic Compounds (SVOCs).
- Using electromagnetic measurement, determination of pH.

6.2.2 Laboratory testing was carried out by an independent specialist testing house, which operates a quality assurance scheme. Copies of laboratory test result certificates are presented in Appendix G.

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7 Engineering assessment

7.1 General description of the development

7.1.1 The following assessments are made on the investigatory data presented in the preceding sections of this report and are made with reference to the specific nature of the development. Should scheme proposals change then it may be necessary to review the investigation and report.

7.1.2 We understand the scheme in its entirety will comprise the construction of up to 363 dwellings within what is termed Phases 1 and 2 (refer to Drawing 02a for details), with associated landscaping, gardens, hardstanding and access roads. The following assessment refers to the Phase 2 area only, in which 245 dwellings are proposed.

7.2 Building foundation, design and construction

7.2.1 Definitions of geotechnical terms used in the following paragraphs are provided in Appendix A.

7.2.2 Ground conditions

7.2.2.1 A detailed summary of ground conditions is provided in Section 5. Essentially ground conditions comprised of Topsoil overlaying cohesive Devensian Till deposits, the latter comprising low to very high strength brown mottled grey and orange brown/grey clay in the initial 1m-1.5m below surface level. Below such depths deposits generally exhibit an increase in shear strength and trend towards a brown mottled grey, dark brown and reddish brown colour with varying amounts of silt, sand and gravel.

7.2.2.2 A more consistent positive trend was noted in shear strength data derived using the shear vane within the Phase 2 development area compared to those taken within the Phase 1 area (refer to Drawing 05), with strength generally increasing with depth and only very localised softening of soils noted below depths of 2.0m. It is also noted that shear strength data derived using the pocket penetrometer is much more varied, with inconsistent strength measurements recorded with depth. The shear vane is, however, considered to provide much more reliable insitu shear strength results and we have adopted such values in the following foundation assessments.

7.2.2.3 Made Ground was encountered in trial pits TP101, TP103, TP108 and TP125 and extended to depths between 1.2m and 2.0m. The reason for the presence of such Made Ground is unclear as the site has never been developed, however, it is possibly due to infilling of localised depressions or associated with the construction of the underground services identified, particularly in the areas of TP101 and TP103. It is also acknowledged that historic ponds are also recorded adjacent to some areas of Made Ground onsite (TP103 and TP108) and Drawing 02b indicates the positions of these, which could have been backfilled. Foundations will need to extend through any Made Ground into the underlying Devensian Till at depth.

7.2.3 Foundation solution

7.2.3.1 In our opinion naturally deposited Devensian Till will adequately support proposed buildings on concrete strip/trench fill foundations. Based on laboratory determination of plasticity and following National House Building Council (NHBC) Standards Chapter 4.2, we recommend foundations extend to a minimum depth of 0.9m below existing or proposed ground levels whichever gives the deeper founding level. In all cases we recommend foundation excavations fully penetrate any Made Ground and extend into the Devensian Till by a minimum of 0.3m into the naturally deposited soils, subject to an overall minimum foundation depth of 0.9m. Based on such, in areas of the site where Made Ground deposits have been encountered, foundations are likely to be located between depths of 1.5m and 2.3m. It should be noted that there are a number of trees and major vegetation along field boundaries which may require foundation depths exceeding the minimum depth defined above. Further guidance on this is provided in the following report paragraphs.

7.2.3.2 Laboratory testing indicates the Devensian Till deposits are plastic, thus our assessment of bearing values are based on the assumption that these soils predominantly exhibit cohesion. Calculations, based on a conservative undrained shear strength of say $60kN/m^2$ (derived from measured insitu shear strengths taken below proposed founding levels – refer Drawing 05) indicates the following bearing values for strip/trench fill foundations:

Table of bearing values for traditional strip/trench fill foundations

Width (m)	Ultimate bearing value kN/m^2	Presumed bearing value kN/m^2	Allowable bearing pressure kN/m^2
0.45	445	160	150
0.6	420	150	140
0.75	405	145	135
1.0	390	140	130

Table 7.2.3.2

7.2.3.3 The presumed bearing value has been derived from the ultimate bearing value by applying a factor of safety of 3, and the allowable bearing pressure derived to limit total settlement.

7.2.3.4 It is difficult to accurately predict the amount of total and differential movement caused by consolidation of the foundation supporting subsoils, however, providing the foundation loads do not exceed the allowable bearing pressure provided in the preceding paragraph, we suggest total settlement will be small, and probably less than 25mm. Differential settlements are totally dependent on the variation of foundation loads and consistency of the supporting ground. Assuming the foundation loads are reasonably uniform, we suggest differential settlement is unlikely to exceed say 15mm. It is likely settlement will be fully achieved within 20 years of construction.

7.2.3.5 The Devensian Till deposits encountered in exploratory excavations are generally consistent and will provide uniform support to foundations. In the event foundation excavations encounter a soft area, we recommend foundation excavations continue to locate stiffer soils (see below) or reinforcement introduced into foundation concrete to span the soft area. Whilst not extensively evident within the Phase 2 development area, caution should be taken as such soils were recorded within localised areas of the Phase 1 development site and likely to be largely associated with prolonged and extensive water logging of the site. If there is any doubt when trenches are being excavated, a suitably qualified Geo-Environmental Engineer could attend site with the purpose of providing an indication when suitable founding strata has been reached.

7.3 Influence of trees and other major vegetation

7.3.1 Soil classification and new foundation design

7.3.1.1 The results of plastic and liquid limit determinations performed on samples of the Devensian Till indicate the deposits are soils of medium volume change potential when classified in accordance with National House Building Council (NHBC) Standards, Chapter 4.2. Foundations taken down onto a depth of 0.9m will penetrate the zone of shrinkage and swelling caused by seasonal wetting and drying. Trees and other major vegetation extend this zone and will require deeper foundations. A good guide to this subject is provided in NHBC Standards, Chapter 4.2.

7.3.2 New planting

7.3.2.1 Any planting schemes should also take into account the effect that new trees could have on foundations when they reach maturity. Again a good guide to this subject is provided in NHBC Standards, Chapter 4.2.

7.3.3 Tree species identification

7.3.3.1 There are a number of trees and other major vegetation located along field boundaries at the site. We recommend a qualified Arboriculturist (listed in the Arboricultural Association Directory of Consultants – www.trees.org.uk) be appointed to determine the location, height (and mature height) and water demand of all trees/major hedgerows at the site, information, which will be necessary to design foundations in accordance with NHBC Standards, Chapter 4.2.

7.3.4 Agricultural crops

7.3.4.1 It is important to note that the site at the time of our investigations comprised fields surfaced in rough grass and used for grazing livestock. Based on our site reconnaissance, anecdotal information and fieldwork observations, the likelihood that near surface soils have recently supported a crop is considered low.

7.4 Ground Floor Construction

7.4.1 Ground bearing floor slabs can be adopted at this site where buildings are remote from trees and where Topsoil and Made Ground deposits are fully removed within the footprint of the building. We recommend a blanket of good quality compacted granular material be placed prior to construction of the floor slabs.

7.4.2 In areas close to existing major vegetation at the site, where significant Made Ground deposits are present (or where ground floors are elevated requiring in excess of 600mm of fills) then we recommend the use of a suspended ground floor with a sub floor void determined following NHBC Standards, Chapter 4.2.

7.5 Foundation and Service Trench Excavations

7.5.1 Generally the sides of foundation/service trench excavations will remain stable and we anticipate no significant groundwater inflows will be encountered in any of the excavations. Some minor overbreak and instability could be encountered within trenches formed through deposits of Made Ground. The silty nature of the near surface Devensian Till deposits will render them moisture susceptible with small increases in moisture content promoting rapid deterioration. We recommend, therefore, that as soon as foundation trench excavations are opened foundation concrete be poured as quickly as practically possible.

7.5.2 We recommend any trench excavation requiring human entry is shored as necessary to conform with current best practice, and accepted by the Health and Safety Executive (HSE) and in particular, following guidance provided in the HSE publication 'Health and Safety in Construction (HSG 150)' (www.hse.gov.uk).

7.6 Infiltration Potential

7.6.1 Based on infiltration testing undertaken in trial pits TP107 and TP114 at the site (refer to Appendix E), the Devensian Till deposits are considered to be effectively impermeable and would not be able to dispose of water using soakaway systems. Alternative means of storm water disposal will be required. Disposal into Higgin Brook could be an option and we understand that the surface water sewer, which cuts across the south-western part of the site, outfalls into the brook and serves a similar residential development adjacent to the south-east.

7.7 Pavement Foundations

7.7.1 It is anticipated that the proposed access road and associated hardstanding areas will be located at or about existing ground levels with formation located on Devensian Till deposits and locally Made Ground.

7.7.2 Equilibrium CBR (California Bearing Ratio) values (with reference to Transport and Road Research Laboratory (TRRL) Report LR1132 *'Structural design of Bituminous Roads')* are derived from knowledge of soil classification data (plasticity index for soils exhibiting cohesion (clay type) and particle size distribution for granular soils), the location of the water table pavement thickness, and weather conditions at the time of construction. It is anticipated that excavations to formation levels will generally encounter cohesive soils. Assuming an average plasticity index of say 30 for cohesive soils, a low water table, a 'thin' pavement the following equilibrium CBR values are derived for varying construction conditions.

Equilibrium CBR values for differing construction conditions		
Poor	**Average**	**Good**
CBR = 3%	CBR = 4%	CBR = 4%

Table 7.7.2

7.7.3 It is also possible to derive the 'insitu' CBR value at formation from undrained shear strength data by applying a conversion factor of 23 (refer TRRL laboratory report LR889). Thus adopting pessimistic undrained shear strength of say 50kN/m^2 at formation level (based on insitu shear strength measurements) then an equivalent CBR value can be obtained i.e.

$$\text{Insitu CBR} = \text{undrained shear strength } {}^{50}\!/_{23} = 2.17\%$$

7.7.4 The 'insitu' CBR derived above, is susceptible to change dependent upon weather conditions during construction. The equilibrium CBR value derived in paragraph 7.7.2 above is an estimate of the CBR value, which will predominate during the life of the pavement. We recommend the insitu CBR of 2.17% derived from shear strength data be utilised for design purposes and reassessed during construction. The fact that the clay subgrade soils are likely to be deemed frost susceptible will probably be the overriding criteria for pavement foundation design purposes. It should also be noted that the thickness of the pavement foundation also relates to the amount and loading from construction traffic, which is discussed in detail in the Transport and Road Research Laboratory (TRRL) Report LR1132 *'Structural design of Bituminous Roads'.*

7.7.5 The CBR value based on insitu shear strength test data is relatively low and subsequently pavement formation thicknesses will be need to be increased accordingly. Undertaking further insitu testing (maybe using a TRL DCP probe) along proposed access roads and hardstanding may yield an increase in this value, potentially above 3% which would decrease the required formation thickness and provide associated cost savings.

7.7.6 Once formation levels have been established it is recommended that the formation be trimmed and rolled following current requirements of the Highways Agency Specification for Highways Works (clause 616) (refer www.dft.gov.uk/ha/standards/mchw/vol1). Such a process will identify any soft areas, which we recommend be either excavated out and backfilled with a suitable well compacted material similar to those exposed in the sides of the resulting excavation, or large cobbles of a good quality stone rolled into the formation to stabilise the 'soft' area.

7.7.7 The silty nature of the Devensian Till will render them moisture susceptible with small increases in moisture content giving rise to a rapid loss of support to construction plant. We therefore recommend, as soon as formation is trimmed and rolled, that sub-base is laid in order to avoid deterioration of the subgrade in wet or frosty conditions.

8 Chemical contamination

8.1 Contaminated land, regulation and liabilities

8.1.1 Statute

8.1.1.1 Part IIA of the Environment Protection Act 1990 became statute in April 2000. The principal feature of this legislation is that the hazards associated with contaminated land should be evaluated in the context of a site-specific risk based framework. More specifically contaminated land is defined as:

"any land which appears to the Local Authority in whose area it is situated to be in such a condition, by reasons of substances in, on or under the land, that:

a) Significant harm is being caused or there is a significant possibility of such harm being caused; or
b) Pollution of controlled waters is being or is likely to be caused".

8.1.1.2 Central to the investigation of contaminated land and the assessment of risks posed by this land is that:

i) There must be contaminant(s) at concentrations capable of causing health effects (*Sources).*
ii) There must be a human or environmental receptor present, or one which makes use of the site periodically *(Receptor)*; and
iii) There must be an exposure pathway by which the receptor comes into contact with the environmental contaminant *(Pathway).*

8.1.1.3 In most cases the Act is regulated by Borough or District Councils and their role is as follows:

i) Inspect their area to identify contaminated land
ii) Establish responsibilities for remediation of the land
iii) See that appropriate remediation takes place through agreement with those responsible, or if not possible:
   - by serving a remediation notice, or
   - in certain cases carrying out the works themselves, or
   - in certain cases by other powers
iv) keep a public register detailing the regulatory action which they have taken

8.1.1.4 For "special" sites the Environment Agency will take over from the Council as regulator. Special sites typically include:

- Contaminated land which affects controlled water and their quality
- Oil refineries
- Nuclear sites
- Waste management sites

8.1.2 Liabilities under the Act

8.1.2.1 Liability for remediation of contaminated land would be assigned to persons, organisations or businesses if they caused, or knowingly permitted contamination, or if they own or occupy contaminated land in a case where no polluter can be found.

8.1.3 Relevance to predevelopment conditions

8.1.3.1 For current use, Part IIA of the Environmental Protection Act 1990 provides the regulatory regime. The presence of harmful chemicals could provide a 'source' in a 'pollutant linkage' allowing the regulator (Local Authority or Environment Agency) to determine if there is a significant possibility of harm being caused to humans, buildings or the environment. Under such circumstances the regulator would determine the land as 'contaminated' under the provision of the Act requiring the remediation process to be implemented.

8.1.4 Relevance to planned development

8.1.4.1 The developer is responsible for determining whether land is suitable for a particular development or can be made so by remedial action. In particular, the developer should carry out an adequate investigation to inform a risk assessment to determine:

a) Whether the land in question is already affected by contamination through source – pathway – receptor pollutant linkages and how those linkages are represented in a conceptual model.
b) Whether the development proposed will create new linkages e.g. new pathways by which existing contaminants might reach existing or proposed receptors and whether it will introduce new vulnerable receptors, and

c) What action is needed to break those linkages and avoid new ones, deal with any unacceptable risks and enable safe development and future occupancy of the site and neighbouring land?

8.1.4.2 Building control bodies enforce compliance with the Building Regulations. Practical guidance is provided in Approved documents, one of which is Part C, '*Site preparation and resistance to contaminants and moisture*' which seeks to protect the health, safety and welfare of people in and around buildings, and includes requirements for protection against harm from chemical contaminants.

8.1.5 Pollution of controlled waters

8.1.5.1 Part IIA of the Environment Protection Act 1990, defines pollution of controlled waters as

'The entry into controlled waters of any poisonous, noxious or polluting matter or any solid waste matter'

8.1.5.2 Paragraphs A36 and A39 of statutory guidance (DETR 2000) further define the basis on which land may be determined to be contaminated land on the basis of pollution of controlled waters.

'Before determining that pollution of controlled waters is being, or likely to be, caused, the Local Authority should be satisfied that a substance is continuing to enter controlled waters, or is likely to enter controlled waters. For this purpose, the local authority should regard something as being likely when they judge it more likely than not to occur'

'Land should not be designated as contaminated land where:

a) A substance is already present in controlled waters:
b) Entry into controlled waters of that substance from the land has ceased, and
c) It is not likely that further entry will take place.

Substances should be regarded as having entered controlled waters where:

a) They are dissolved or suspended in those waters; or
b) If they are immiscible with water, they have direct contact with those waters, or beneath the surface of the waters'

8.1.5.3 Controlled waters are defined in statute to be:

'territorial waters which extend seawards for 3 miles, coastal waters, inland freshwaters, that is to say, the waters in any relevant lake or pond or of so much of any relevant river or watercourse as is above the freshwater limit, and groundwaters, that is to say, any waters contained in underground strata.'

8.1.6 Further information

8.1.6.1 The above provides a brief outline as regards current statute and planning controls. Further information can be obtained from the Department for the Environment, Food and Rural Affairs (DEFRA) and their website www.defra.gov.uk.

8.2 Objectives and procedures

8.2.1 Objectives

8.2.1.1 This report section discusses investigations carried out with respect to chemical contamination issues relating to the site. The investigations were carried out to determine if there are any liabilities with respect to Part IIA of the Environment Protection Act. As stated in Section 2.4.2, the investigation process followed the principles of BS10175: 2011 *'Investigation of potentially contaminated sites – Code of Practice',* with the investigation combining a desk study (preliminary investigation) together with the exploratory and main investigations (refer BS10175: 2011 for an explanation).

8.2.1.2 This section of the report produces *'Conceptual models'* based on investigatory data obtained to date. The conceptual model is constructed by identification of *contaminants* and establishment of feasible *pathways* and *receptors.* The conceptual model allows a *risk assessment* to be derived. Depending upon the outcome of the risk assessment it may be necessary to carry out remediation and/or further investigations with a view to eliminating, reducing or refining the risk of harm being caused to identified receptors. If appropriate, our report will provide recommendations in this respect.

8.2.1.3 Clearly we must consider the current pre-development condition, establishing risks which may require action to render the site safe to all relevant (current) receptors meeting the requirements of current legislation (Part IIA of the Environmental Protection Act 1990).

8.2.1.4 Definition of terms used in the preceding paragraph and subsequent parts of this section of the report are presented in Appendix B.

8.2.2 Procedure to assess risks of chemical contamination

8.2.2.1 For the purposes of presenting this section of this report, we have adopted the following sequence in assessing risks associated with chemical contamination.

Table outlining sequence to assess risk associated with chemical contamination

Conceptual model element	Contributory information	Outcome
Receptor	Development categorisation	Identification of receptors at risk of being harmed Method of analysing test data Criteria for risk assessment modelling
Pathways	Geology and ground conditions Development proposals	Identification of critical pathways from source to receptor
Source	Previous site history Desk study information Site reconnaissance Fieldwork observations	Testing regime Identification of a chemical source Analysis of test data and other evidence

Table 8.2.2

8.2.2.2 We have adopted, in general, the procedures described in CIRIA C552 *'Contaminated land risk assessment - a guide to good practice'* in deriving a risk assessment. Initially we have carried out a 'phase 1 assessment' based on desk study information and site reconnaissance, to produce an initial conceptual model and thus a preliminary risk assessment. This model/assessment is then used to target fieldwork activities and laboratory testing, with the results of this part of the investigation used to allow a phase 2 assessment to be produced by updating the conceptual model and refining the risk assessment.

8.3 Development characterisation and identified receptors

8.3.1 Site characterisation

8.3.1.1 The nature of the site has a significant influence the likely exposure pathways between potentially contaminated soils and potential receptors. The following table summarises elements which characterise the site based on site observations and desk study information.

Summary of site characteristics		
Element	**Source/criteria**	**Characteristic**
Current land use	Observations	Site currently in use as grazing land for livestock. Not accessible to the general public.
Future land use	Advice	Residential development which includes domestic gardens.
Site history	Desk study	Recorded as fields from earliest maps.
Geology	Desk study/Site investigation	Topsoil and localised Made Ground overlying >5m thickness of Devensian Till deposits with Bowland Shale Formation/Pendleside Sandstone Member at depth.
Ground water	Aquifer potential	Devensian Till deposits recorded as unproductive strata. Underlying Bowland Shale recorded as a Secondary A and secondary undifferentiated aquifers (r), with Pendleside Sandstone recorded as Secondary A.
	Abstractions	There are no potable water abstractions within 1000m of the site. There are two groundwater abstractions within 1000m of the site, the nearest associated with Mill Farm borehole located 890m south of the site.
	Source protection zone	Site not recorded in source protection zone (SPZ).
Surface waters	Location	The nearest surface water feature is a tertiary river (Higgin Brook) which flows in a north-easterly and north-westerly direction along the north-western boundary of the site.
	Abstractions	There is one surface water abstraction within 1000m of the site located 445m south-east associated with a field drain located in Lyndhurst, Longridge.

Table 8.3.1

8.3.2 Identified receptors

8.3.2.1 The principal receptors subject to harm caused by any contamination of the proposed development site are as follows.

Principle Receptor	Detail
Humans	Users of the current site
	End user of the developed site
	Construction operatives and other site investigators
Vegetation	Plants and trees, both before and after development
Controlled waters	Surface waters (Rivers, streams, ponds and above ground reservoirs)
	Ground waters (used for abstraction or feeding rivers/streams etc.)
Building materials	Materials in contact with the ground

Table 8.3.2

8.3.2.2 This section of the report assesses those receptors listed above. Section 10 provides a risk assessment in relation to building materials.

8.3.3 Human receptors

8.3.3.1 The Contaminated Land Exposure Assessment (CLEA) model can be used to derive guideline values, against which land quality data can be compared to allow an assessment of the likely impacts of soil contamination on humans. The parameters used within the model can be chosen to allow guideline values to be derived for a variety of land uses and exposure pathways. For example, a construction worker is likely to be exposed in different ways and for different durations than an adult in a residential setting.

8.3.3.2 On the basis that the existing site is restricted to agricultural activities the adult is considered an appropriate current receptor. Following completion of the residential development the critical site user (receptor) is considered to be a child under the age of 6 years. These criteria have been used in the conceptual model for the current and future site use. Our assessment also considers construction operatives as adult receptors.

8.3.4 Vegetation receptors

8.3.4.1 Soil contaminants can have an adverse effect on plants if they are present at sufficient concentrations. The effects of phytotoxic contaminations include growth inhibition, interference with natural processes within the plant and nutrient deficiencies.

8.3.4.2 Vegetation is currently present at the site and will remain so following development, in addition to further vegetation proposed as part of the new development. We have therefore considered vegetation a viable receptor.

8.3.5 Water receptors

8.3.5.1 The near surface Devensian Till deposits are recorded as unproductive strata and extend to depths beyond 3.2m at the site. The underlying Bowland Shale Formation is recorded as a Secondary A aquifer. The site is not recorded in a source protection zone. Based on the above, given the thickness of Devensian Till groundwater is not considered a viable receptor. The nearest watercourse to the site is Higgin Brook, which flows along the north-western site boundary. On this basis, surface water is considered to be a viable receptor.

8.3.6 Summary of identified receptors

8.3.6.1 Based on the above assessments, the following table summarises identified and critical receptors.

Table summarising identified (viable) receptors				
Principle Receptor	**Detail**	**Viable and critical receptors**		
		Viability and justification		**Critical receptor**
Humans	Users of the current site	Yes	Grazing land	Adult
	End user of the developed site	Yes	Residential	Child
	Construction operatives and other site investigators	Yes		Adult
Vegetation	Current site	Yes	Trees on site	Vegetation
	Developed site	Yes	Trees to remain	Vegetation
Controlled waters	Surface waters (Rivers, streams, ponds and above ground reservoirs)	Yes	Higgin Brook along site boundary	Surface waters
	Ground waters (used for abstraction or feeding rivers/ streams etc.)	No	Devensian Till at crop (impermeable)	Groundwater
Building materials	Materials in contact with the ground	Yes	Assessed in report Section 10	Building materials

Table 8.3.6

8.4 Identification of pathways

8.4.1 Pathways to human receptors

8.4.1.1 Guidance published by the Environment Agency in Science Report SC050021/SR3 *'Updated technical background to the CLEA model'* provides a detailed assessment of pathways and assessment and human exposure rates to source contaminants. In summary, there are three principal pathway groups for a human receptor:

Table summarising likely pathways	
Principal pathways	**Detail**
Ingestion through the mouth	Ingestion of air-borne dusts
	Ingestion of soil
	Ingestion of soil attached to vegetables
	Ingestion of home grown vegetables
Inhalation through the nose and mouth.	Inhalation of air-borne dusts
	Inhalation of vapours
Absorption through the skin.	Dermal contact with dust
	Dermal contact with soil

Table 8.4.1

8.4.1.2 The site currently comprises open fields surfaced in grass and used for grazing livestock. It is understood that this has been the principal site use for much of the sites history, if not all. Based on such we have considered all the above pathways would be present for current users with the exception of those associated with the consumption of vegetables.

8.4.1.3 Following redevelopment the site will be occupied by housing with associated gardens and landscaping. Based on such all of the above pathways will be considered viable for proposed site users. A summary of our pathway assessment is presented in Section 8.4.4.

8.4.2 Pathways to vegetation

8.4.2.1 Guidance published by the Environment Agency in Science Report SC050021/SR (Evaluation of models for predicting plant uptake of chemicals from soil) provides a detailed assessment of plant uptake pathways. In summary, plants are exposed to contaminants in soils by the following pathways:

- Passive and active uptake by roots.
- Gaseous and particulate deposition to above ground shoots.
- Direct contact between soils and plant tissue.

8.4.2.2 All of the above routes of exposure are considered to be present for vegetation.

8.4.3 Pathways to controlled waters

8.4.3.1 A number of pathways exist for the transport of soil contamination to controlled waters. A summary of these pathways is presented below:

- Percolation of water through contaminated soils
- Near-surface water run-off through contaminated soils
- Saturation of contaminated soils by flood waters

8.4.3.2 Near surface soils comprised cohesive Devensian Till deposits which are considered impermeable and extend to depths beyond 3.2m at the site. The clay soils will severely restrict the percolation of surface water into the underlying aquifer of the Bowland Shale Formation, therefore, pathways associated with percolation of surface water will not be considered further.

8.4.3.3 Based on the permeability of near surface Devensian Till deposits, in our opinion such soils are considered amenable to promoting significant amounts of near surface water run off through contaminated soils.

8.4.3.4 The site is not recorded within a fluvial flood plain and as such saturation of contaminated soils by flood waters is unlikely to occur.

8.4.4 Summary of identified likely pathways

8.4.4.1 Based on the above assessments, the following table summarises likely pathways of potential chemical contaminants at the site to identified receptors.

Table of likely pathways

Receptor group	Critical receptor	Pathway
Proposed site users	Child	Ingestion of air-borne dusts
		Ingestion of soil
		Ingestion of soil attached to vegetables
		Ingestion of home grown vegetables
		Inhalation air-borne dusts
		Inhalation of vapours
		Dermal contact with dust
		Dermal contact with soil
Current site users and construction operatives	Adult	Ingestion of air-borne dusts
		Ingestion of soil
		Inhalation of air-borne dusts
		Inhalation of vapours
		Dermal contact with dust
		Dermal contact with soil
Vegetation		Root uptake, deposition to shoots and foliage contact
Groundwater	Surface water	Near-surface water run-off through contaminated soils

Table 8.4.4

8.5 Assessment of sources of chemical contamination

8.5.1 Introduction

8.5.1.1 Initially, potential sources of contamination are assessed using the following elements of the investigation process.

- History of the site
- Desk study information
- Site reconnaissance
- Geology
- Fieldwork

8.5.1.2 These elements will dictate a relevant soil/water testing regime to quantify possible risks of any identified contaminative sources which may harm identified receptors.

8.5.2 Source assessment – History of the site

8.5.2.1 The history of the site and its immediate surroundings based on published Ordnance Survey maps is described in Section 3.

8.5.2.2 Based on published historical maps, there is no evidence to indicate the site has been subject to activities which could produce a source of chemical contamination; however, records indicate that a dairy was located on the adjacent site to the south-west, which could be a potential source of contamination. In addition, a mill, unclassified works and a garage were located to the south and west of the site, although all are in excess of 90m from the subject site. Due to the distance from the site and the relatively impermeable geology, in our opinion, there is unlikely to be a significant risk of contamination migrating from these potential sources to the subject site.

8.5.3 Source assessment – Desk study information

8.5.3.1 Envirocheck presents a detailed database of environmental information in relation to the site including;

- Pollution incidents
- Landfill sites
- Trading activities

8.5.3.2 Pollution incidents

8.5.3.2.1 Envirocheck report a number of pollution incidents to controlled waters within 2000m of the site, the closest of which are recorded some 60m to the south and 160m to the west. The incident to the south is associated with the release of waste milk into Higgin Brook and is classified as a Category 2 significant incident. The incidents to the west are dated June 1997 and are associated with the release of paint/dyes and inert suspended solids and oils, again into Higgin Brook and are classified as Category 3 minor incidents. Given the distance from the site and the type and severity of the incidents they are considered unlikely to have impacted the site.

8.5.3.3 Landfill sites

8.5.3.3.1 Envirocheck reports there are two registered landfill sites within 1km of the site. One is located approximately 520m to the east and was in receipt of inert, non-hazardous and industrial wastes. The second is recorded 800m to the south of the site, with records indicating the site is now dormant and was in receipt of demolition material and uncontaminated soils.

8.5.3.3.2 In addition, we have reviewed old Ordnance Survey maps and there are a small number of quarries recorded between 500m and 1000m from the subject site, predominantly to the east, exploiting the underlying clays and grits.

8.5.3.3.3 Based on the above, due to the distance, the risk of any chemical contamination associated with landfill sites and restored mineral sites in the area, migrating and impacting identified receptors at the site, is considered low.

8.5.3.4 Trading activities

8.5.3.4.1 Envirocheck reports the closest active trade entry is located 90m to the south-west of the site, associated with a garage (Irelands Ltd). It should also be noted that the site is recoded as a fuel station entry, however, records indicate this is now obsolete. Such activities utilise chemicals which could harm identified receptors, however, due to the distance from the site and the relatively impermeable geology, in our opinion, there is unlikely to be a significant risk of contamination migrating from the garage to the subject site.

8.5.4 Source assessment – Site reconnaissance

8.5.4.1 A full description of the site and observed adjacent land uses is provided in Section 3 of this report. A plan summarising observations made on site during our site reconnaissance visit is presented on Drawing 02b.

8.5.4.2 We did not observe any obvious evidence of any current or recent activities on site which provide a potential source of chemical contamination.

8.5.5 Source assessment – Geology

8.5.5.1 The geological map of the area indicates the topography local to the site is formed in deposits of Devensian Till, Bowland Shale Formation and Pendleside Sandstone Formation. Typically, and in our experience, such deposits do not exhibit any abnormal concentrations of naturally occurring chemical contaminants.

8.5.6 Source assessment - Fieldwork observations

8.5.5.1 Made Ground was encountered in four locations and contained anthropogenic material, which could potentially provide a source of contamination.

8.5.7 Source assessment - summary

8.5.7.1 Based on the paragraphs above, we have identified the following potential sources of contamination:

Table summarising results of source assessment

Source	Origin of information	Possible contaminant	Probability of risk occurring	Likely extent of contamination
On site				
Made Ground	Fieldwork	Inorganics & organics	Likely	Localised

Table reference 8.5.7

8.6 Initial Conceptual Model

8.6.1 Based on our assessment of potential contaminative sources, identified receptors and viable pathways to receptors described in preceding paragraphs, we have produced an initial conceptual model in the form of a table which is presented in Appendix I.

8.6.2 Based on the conceptual model there are risks which exceed the low category which in our opinion are unacceptable, and require either remedial action or further investigation by laboratory testing of soil/water samples to refine the risk assessment.

8.7 Laboratory testing

8.7.1 Testing regime – Human receptors

8.7.1.1 Based on our source assessment (and our initial conceptual model) we have no evidence to identify any past or recent uses of the site which may have generated specific contamination. However, Made Ground was encountered on site in localised areas. Three samples, targeting areas considered to be at risk of potential contaminative sources were scheduled to measure concentrations of Total Petroleum Hydrocarbons (TPH), in addition to BTEX and MTBE, VOCs and SVOCs. Such samples were taken from exploratory excavations local to site boundaries where potential contaminants could have the potential to migrate onto site or from localised Made Ground.

8.7.1.2 In addition, twenty one samples of near surface Topsoil/Made Ground were submitted for measurement of organic and inorganic contaminants. The results of laboratory determination of concentration of chemical contaminants are presented in Appendix G.

8.7.2 Testing regime – Water receptors

8.7.2.1 We have identified sources of chemical contamination onsite associated with Made Ground and as a result have selected four samples of Topsoil/Made Ground for the measurement of commonly occurring leachable inorganic and organic contaminants where they are considered a risk to water resources. This in our opinion is an absolute minimum to assist in the risk assessment. Further laboratory testing would increase the accuracy of the risk assessment.

8.7.3 Testing regime – Vegetation

8.7.3.1 As described in 8.7.1 above we have scheduled testing for a suite of commonly occurring inorganic and organic contaminants. With reference to '*BPG Note 5 - Best Practice Guidance for Land Regeneration*' testing will include copper and zinc.

8.7.4 Scheduled testing

8.7.4.1 The following table summarises the scheduled testing, in relation to soil types and identified receptors under consideration of the conceptual model.

Table summarising scheduled testing

Sample origin	Sample type	Strata	Targeted sampling	Non targeted sampling	Scheduled testing	Critical receptor
TP101 0.3m TP103 0.1m TP103 0.3m TP108 0.1m TP108 0.5m TP125 0.1m	Soil	Made Ground		✓	Inorganic & organics	All human receptors
TP102 0.2m TP104 0.1m TP106 0.1m TP107 0.1m TP110 0.1m TP112 0.1m TP113 0.1m TP114 0.1m TP116 0.1m TP117 0.1m TP118 0.1m TP119 0.1m TP120 0.1m TP123 0.1m TP124 0.1m	Soil	Topsoil		✓	Inorganic & organics	
TP101 0.9m TP108 0.5m TP125 0.5m	Soil	Made Ground	✓		TPH, VOCs and SVOCs	
TP102 0.2m TP110 0.1m TP114 0.1m	Soil	Topsoil		✓	Leachable inorganics & organics	Water receptors
TP125 0.5m	Soil	Made Ground		✓		

Table 8.7.4.1

8.7.5 Criteria for assessment of test data – Human receptors

8.7.5.1 Assessment of laboratory test data has been carried out with reference to current nationally recognised documents listed in the final page of Appendix B. Due to changes in guidance on contaminated land, items 6-8 and item 10 in the document listing above have been withdrawn. In the absence of alternative guidance however we have used these documents. Where new guidance is available, this has been followed in preference to superseded guidance.

8.7.5.2 Suitable 4 Use Levels (S4ULs) are used as a screening tool to assess the risks posed to health of humans from exposure to soil contamination in relation to land uses. Where published S4ULs are not available, we have adopted Category 4 Screening Levels (C4SLs) where appropriate, derived by DEFRA, and Soil Screening Values (SSV) derived by Soiltechnics and by Atkins (SSV^{ATK}). The S4UL s have been derived by Land Quality Management (LQM) and the Chartered Institute of Environmental Health (CIEH) and presented in *'The LQM/CIEH S4ULs for Human Health Risk Assessment'*. They are derived in accordance with UK legalisation, national as well as Environment Agency (EA) Policy using a modified version of the EA CLEA model and other available guidance. The S4ULs have been prepared for a number of metals and polycyclic aromatic hydrocarbons (PAH) and are used in preference to C4SLs and values produced by Soiltechnics and Atkins. The CLEA model has been used with toxicology data presented by the EA, LQM/CIEH and Atkins (in that order of preference) to derive SSVs by Soiltechnics. SSVs produced by Atkins are presented on their $ATRISK^{SOIL}$ website.

8.7.5.3 S4ULs, C4SLs, SSVs and SSV^{ATK}s represent 'intervention values'; indications to an assessor that soil concentrations above these levels might present an unacceptable risk to the health of site users. These soil guideline values have been produced using conceptual exposure models, which use assumptions and are applied to differing end uses of land. If the values are exceeded, it does not necessarily imply there is an actual risk to health and site-specific circumstances should be taken into account. Conversely, where a critical pathway or chemical form of the contaminant has not been evaluated, a risk may be present even if the guideline has not been exceeded.

8.7.5.4 For evaluation of test data in relation to polycyclic aromatic hydrocarbon (PAH) contamination, we have compared measured concentrations with corresponding S4ULs. The S4ULs for PAHs are dependent on the Soil Organic Matter (SOM) content of the soils.

8.7.5.5 For evaluation of total petroleum hydrocarbon (TPH), BTEX and VOC/SVOC related contamination we have compared measured concentrations directly to the relevant S4ULs where available. Alternatively, we have assumed a possible risk if concentrations are above detectable limits.

8.7.5.6 We have followed procedures outlined by the CIEH to compare measured concentrations of metals and PAH contaminants against guideline values. TPH, SVOC and VOC related contaminants are compared directly with the relevant guideline values. The guidance presents an approach to data analysis and includes the examination of data for potential outliers, assessment of the normality of the test data and the calculation of a 95% Upper Confidence Limit (UCL). The UCL provides an estimate of the population mean, based on test data, with a 95% confidence that the actual mean does not exceed this value. The UCL is compared to the guideline value for the site.

8.7.5.7 We have adopted a conservative approach for current site users and compared measured concentrations of contaminants against guideline values for residential without plant uptake land use. For end users we have compared measured test data against guideline values presented for residential with plant uptake land use. In the absence of guidelines we have adopted commercial guideline values for assessment of construction operatives.

8.7.6 Criteria for assessment of test data – Vegetation

8.7.6.1 Guidance published by Forest Research in "*BPG Note 5 - Best Practice Guidance for Land Regeneration*" suggests that a residential without plant uptake or industrial/commercial CLEA model should be adopted for this receptor although specific guideline values are provided for copper and zinc at 130mg/kg and 300mg/kg respectively. As a practice we have adopted the industrial/commercial CLEA model for assessment of test data for vegetation.

8.7.6.2 It is difficult to quantify the phytotoxicity of a contaminant as large variations exist between plant tolerances, soil effects and synergistic/antagonistic reactions between chemicals. Due to the complexities of the effects of soil contamination on different plant species, we recommend that the test results presented in this report are passed to a landscape architect for the selection of suitable planting.

8.7.7 Criteria for assessment of test data – Controlled waters

8.7.7.1 For interpretation of test data in relation to water receptors we have directly compared measured values with the Environmental Quality Standards (EQS) and UK Drinking Water Standards (UKDWS). In the absence of EQS or UKDWS we have adopted World Health Organisation Drinking Water Guidelines (WHODWG).

8.7.7.2 EQS values are published by the Environment Agency in their publication, "*Environment Agency technical advice to third parties on Pollution of Controlled Waters for Part 11A of the Environmental Protection Act 1990*". EQS values for most inorganic contaminants in freshwater are dictated by the hardness of the receiving watercourse. The hardness of water is a measure of the concentration of calcium carbonate in the water. Although we have not sampled water from nearby watercourses, we have reviewed information supplied by the Drinking Water Inspectorate website, which indicates a hardness of <100mg/l for drinking water in the local area. Although not an insitu groundwater measurement, such results are likely to be similar to those that would be measured in groundwater in the local area.

8.7.7.3 Using this information for List II substances (DOE Circular 7/89) we have compared the measured values with the EQS values relative to the hardness of the receiving watercourse assuming a worst case scenario of the watercourse supporting 'sensitive' aquatic life.

8.7.7.4 UKDWS are presented in the Water Supply (Water Quality) Regulations. We have adopted EQS values in preference to alternative guidelines where possible.

8.7.8 Evaluation of test data – Human receptors

8.7.8.1 Tables summarising and analysing test data are presented in Appendix H. The following table summarises the outcome of the analyses.

Table Summarising assessment of test data for Human receptors

Analysis tables	Receptor group	Critical receptor	CLEA model	Inorganic contaminants	Organic contaminants (PAH)	Organic contaminants (TPH)
1 and 2	Current site users	Adult	Residential without plant uptake	No exceedances	No exceedances	n/a
3 and 4	Future site users	Child	Residential with plant uptake	No exceedances	No exceedances	n/a
5 and 6	Construction operatives	Adult	Industrial/ commercial	No exceedances	No exceedances	n/a
8	Future site users	Child	Residential with plant uptake	n/a	n/a	No exceedances

Table 8.7.8.1

8.7.8.2 Based on the above, laboratory testing has not identified any measured concentrations of commonly occurring inorganic and organic contaminants which exceed current guideline values for human receptors. It should also be noted that all measured concentrations of VOCs and SVOCs have been recorded below detectable limits.

8.7.9 Evaluation of test data – Vegetation

8.7.9.1 Comparison of test data with guideline values is presented on Tables 6 and 7 in Appendix H. None of the measured concentrations exceed the adopted guideline values. On this basis, we are of the opinion that measured concentrations are unlikely to exhibit significant contamination with respect to vegetation.

8.7.9.2 It is difficult to quantify the phytotoxicity of a contaminant as large variations exist between plant tolerances, soil effects and synergistic/antagonistic reactions between chemicals. Due to the complexities of the effects of soil contamination on different plant species, we recommend that the test results presented in this report are passed to a landscape architect for the selection of suitable planting.

8.7.10 Evaluation of test data – Controlled waters

8.7.10.1 Inorganic contaminants

8.7.10.1.1 The measured values of inorganic contaminants fall well below relevant guideline values with the exception of copper. Out of the four samples of Topsoil/Made Ground tested across the site three exceed the EQS value of 6µg/l, with concentrations measured at concentrations of 6µg/l and 13µg/l and recorded in Topsoil deposits only. The remaining sample of Made Ground exhibited a concentration of 5.7 µg/l, which is marginally below the guideline value.

8.7.10.2 Organic contaminants (polycyclic aromatic hydrocarbons)

8.7.10.2.1 For the analysis of PAH contamination, the sum of the following contaminants has been compared to a UKDWS.

- Benzo(b)fluoranthene
- Benzo(k)fluoranthene
- Benzo(ghi)perylene
- Indeno(1,2,3-cd)pyrene

8.7.10.2.2 The summed concentration of the PAH 'suite' for each samples do not exceed the UKDWS. In addition the leachable concentration of benzo(a)pyrene and naphthalene do not exceed their respective guideline values.

8.8 Updated conceptual model

8.8.1 Human receptors

8.8.1.1 Based on the above, laboratory testing has not identified any measured concentrations of chemical contaminants which exceed current guideline values for identified human receptors. Based on the above evaluation, the concentrations of contaminants measured on soil samples taken from the site are considered unlikely to exhibit significant contamination from a perspective of human receptors.

8.8.2 Water receptors

8.8.2.1 Laboratory testing has identified elevated concentrations of leachable copper in three samples of Topsoil tested across the site. Given the limited historic use of the site (fields from earliest historical maps until present) it is most likely to be attributed to the use of copper based fertilisers in agriculture. However, if this is the source total concentrations of copper would also be expected to be present to some extent in Topsoil across the site and certainly at higher concentrations than those measured to date. The underlying naturally deposited Devensian Till has not been noted to contain gravels which could provide a potential source of copper.

8.8.2.2 The EQS values used in the assessment are largely dictated by the hardness of the receiving watercourse and we have been fairly conservative with the hardness value adopted for the site based on readily available groundwater data. It is likely that if water was tested within Higgin Brook (receiving surface watercourse) that hardness values would be higher than those adopted (>200mg/l rather than <100mg/l) which would have the effect of increasing the EQS value of copper from 6µg/l to 28µg/l. If this were to be the case then the concentrations of leachable copper measured in Topsoil deposits would fall below the guideline value for the site.

8.8.2.3 Based on the above, we are of the opinion that the concentrations of leachable copper recorded in Topsoil at the site are unlikely to have an adverse effect on surface waters in the area. However, as a precaution we recommend that surface waters within Higgin Brook are tested to determine site specific values of hardness which will enable a more detailed risk assessment to be completed.

8.8.3 Summary

8.8.3.1 Having now completed analysis of laboratory testing, we can now update our conceptual model which is presented in Appendix I.

8.8.3.2 Based on the updated conceptual model, with the exception of determining hardness values of surface waters in Higgin Brook in relation to further assessment of leachable copper, none of the assessed risks exceed the low category and on this basis remedial action is not considered necessary at this stage to render the site fit for purpose. Sources that have not been identified by laboratory testing have been removed from the conceptual model.

8.9 Actions

8.9.1 Based on the above our sole recommendations are as follows:-

- Hardness values within surface waters of Higgin Brook are determined to enable a more detailed risk assessment to be completed in relation to concentrations of leachable copper affecting water receptors
- Construction operatives adopt adequate hygiene precautions

8.10 Risk assessment summary and recommendations

8.10.1 Based on our assessments described above, we can provide the following summary and recommendations for each identified receptor.

8.10.2 Current and proposed site users

8.10.2.1 As no source of significant chemical contamination has been identified on site, we are of the opinion that the site represents a very low risk of causing harm to the health of identified current users of the site.

8.10.3 Construction operatives and other site investigators

8.10.3.1 The risk of damage to health of construction operatives and other site investigators is, in our opinion, low. As a precautionary approach, however, we recommend adequate hygiene precautions are adopted on site. Such precautions would be:-

- Wearing protective clothing particularly gloves to minimise ingestion from soil contaminated hands.
- Avoiding dust by dampening the soils during the works.
- Wearing masks if processing produce dust.

8.10.3.2 Guidance on safe working practices can be obtained from the following documents

- The Health and Safety Executive Publication *“Protection of Workers and the General Public during the Development of Contaminated Land”* (HMSO) and
- *“A Guide to Safer Working on Contaminated Sites”* (CIRIA Report 132).

8.10.3.3 In addition, reference should be made to the Health and Safety Executive. In all cases work shall be undertaken following the requirements of the Health and Safety at Work Act 1974 and regulations made under the Act including the COSHH regulations.

8.10.4 Controlled waters

8.10.4.1 Based on the risk assessment outlined in Section 8.8.2 above, we are of the opinion that the site currently represents a low-moderate risk of causing harm to water receptors, and as a precaution we recommend that values of hardness are determined in surface waters of Higgin Brook to enable a more detailed risk assessment to be undertaken in relation to concentrations of leachable copper.

8.10.5 Vegetation

8.10.5.1 As no source of significant chemical contamination has been identified on site, we are of the opinion that the site represents a low risk of causing harm to vegetation.

8.11 Statement with respect to National Planning Policy Framework

8.11.1 Based on investigations completed to date with respect to chemical contamination, we are of the opinion the proposed development will be safe and suitable for use for the purpose for which it is intended (without the need for any remedial action) thus meeting the requirements of the National Planning Policy Framework section 121, and compliant with the Building Regulations Part C, '*Site preparation and resistance to contaminants and moisture*'.

8.12 On Site Monitoring

8.12.1 We have attempted to identify the potential for chemical contamination on the site, however, areas, which have not been investigated at this stage, may exhibit higher levels of contamination. If such areas are exposed at any time during construction we will be pleased to re-attend site to assess what action is required to allow the development of safely proceed.

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9 Gaseous contamination

9.1 Legislative framework

9.1.1 There is currently a complex mix of documentation relating to legislative and regulatory procedures on the issue of contamination and it is not considered a purpose of this report to discuss the detail of these regulations. Essentially, Government Policy is based on *'suitable for use approach',* which is relevant to both the current and proposed future use of land. For current use Part IIA of the Environmental Protection Act 1990 provides the regulatory regime (see Section 8.1). The presence of harmful soil gases could provide a 'source' in a 'pollutant linkage' allowing the regulator (Local Authority) to determine if there is a significant possibility of harm being caused to humans, buildings or the environment. Under such circumstances the regulator would determine the land as 'contaminated' under the provision of the Act requiring the remediation process to be implemented with the Environment Agency responsible for enforcement.

9.1.2 The Town and Country Planning (General Development Procedure) Order 1995, requires the planning authority to consult with the Environment Agency before granting planning permission for development on land within 250 metres of land which is being used for deposit of waste, (or has been at any time in the last 30 years) or has been notified to the planning authority for the purposes of that provision.

9.1.3 Building control bodies enforce compliance with the Building Regulations. Practical guidance is provided in Approved documents, one of which is Part C, '*Site preparation and resistance to contaminants and moisture'* which seeks to protect the health, safety and welfare of people in and around buildings and includes requirements for protection against harm from soil gas.

9.2 General

9.2.1 The following assessment relates to the potential for, and the effects of, gases generated by biodegradable matter. The potential for the development to be affected by radon gas is considered in Section 3. The principal ground gases are carbon dioxide (CO_2) and methane (CH_4). The following table provides a summary of the effects of these gases when mixed with air.

Significant gas concentrations in air		
Gas	**Concentration by volume**	**Consequence**
Methane	0.25%	Ventilation required in confined spaces
	5 - 15%	Potentially explosive when mixed with air
	30%	Asphyxiation
	75%	Death after 10 minutes
Carbon Dioxide	0.5%	8 hour long term exposure limit (LTEL) (HSE workplace limit)
	1.5%	15 min short term exposure limit (STEL) (HSE workplace limit)
	>3%	Breathing difficulties
	6 – 11%	Visual distortion, headaches, loss of consciousness, possible death
	>22%	Death likely to occur

Table 9.2.1

9.2.2 Following the current Building Regulations Approved Document C1, Section 2 *'Resistance to Contaminants'* (2004 incorporating 2010 and 2013 amendments) a risk assessment approach is required in relation to gaseous contamination based on the source-pathway-receptor conceptual model procedure. We have adopted procedures described in the following reference documents for investigation and assessments of risk of the development being affected by landfill type gases (permanent gases) and if appropriate the identification of mitigation measures.

- BS10175:2011 *'Investigation of potentially contaminated sites- Code of Practice'*
- BS8576:2013 *'Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs)'*
- BS8485:2015 *'Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings'*
- CIRIA Report C665 *'Assessing risks posed by hazardous ground gases to buildings'* (2007)
- NHBC report No 10627-R01(04) *'Guidance on development proposals on sites where methane and carbon dioxide are present'* (January 2007)
- CL:AIRE Research Bulletin RB17 *'A pragmatic approach to ground gas risk assessment'* (November 2012)

9.2.3 Whilst we have followed the guidance and recommendations of BS8576, we have used BS8485:2015 to derive recommendations for protective works, and where considered necessary supplemented by NHBC report No 10627-R01(04).

9.2.4 An assessment of the risk of the site being affected by ground gases is based on the following aspects:

a) Source of the gas
b) Investigation information
c) Migration feasibility
d) Sensitivity of the development and its location relative to the source

9.3 Assessment of source of gases

9.3.1 General sources

9.3.1.1 The following table summarises the common sources of ground gases and parameters affecting the generation of ground gases:

Source and control of gases	
Type	**Parameters affecting the rate of gassing**
Landfills	Portion of biodegradable material, rate reduces with time
Mineworkings	Flooding reduces rate of gassing
Dock silt	Portion of organic matter
Carbonate deposits	Ground/rainwater (acidic) reacts with some carbonates to produce carbon dioxide.
Made Ground	Thickness of Made Ground and proportion of degradable organic matter.
Naturally deposited soils/rocks	Thickness of Made Ground and proportion of degradable organic matter.
Table 9.3.1	

9.3.1.2 The rate of decomposition in gas production is also related to atmospheric conditions, pH, temperature, and water content/infiltration.

9.3.1.3 As the site is not within a dockland environment or an area affected by mineworkings, and near surface soils do not exhibit high carbonate content, then potential gas sources are limited to landfills and/or soils with a high proportion of organic matter.

9.3.2 Landfill and infilled ground sources

9.3.2.1 Waste Management Paper 27 (1991) produced by the Department of the Environment *'Control of Landfill Gases'* contains the recommendation to avoid building within 50m of a landfill site actively producing large quantities of landfill type gases and to carry out site investigations within a zone 250m beyond the boundary of a landfill site. No distinction is made between sites of differing ground conditions, but the paper does not advocate the site is safe beyond the 250m zone, dependant, of course, upon the type of landfill and potential for migration of landfill gases.

9.3.2.2 Within a 2km radius of the site, there are no BGS recorded or historical landfill sites; however, there are two registered landfill sites. Lords Delph (Forty Acre Lane, Longridge) is located approximately 520m to the east of the site and has been accepting non-biodegradable waste since at least 1982. Chapel Hill Quarry is located approximately 800m to the south of the site and accepted non-biodegradable waste; in 1992, the site was recorded as dormant.

9.3.2.3 In addition, we have reviewed old Ordnance Survey maps there are a small number of quarries recorded between 500m and 1000m from the subject site, predominantly to the east. The geological map of the area indicates areas of infilled ground which approximately coincide with such areas.

9.3.2.4 Due to the distance of the sites from the subject site and the nature of the waste, in our opinion they are considered very unlikely to represent potential sources of ground gases which could affect the subject site. Furthermore, a series of small ponds are noted to have been recorded onsite and possibly filled in recent years. However, given the limited size of the water features it is considered unlikely that any gases associated with organic/putrescible material contained within would have the potential to affect identified receptors.

9.3.3 Soil conditions

9.3.3.1 None of the soils observed in exploratory excavations, in our opinion, exhibit significant concentrations of organic matter which are likely to produce elevated quantities of carbon dioxide and / or methane gas.

9.3.3.2 Based on an assessment of 'deep' geological conditions we are of the opinion that it is unlikely that the subject site would be affected by significant quantities of carbon dioxide and methane generated by soils/rocks at depth.

9.3.3.3 Based on the presence of extensive deposits of cohesive and impermeable Devensian Till in the local area, any potential migration of landfill type gases which may be generated at the sources outlined in Section 9.3.2 would also be severely restricted and unlikely to feasibly migrate to the subject site. We can confirm that we have consulted with Ribble Valley Borough Council with regards to this matter and they have agreed with such assessments. A copy of their correspondence is presented in Appendix K.

9.3.4 Source assessment summary

9.3.4.1 The following table summarises the possibility of a source of landfill type gases.

Source assessment summary

Potential source origin	Viability of source	Evidence
Landfills	Unlikely	Desk study information
Mineworkings	Unlikely	Desk Study information Geological conditions not amenable
Dock silt	Unlikely	Site remote from dockland environment
Carbonate deposits	Unlikely	Recorded and observed soil conditions do not indicate high concentrations of carbonates
Made Ground	Unlikely	None present at thicknesses and compositions which would give cause for concern
Naturally deposited soils/rocks	Unlikely	Soils exposed in exploratory excavations do not exhibit high concentrations of organic matter

Table 9.3.4

9.4 Conclusion

9.4.1 Based on the above there is no evidence to demonstrate that there is a potential source rendering the site at a significant risk of being affected by ground gases (carbon dioxide / methane) sufficient to cause significant harm to human end users of the site, construction operatives or indeed buildings. On this basis, it is not considered necessary to consider possible pathways for migration of ground gases, and indeed implementation of further investigations to measure concentrations of ground gases. Again on the basis of evidence provided above, mitigation measures against ingress of ground gases into the proposed development are not considered necessary.

9.5 Statement with respect to National Planning Policy Framework

9.5.1 Based on investigations completed to date with respect to gaseous contamination, we are of the opinion the proposed development will be safe and suitable for use for the purpose for which it is intended (without the need for any remedial action) thus meeting the requirements of the National Planning Policy Framework section 121, and compliant with the Building Regulations Part C, '*Site preparation and resistance to contaminants and moisture*'.

10 Effects of ground conditions on building materials

10.1 General

10.1.1 Building materials are often subjected to aggressive environments which cause them to undergo chemical or physical changes. These changes may result in loss of strength or other properties that may put at risk their structural integrity or ability to perform to design requirements. Aggressive conditions include:

- Severe climates
- Coastal conditions
- Polluted atmospheres
- Aggressive ground conditions

10.1.2 This report section only considers aggressive ground conditions, with other items considered outside our brief and scope of investigations.

10.1.3 In aggressive ground conditions, the potential for contaminant attack depends on the following:

- The presence of water as a carrier of chemical contaminants, (except free phase organic contamination).
- The availability of the contaminant in terms of solubility, concentration and replenishment rate.
- Contact between the contaminant and the building material.
- The nature of the building materials and its capability of being attacked by contaminants.

10.1.4 In general the thicker the building material the less likelihood there is for contaminant attack to cause damage to the integrity of the structure.

10.2 Reference documents

10.2.1 Following the Environment Agency publication *'Model Procedures for the Management of Land Contamination'* (Contaminated Land Report 11) the following documents have been referred to in production of the following report paragraphs.

- *'Performance of Building Materials in Contaminated Land'* report BR255 (Building Research Establishment 1994).
- *'Risks of Contaminated Land to Buildings, Building Materials and Services. A Literature Review'* - Technical Report P331 (Environment Agency 2000).
- *'Guidance on assessing and managing risks to buildings from land contamination'* - Technical Report P5 035/TR/01).
- Building Regulations Approved document C - site preparation and resistance to contaminants and moisture (Office of the Deputy Prime Minister, 2004).
- *'Concrete in aggressive ground'* Special Digest 1: 2005 (Building Research Establishment).

10.3 Hazard identification and assessment

10.3.1 The identification of hazards is based on the findings of this investigation primarily relating to former land uses (potential for chemical contamination, and likely type of contamination) and laboratory determination of concentration of chemical contaminants. Clearly, the scope of laboratory testing is determined with respect to former land uses, contaminants which may cause harm to human health and water resources.

10.3.2 Based on the above, the scope of our testing regime is described in Section 8. We have utilised this test data in production of the following risk assessments in relation to building materials, in conjunction with test data targeting the effects of chemical attack on concrete in contact with the ground, as described in BRE Special Digest 1.

10.3.3 The identification of hazards from contamination and subsequent assessment of risks is based on the following:

- The contaminants present on site.
- The nature of the contaminant (i.e. calcium sulphate is much less soluble than sodium or magnesium sulphate and is, therefore, less of a concern with regards sulphate attack).
- The concentration of contaminants - in general the higher the concentration the greater the hazard.
- The solubility of the contaminants - contaminants which are not soluble will not generally react with materials.
- The permeability of the soils - i.e. ease by which fluids can transport contaminants to the building.

10.3.4 The process of risk assessment for building materials is concerned with identification of the hazard (contaminants at the site - a source) and subsequently how the contaminants can reach the building (pathway) and how they can react with the building (receptor). Thus the risk assessment is produced based on the source - pathway - receptor model.

10.4 Provision of test data to specifiers/manufacturer/installer

10.4.1 The following risk assessments are based on current published data. We strongly recommend, however, that information gained from this investigation are provided to specifiers/manufacturers/installers of building materials/service ducts/apparatus who may have more up to date research to confirm the ability of the product to resist the effects of chemical contaminants at the site for the desired lifespan of the product.

10.5 Risks assessments for individual building materials

10.5.1 The following/typical sections contain risk assessments for various building materials likely to be incorporated in developments. Other materials which we are not aware of may also be used in developments and in contact with the ground and, therefore, recommend the suppliers are consulted with respect to ground conditions at this site and their opinion sought as to the ability of the product to resist chemical conditions determined at the site.

10.6 Concrete - General mechanisms of attack

10.6.1 There are a number of mechanisms by which contaminants attack concrete including the following:

- Hydrolysis of the hardened concrete.
- Degradation as a result of exchange reactions between calcium in calcium hydroxide (free lime hydrate) and ions in aggressive solutions.
- Expansive reactions as a result of chemical reaction or salt crystallisation.

10.7 Concrete - Sulphate attack

10.7.1 Hazard

10.7.1.1 Sulphate attack on concrete is characterised by expansion, leading to loss of strength, cracking, spalling and eventual disintegration. There are three principal forms of sulphate attack, as follows:

- Formation of gypsum through reaction of calcium hydroxide and sulphate ions.
- Ettringite formation through reaction of tricalcium alluminate and sulphite ions.
- Thaumasite formation as a result of reactions between calcium silicate hydrates, carbonate ions (from aggregates) and sulphate ions.

10.7.2 Assessment

10.7.2.1 The hazard of sulphide attack is addressed by reference to procedures described in Building Research Establishment (BRE) Special Digest 1: 2005 '*Concrete in Aggressive Ground*' to establish a design sulphate class (DS) and the '*Aggressive Chemical Environment for Concrete*' (ACEC). These procedures have been followed during our investigation and are described in the following paragraphs.

10.7.3 Desk Study Information

10.7.3.1 The first step in the procedure is to consider specific elements of the desk study. These are tabulated below.

Summary of desk study information

Element	Interrogation	Outcome	SD1: 2005 reference
Geology	Likelihood of soils containing pyrites	**Unlikely**	Box C6
Past industrial uses	Brownfield site?	**No**	C2.1.2

Table 10.7.3

10.7.3.2 A brownfield site is defined in SD1: 2005 as a site, or part of a site which has been subject to industrial development, storage of chemicals (including for agricultural use) or deposition of waste, and which may contain aggressive chemicals in residual surface materials, or in ground penetrated by leachates. Where the history of the site is not known, it should be treated as brownfield until there is evidence to classify it as natural.

10.7.3.3 Based on the above it is necessary to follow the procedures described in figure C4 *('natural ground sites except where soils may contain pyrite').*

10.7.4 Assessment of Design Sulphate Class

10.7.4.1 The sulphate concentration in a 2:1 water/soil extract was measured in one sample of Made Ground and seven samples of Devensian Till. The mean of the two highest values has been calculated as the characteristic value (refer to table 10.7.7) for Till, with the measured test result used for Made Ground.

10.7.5 Assessment of groundwater mobility

10.7.5.1 With reference to SD1: 2005, Section C3.1, we are of the opinion that soils at the site generally have a low permeability and thus 'static' groundwater conditions are considered characteristic of the site.

10.7.6 Assessment of pH

10.7.6.1 Following SD1: 2005, Section C5.1.1 (step 4) the characteristic value for pH within Devensian Till is 7.75, derived by taking the mean of the lowest 2 of the pH results. The characteristic value for pH within Made Ground relates to the measured value of 6.5.

10.7.7 Assessment of aggressive chemical environment for concrete (ACEC)

10.7.7.1 Based on the design sulphate class, characteristic value of pH and assessment of groundwater mobility, and with reference to table C1 of SDI: 2005, the ACEC class for each soil type is presented in Table 10.7.2 below.

Summary of concrete classification

Soil type	No. of samples	Characteristic pH	Groundwater mobility	Characteristic sulphate (mg/l)	DS class	ACEC class
Made Ground	1	6.5	Static	10	DS-1	AC-1s
Devensian Till	7	7.75	Static	10	DS-1	AC-1s

Table reference 10.7.7

10.8 Concrete - Chloride attack

10.8.1 Hazards

10.8.1.1 There are a number of ways in which chlorides can react with hydrated cement compounds in concrete. These are as follows:

- Chlorides react with calcium hydroxide in the cement binder to form soluble calcium chloride. This reaction increases the permeability of the concrete reducing its durability.
- Calcium and magnesium chlorides can react with calcium aluminate hydrates to form chloroaluminates which result in low to medium expansion of the concrete.

- If concrete is subject to wetting and drying cycles caused by groundwater fluctuations, salt crystallisation can form in concrete pores. If pressure produced by crystal growth is greater than the tensile strength of the concrete, the concrete will crack and eventually disintegrate.

10.8.2 Risk assessment

10.8.2.1 Chlorides of sodium, potassium, and calcium are generally regarded as being non-aggressive towards mass concrete; indeed brine containers used in salt mines have been known to be serviceable after 20 years' service. Depending upon the type of concrete, and the cement used up to 0.4% chloride is allowed in BS8110: Part 1.

10.8.2.2 In view of the past use of the site we consider the likelihood of elevated concentrations of chlorides in the ground to be low and on this basis have not specifically measured concentrations of chlorides.

10.9 Concrete - Acid attack

10.9.1 Hazards

10.9.1.1 Concrete being an alkaline material is vulnerable to attack by acids. Prolonged exposure of concrete structures to acidic solutions can result in complete disintegration.

10.9.2 Risk assessment

10.9.2.1 The rate of acid attack on concrete depends upon the following:

- The type of acid
- The acid concentration (pH)
- The composition of the concrete (cement/aggregate)
- The soil permeability
- Groundwater movement

10.9.2.2 British Standard BS8110: Part 1 classifies extreme environment as one where concrete is exposed to flowing groundwater that has a pH<4.5. The standard also warns that Portland Cement is not suitable for acidic conditions with a pH of 5.5 or lower.

10.9.2.3 The pH of the soil/groundwater was measured exceeding 5.5 and on this basis the risk of concrete being affected by acidic conditions is considered low.

10.10 Concrete - Magnesium attack

10.10.1 Hazards

10.10.1.1 Magnesium salts (excepting magnesium hydrogen carbonate) are destructive to concrete. Corrosion of concrete occurs from cation exchange reactions where calcium in the cement paste hydrates and is replaced with magnesium. The cement loses binding power and eventually the concrete disintegrates.

10.10.2 Risk assessment

10.10.2.1 In practise 'high' concentrations of magnesium will be found in the UK only in ground having industrial residues. Following BRE Special Digest 1:2005, measurement of the concentration of magnesium is recommended if sulphate concentrations in water extract or groundwater exceed 3000mg/l. Once measured the concentration of magnesium is considered further in BRE Special Digest in establishing the concrete mix to resist chemical attack.

10.10.2.2 We are not aware the site has been subject to any manufacturing processes which would have included magnesium containing compounds, and in addition sulphate concentrations did not exceed 3000mg/l, on this basis we have not measured the concentration of magnesium in soils at the site, and would consider the risk of soils at the site promoting attack on concrete to be low.

10.10.2.3 BS EN 206-1:2000 '*Concrete - Part 1: Specification, performance, production and conformity*' does, however, provide exposure classes for concrete in contact with water, with varying concentrations of magnesium for the design/specification for concrete mixes. No groundwater was encountered by the investigation and we would consider the risk of magnesium requiring special consideration with respect to enhancement of exposure class for this contaminant in isolation to be low.

10.11 Concrete - Ammonium attack

10.11.1 Hazards

10.11.1.1 Ammonium salts, like magnesium salts act as weak acids and attack hardened concrete paste resulting in softening and gradual decrease in strength of the concrete.

10.11.2 Risk assessment

10.11.2.1 UK guidance is not available on the concentration of ammonium which may affect concrete. BS EN 206-1: 2000 '*Concrete - Part 1: Specification, performance, production and conformity*' does, however, provide exposure classes for concrete in contact with water with varying concentrations of ammonia for the design/specification for concrete mixes.

10.11.2.2 As no groundwater was encountered by the investigation, we have not been able to obtain water samples for measurement of concentration of ammonia. In addition the site has no history which provides evidence of the uses of ammonia on site, and in overall conclusion the risk of concrete being affected by ammonia is considered low.

10.12 Concrete blocks

10.12.1 Hazards

10.12.1.1 Precast aggregate concrete blocks and autoclaved aerated concrete blocks are commonly used in the construction of shallow foundations. Concrete blocks are potentially attacked by the same contaminants and ground conditions which affect dense concrete.

10.12.2 Risk Assessment

10.12.2.1 In general, the mechanism of attack on concrete blocks is the same for hardened concrete. We recommend parameters for ground conditions for concrete described in the preceding paragraphs for concrete blockwork in contact with the ground/groundwater and the blockwork manufacturers confirmation sought for applicability of their product.

10.13 Clay Bricks/Pipes

10.13.1 Clay Bricks are highly durable materials which have been used in buildings for many centuries. Fire clay pipe material can also be considered similarly resistant to contaminants.

10.13.2 Hazards

10.13.2.1 Dissolution of clay brick in a potentially serious cause of deterioration. The extent of dissolution depends upon the solubility of the glassy material (produced by firing of the clay) contained in the brick. The acidic nature of the glass phase will produce low solubility in a neutral and acidic environment, but can be soluble in a basic environment.

10.13.2.2 A potentially more serious hazard for brickwork is the crystallisation of soluble salts within the brick pore structure. Salts are transported by water to the interior of the brick originating from the external environment or by rehydration, however, are only likely to occur when there is a gradient from a wet interior to a drying surface. The potential, therefore, for salt crystallisation in the ground is, therefore, low.

10.13.3 Risk Assessment

10.13.3.1 There seems to be little published information as regards the resistance to clay bricks/pipes in aggressive ground conditions, however, clay bricks are generally considered very durable. As no significant concentrations of chemical contaminants have been identified at this site in combination with near neutral pH conditions it is considered unlikely that ground conditions are sufficiently aggressive to cause damage to brickwork/clay pipes.

10.13.3.2 Some basic guidance is provided in BS5628-3: 2005 '*Code of Practice for the Use of Masonry - Part 3: Materials and components, design and workmanship*' with regards to resistance of masonry to resist the effects of sulphate attack.

10.14 Mortar

10.14.1 Mortars are based on building sands mixed with cement and/or lime as a binder. In the UK Portland cements and masonry cement are commonly used. Masonry cements are a mixture of Portland Cements and fine mineral filler (i.e. Limestone) with an air entraining agent.

10.14.2 Hazards

10.14.2.1 Mortar is subject to the same agents for deterioration as concrete with the major cause of deterioration being sulphate attack.

10.14.3 Risk assessment

10.14.3.1 Sulphates can originate from soils/groundwater or from the bricks themselves. Calcium, magnesium, sodium and potassium sulphates are present in almost all fired-clay bricks. Water can dissolve a fraction of these sulphates and transport them to the mortar.

10.14.3.2 Currently, we are not aware of any guidance on the resistance of mortars to sulphate attack. The Building Research Establishment report that the sulphate resistance of mortar was improved by the use of sulphate resisting Portland cements and lime. Some guidance is also provided in BS5628-3: 2005 '*Code of Practice for the use of Masonry - Part 3: Materials and components, design and workmanship*'.

10.14.3.3 Based on ground conditions determined at the site the risk of significant sulphate attack on mortars (Based on testing/analysis of sulphates in relation to concrete - refer Section 10.7) is considered low.

10.15 Metals - general

10.15.1 There are a number of metals which are used in buildings either as piles, services, non-structural and, indeed, structural components. The most common metals used in buildings are steel, stainless steel, copper, lead, zinc, aluminium and cast iron. All these metals can deteriorate through corrosion process. Corrosion can affect metals in a variety of ways depending upon the nature of the metal and the environment to which it is subjected. In most common forms of corrosion are:-

- Electrochemical - the most common form of corrosion in an aqueous solution
- Chemical corrosion - occurs when there is a direct charge transfer between the metal and the attacking medium (examples are oxidation, attack by acids, alkalis and organic solvents)
- Microbial induced corrosion

10.16 Metals - Cast iron

10.16.1 Cast iron is a term to describe ferrous metals containing more than 1.7% carbon and is used extensively in the manufacture of pipes.

10.16.2 Hazards

10.16.2.1 Generally, cast iron has a good resistance to corrosion by soils, however, corrosion can occur due to the following mechanisms:-

1) Generation of large scale galvanic cells caused by differences in salt concentrations, oxygen availability or presence of stray electrical currents.

2) Hydrochloric acid will cause corrosion at any concentration and temperature. Dilute sulphuric, nitric and phosphoric acids are also aggressive as also are well aerated organic acids.

10.16.3 Risk assessment

10.16.3.1 Testing can be carried out on site to measure the resistivity and redox potential of soils which can assist in deriving recommendations for protection of cast iron components using coatings, burial trenches, or isolation techniques. Currently, however, there is no specific guidance and we recommend advice is sought from manufacturers.

10.16.3.2 Guidelines produced by the Water Research Centre (WRc) on the use of ductile iron pipes, state that highly acidic soils (pH <5) are corrosive to cast iron pipe even when protected by a zinc coating or polythene sleeving. WRc also indicate that groundwater containing >300ppm chloride may corrode even protected cast iron pipes.

10.16.3.3 On the basis that the pH of soils at the site are not less than 5, and groundwater is unlikely to be in contact with cast iron elements, then the risk of ductile cast iron pipes being affected by acid/chloride attack is considered low. We have not carried out any redox/resistivity testing (considered outside our brief) and thus we cannot comment further with regards to the risks of galvanic action.

10.17 Metals - Steel piles

10.17.1 Hazards

10.17.1.1 The corrosion of steel requires the presence of both oxygen and water. In undisturbed natural soils the amount of corrosion of driven steel piles is generally small. In disturbed soils (made ground) however, corrosion rates can be high and normally twice as high as those for undisturbed natural soils.

10.17.2 Risk Assessment

10.17.2.1 Guidance on the use of steel piles in different environments is provided in British Steel's piling handbook which includes calculating the effective life of steel piles. There is no specific guidance, however, for contaminated soils in this publication. Coatings can be provided to the pile surface but experience has shown that some coatings can be damaged during driving, particularly in ground which can contain hard materials such as brick/concrete/stone.

10.18 Metals - Stainless steel

10.18.1 Hazards

10.18.1.1 Stainless steel is used in a number of building components including services, pipework, reinforcement bars and wall ties. There is little knowledge, however, of the performance of stainless steel in aggressive environments.

10.18.2 Risk assessment

10.18.2.1 Stainless steel can withstand pH of 6.5 to 8.5, but the chlorine content of a soil increases the risk of corrosion. At concentrations of 200mg/l type 304 stainless steel can be used, but for concentrations of 200mg/l to 1000mg/l type 316 should be used in preference to type 304, but for concentrations greater than 1000mg/l type 316 should always be used.

10.18.2.2 At this site the pH of the natural soils was recorded within the range of 5.0 to 8.2, and whilst groundwater will not be in contact with stainless steel components, we recommend that manufacturer’s advice is sought to the affects of soils on stainless steel at the site.

10.19 Metals - Galvanised steel

10.19.1 Hazards

10.19.1.1 Galvanising steel is a means of protecting steel from aggressive environments; however, zinc galvanising can be corroded by salts and acids.

10.19.2 Risk assessment/remedial action

10.19.2.1 There is no current specific guidance on the effects of aggressive ground conditions on galvanised steel, however, some research indicates zinc alloys are generally more resistant than pure zinc coatings in aggressive conditions.

10.20 Metals - Copper

10.20.1 Hazards

10.20.1.1 Copper is commonly used for gas and water supplies. Copper is generally resistant to corrosion in most natural environments, but in contaminated ground copper can be subject to corrosion by acids, sulphates, chlorides and ground containing cinders/ash. Wet peat (pH 4.6) and acid clays (pH 4.2) are considered aggressive conditions to promote corrosion to copper.

10.20.2 Risk assessment

10.20.2.1 There is no specific published guidance on what constitutes aggressive conditions to copper except very acid/peaty conditions.

10.20.2.2 There are no significantly acidic or peaty conditions in near surface soils at the site or, indeed, significant concentrations of ash/cinders. On this basis the risk of significant corrosion to copper in contact with the ground is considered low.

10.21 Metals - Lead

10.21.1 Hazards

10.21.1.1 Lead is used in tanking, flashings, damp proof courses, etc. Lead is a durable material which is resistant to corrosion in most environments. Lead damp proof courses can be subject to attack from the lime released by Portland Cement based mortar and concrete. In the presence of moisture, a slow corrosive attack is initiated on lead sheet. In such cases a thick coat of bitumen should be used to protect the lead damp proof course.

10.21.2 Risk assessment

10.21.2.1 There is no current guidance on the performance of lead in contact with contaminated soils, however, acids and alkalis (lime) could be aggressive towards lead.

10.21.2.2 At the site pH conditions are not considered significantly extreme and this it is considered unlikely that ground conditions at the site would significantly affect lead.

10.22 Plastics - General

10.22.1 The range of plastics in construction is wide and increasing. The deterioration of plastics varies with the individual material and the environment to which it is exposed. In general, plastics deteriorate through degradation of their polymer constituent, but loss of plasticizer and other additives can render plastics ultimately unserviceable.

10.23 Plastic membranes and geotextiles

10.23.1 Plastic membranes and textiles are used in the construction industry as damp proof courses, gas resistant membranes, cover systems and liners. They are typically used to restrict the movement of gas or water into buildings, building materials or components or to separate differing soil types. Typically materials used for membranes are polyethylene (PE) and poly vinyl chloride (PVC).

10.23.2 Hazards

10.23.2.1 Membranes of PE and PVC are attacked by a variety of acids and solvents. PE has a poor corrosion resistance to oxidising acids (nitric and sulphuric) at high concentrations. Hydrochloric acid (HCl) does not chemically attack PE but can have a detrimental effect on its mechanical properties. Alkalis, basic salts, ammonia solutions and bleaching chemicals such as chlorine will cause deterioration of PE. PE is resistant to non-oxidising salt solutions.

10.23.2.2 PVC is degraded by the action of oxidising acids. Nitric acid is particularly aggressive towards PVC. PVC does not deteriorate under the action of neutral or alkaline solutions.

10.23.3 Risk assessment

10.23.3.1 There is no published guidance on quantitative assessment of the risks to PE or PVC although there is a lot of advice on how contaminants react with these plastics. In general, the more concentrated the contamination the greater the risk to plastic membranes/geotextiles.

10.23.3.2 Based on the investigatory data obtained to date, and in consideration of the hazards described above, there is no evidence of significant concentrations of acids or alkalis, indicating the risks of ground conditions at the site affecting PE and PVC materials are considered low.

10.24 Plastic Pipes

10.24.1 Hazards

10.24.1.1 Plastic pipes are predominantly manufactured from PVC and PE but other materials can be used. In general they perform well but it is known that chemical attack and permeation of contaminants through the pipes can result from use in contaminated land. A published review on plastic pipes reports the following:

- Polyethylene (PE) - good resistance to solvents, acids and alkalis
- Poly vinyl chloride (PVC) - most common form of pipe. Good general resistance to chemical attack but can be attacked by solvents such as ketones, chlorinated hydrocarbons and aromatics
- Polypropylene (PP) - chemically resistant to acids, alkalis and organic solvents but not recommended for use with storing oxidising acids, chlorinated hydrocarbons and aromatics.
- Poly vinylidene fluoride (PVDF) - inert to most solvents, acids and alkalis as well as chlorine, bromide and other halogens
- Polytetrafluoroethylene (PTFE) - one of the most inert thermoplastics available. PTFE has good chemical resistance to solvents, acids and alkalis

10.24.1.2 A survey carried out by the Water Research Centre (WRc) on reported incidents of permeation (more than 25), only two involved PVC with these incidents relating to spillages of fuel.

10.24.2 Assessment

10.24.2.1 A survey carried out by the Water Research Centre (WRc) on reported incidents of permeation (more than 25), only two involved PVC with these incidents relating to spillages of fuel.

10.24.2.2 The UK Water Industry research (UKWIR) have published a document entitled *'Guidance for the selection of Water supply pipes to be used in Brownfield sites'*. The publication defines brownfield sites as

> *'Land or premises that have been used or developed. They may also be vacant, or derelict. However they are not necessarily contaminated'*

10.24.2.3 The subject site has not previously been developed and is not considered to be a brownfield site as defined by the UKWIR publication. In addition laboratory test data for polycyclic aromatic hydrocarbons (PAHs) produced no or very limited concentrations above detectable limits. Based on this evidence we are of the opinion that special precautions are unlikely to be required for water supply pipe. We recommend United Utilities is however consulted on this to gain their opinion and requirements.

10.25 Electrical cables

10.25.1 Hazards

10.25.1.1 Electrical cables are generally protected by plastic sleeves. These sleeves are potentially subject to chemical and permeation in similar modes as plastic pipes. Medium and low voltage cables are often laid directly into the ground and are thus at risk of attack by contaminants. High voltage cables tend to be laid in trenches backfilled with 'clean' materials.

10.25.2 Risk assessment/remedial action

10.25.2.1 The selection of appropriate sheathing material is important to provide resistance to ground conditions at the site and recommend manufacturers' advices are sought.

10.26 Rubbers

10.26.1 Hazards

10.26.1.1 Rubbers are crosslinked polymeric materials containing a number of additives such as carbon black, fillers, antioxidant and vulcanising agents. The corrosion resistance of rubber is dependent upon the polymeric constituent. The mechanisms by which rubbers deteriorate when placed in aggressive chemical environments are similar to those described for plastics. Oxidation is the principal form of degradation. Whilst rubbers are resistant to strong acids and alkalis, they are rapidly attacked by oxidising agents such as nitric acid and oxidising salts such as copper, manganese and iron.

10.26.1.2 Rubber is also susceptible to attack by certain hydrocarbons and oils. The absorption of these liquids causes the rubber to smell.

10.26.2 Risk assessment/remedial action

10.26.2.1 Information on the effect of a range of chemicals on the physical properties of various rubbers has been produced by the Rubber and Plastics Research Association. This was based on observations carried out following immersion tests using undiluted chemicals, but this has limitations such as the effects of combined chemicals and the effects of dilution.

10.26.2.2 We recommend manufacturers of the rubber materials likely to be in contact with the ground at the site are consulted to confirm, or otherwise, the applicability of their product.

11 Landfill issues

11.1 Disposal of soils off site

11.1.1 Disposal of waste soils must comply with the Landfill Directive and amendments to the *'Landfill (England and Wales) Regulations'*. Essentially, this requires the 'waste producer' to classify soils for off-site disposal to an appropriately licensed landfill facility. Laboratory testing on soils from the site would be required to allow such classification in accordance with current Environment Agency waste acceptance criteria and procedures. We can carry such testing and an assessment of soil classification for disposal on further instructions.

11.2 Landfill tax

11.2.1 Disposal of soils to landfill sites is normally subject to landfill tax with rates varying from year to year based on government policy. Current information on rates of landfill tax can be obtained from the HM Revenue and Customs website (www.hmrc.gov.uk).

11.3 Reuse of Soils - Materials Management Plans

11.3.1 Where soils are to be moved and reused onsite, or are to be imported to the site, a Waste Exemption or an Environmental Permit is required.

11.3.2 An alternative is the use of a Materials Management Plan (MMP) to determine where soils are and are not considered to be a waste. By following *'The Definition of Waste: Development Industry Code of Practice'* published by CL:AIRE (produced in 2008 and revised in March 2011), soils that are suitable for reuse without the need for remediation (either chemical or geotechnical) and have a certainty of use, are not considered to be waste and therefore do not fall under waste regulations. In addition, following this guidance may present an opportunity to transfer suitable material between sites, without the need for Waste Exemptions or Environmental Permits.

11.3.3 MMPs offering numerous benefits, including maximising the use of soils onsite, minimising soils going to landfill and reducing costs and time involved in liaising with waste regulators.

11.3.4 We can provide further advice on this and provide fees for producing a Materials Management Plan on further instructions.

12 Further investigations

12.1 Although we have endeavoured to provide a comprehensive investigation for the proposed development within budgetary constraints there are areas, which we recommend further investigations be carried out. These are as follows:

- Further insitu CBR testing using a TRL DCP probe along proposed access roads and hardstanding may yield a value above 3% which would decrease the required formation thickness and provide associated cost savings.
- Precautionary testing to determine hardness values within surface waters of Higgin Brook onsite which will enable a more detailed risk assessment to be completed in relation to water receptors.

12.2 We would be pleased to carry out any of the supplementary investigations described above and provide proposals with costings on further instructions.

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13 Remediation strategy and specification

13.1.1 We have not identified any significant chemical contamination at the subject site, therefore, remediation is not considered necessary. It is recommended, however, that hardness values within surface waters of Higgin Brook are determined to enable a more detailed risk assessment to be completed in relation to water receptors.

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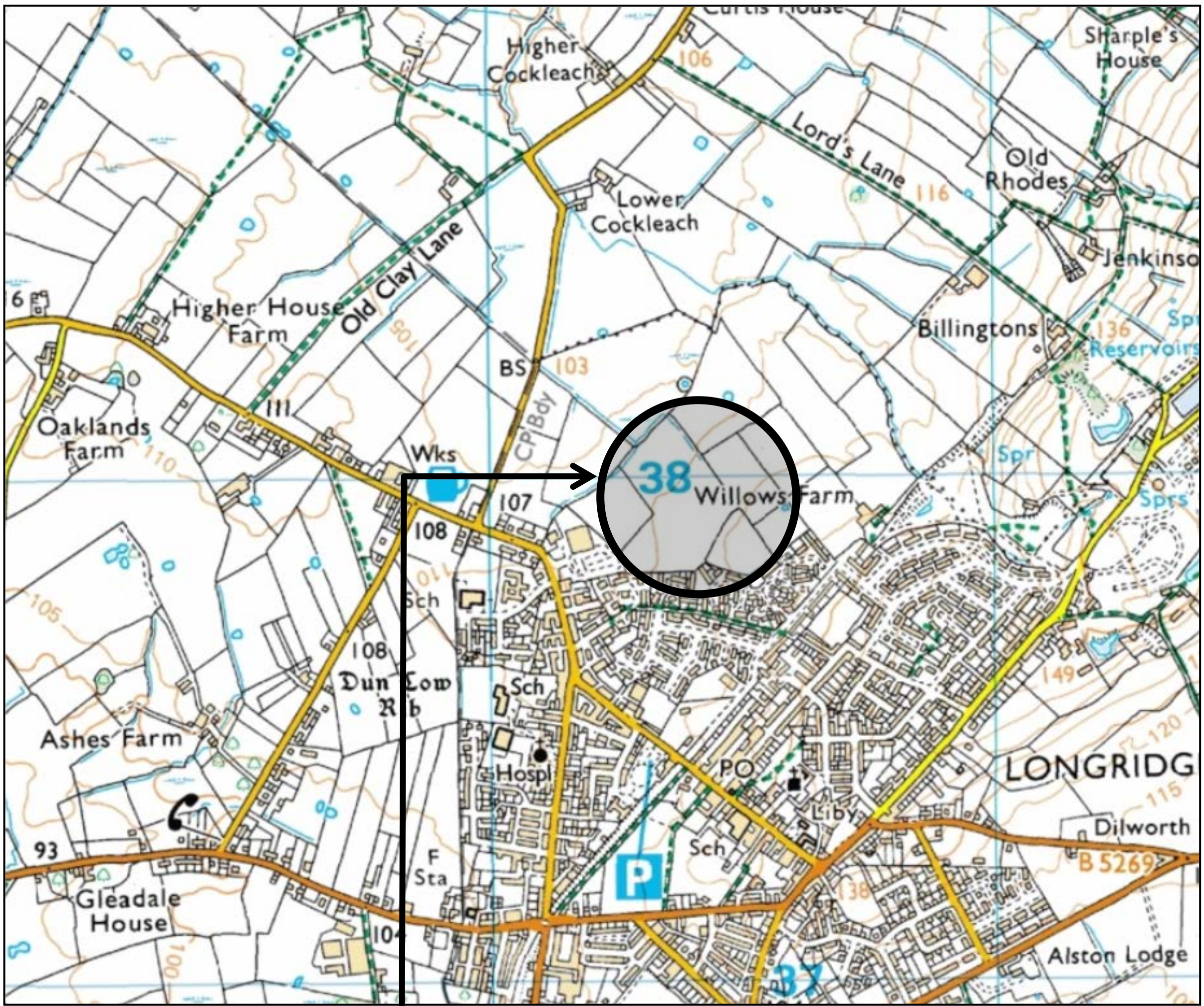

Approximate area of investigation

Title	Scale	Drawing number
Site location plan	Not to scale	01

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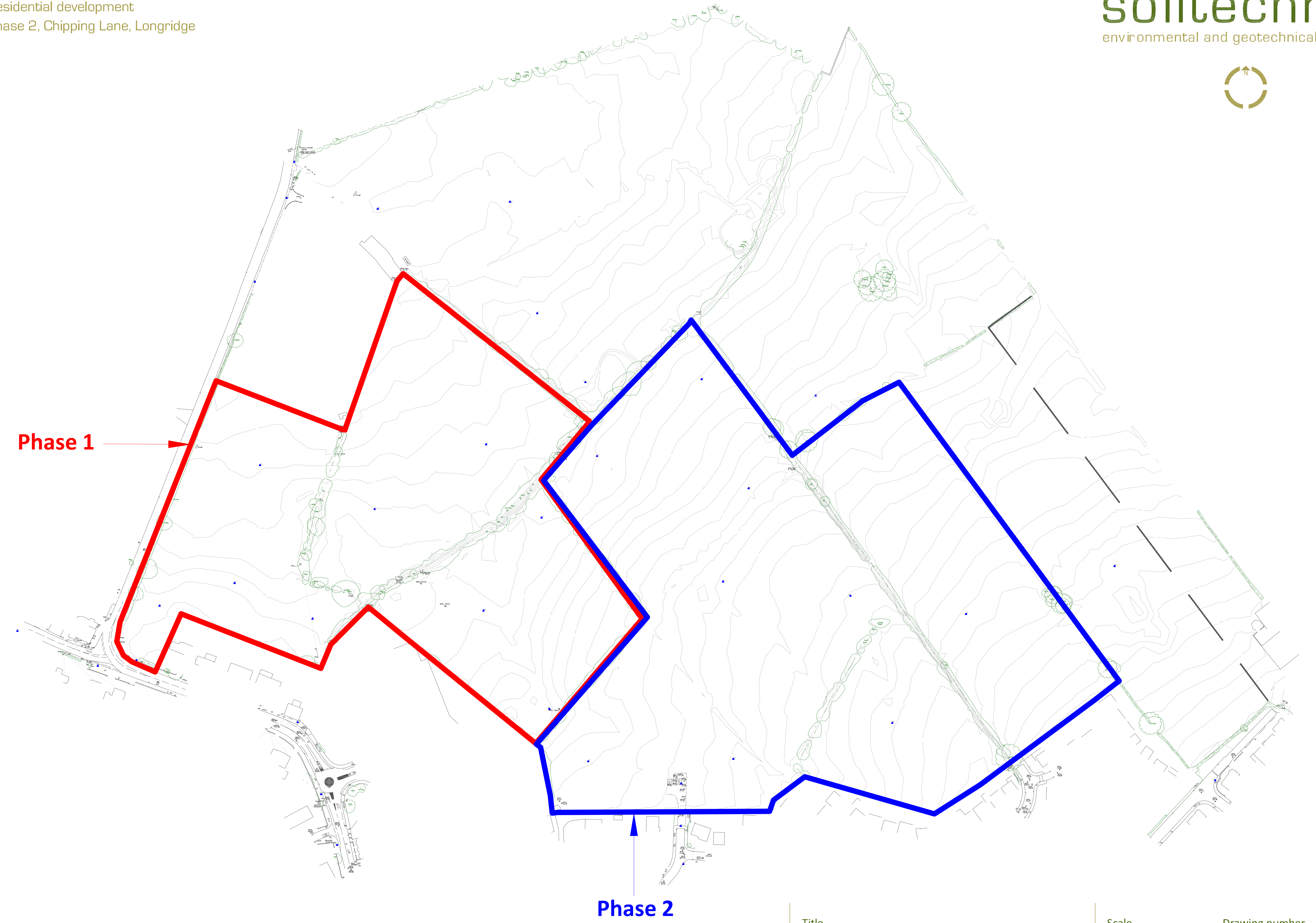

Title	Scale	Drawing number
Plan showing existing site features and location and extent of development phases	1:2500 at A3	02a

Residential development
Phase 2, Chipping Lane, Longridge

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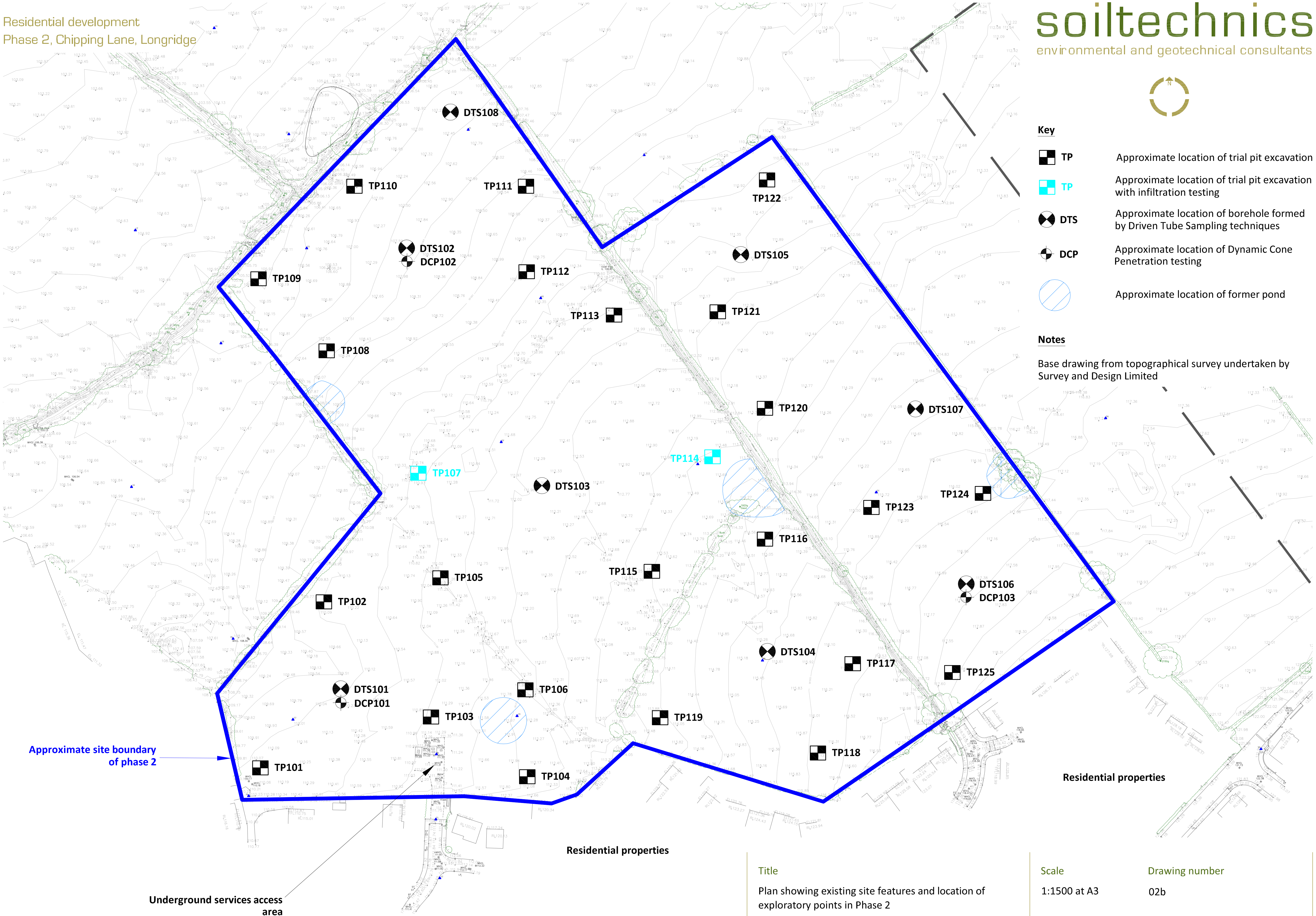

Key

TP	Approximate location of trial pit excavation
TP	Approximate location of trial pit excavation with infiltration testing
DTS	Approximate location of borehole formed by Driven Tube Sampling techniques
DCP	Approximate location of Dynamic Cone Penetration testing
	Approximate location of former pond

Notes

Base drawing from topographical survey undertaken by Survey and Design Limited

Title	Scale	Drawing number
Plan showing existing site features and location of exploratory points in Phase 2	1:1500 at A3	02b

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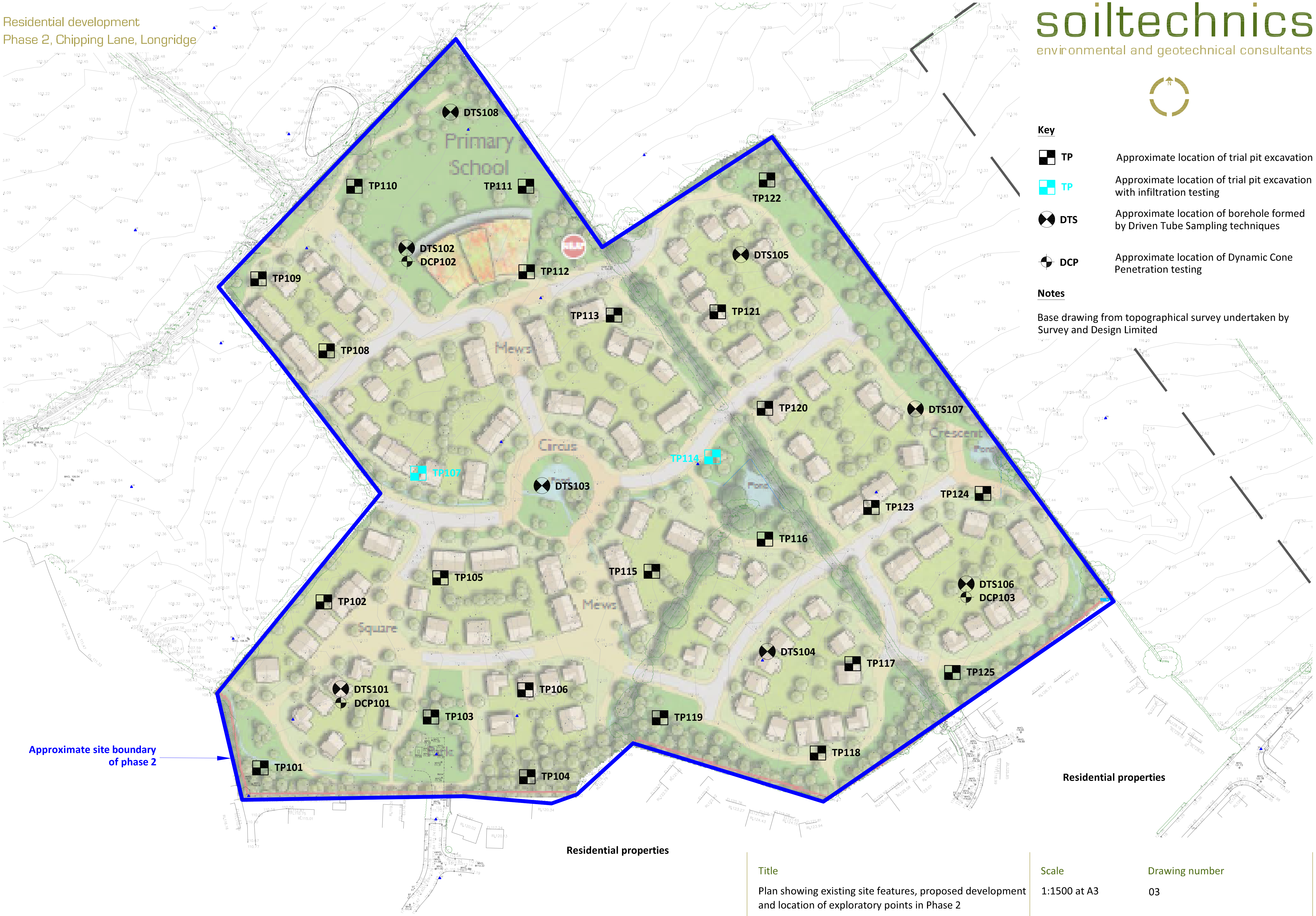


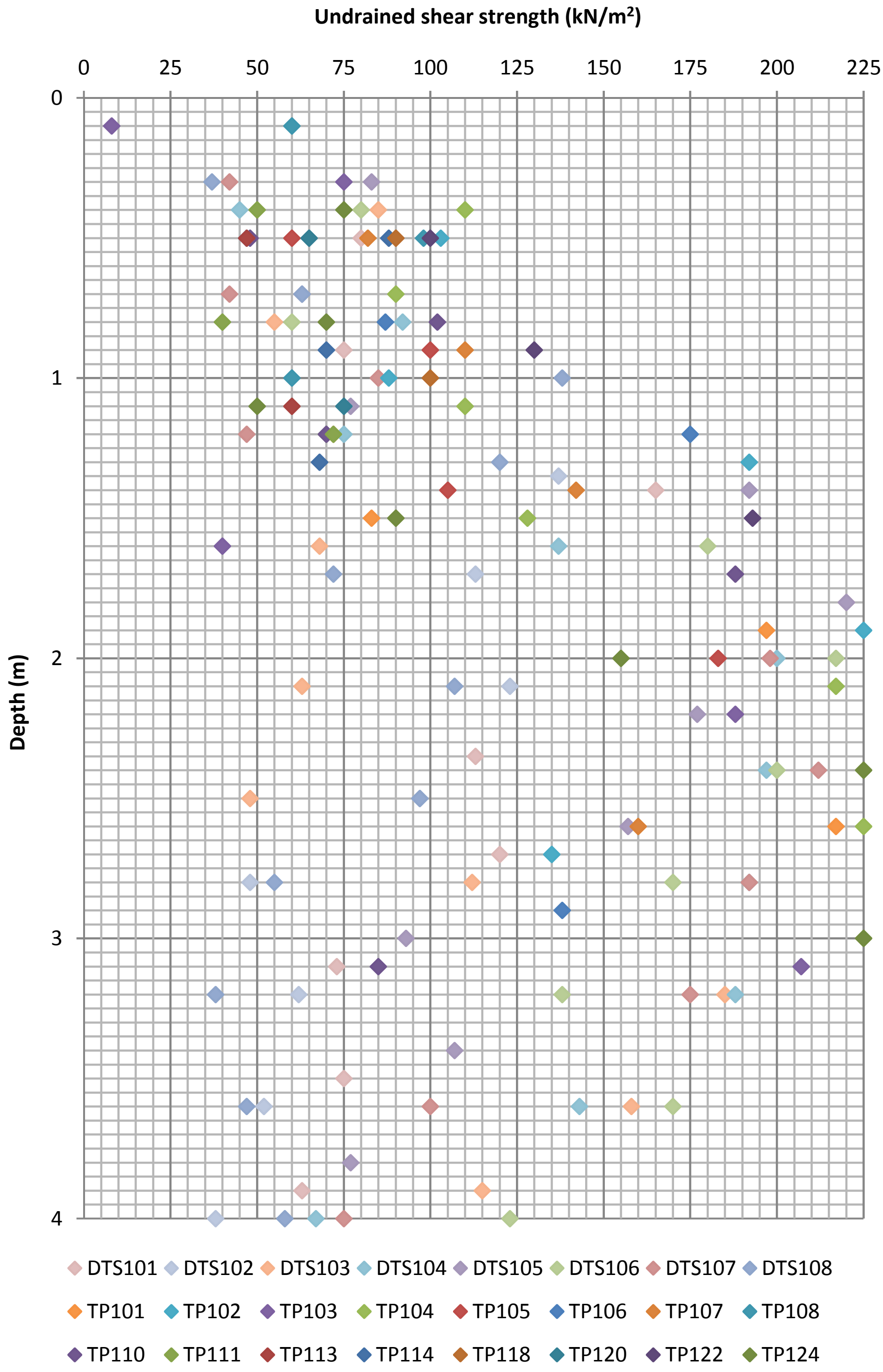
Key

TP	Approximate location of trial pit excavation
TP	Approximate location of trial pit excavation with infiltration testing
DTS	Approximate location of borehole formed by Driven Tube Sampling techniques
DCP	Approximate location of Dynamic Cone Penetration testing

Notes

Base drawing from topographical survey undertaken by Survey and Design Limited

Title	Scale	Drawing number
Plan showing existing site features, proposed development and location of exploratory points in Phase 2	1:1500 at A3	03



Notes

1) Equivalent undrained shear strength derived by multiplying Pocket Penetrometer (PP) results by 50

Title	Scale	Drawing number
Plot summarising results of pocket penetrometer determinations by location	As shown	04

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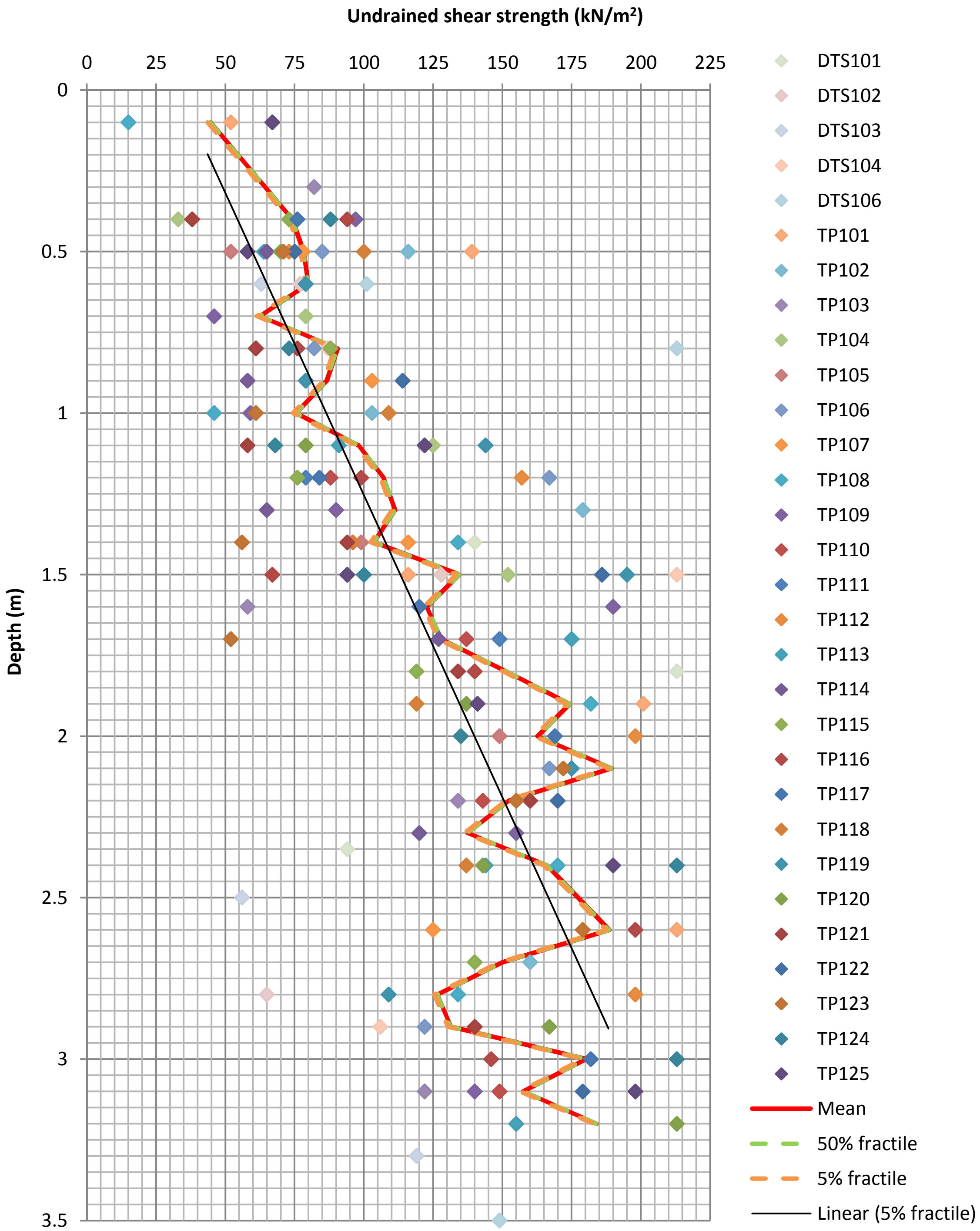
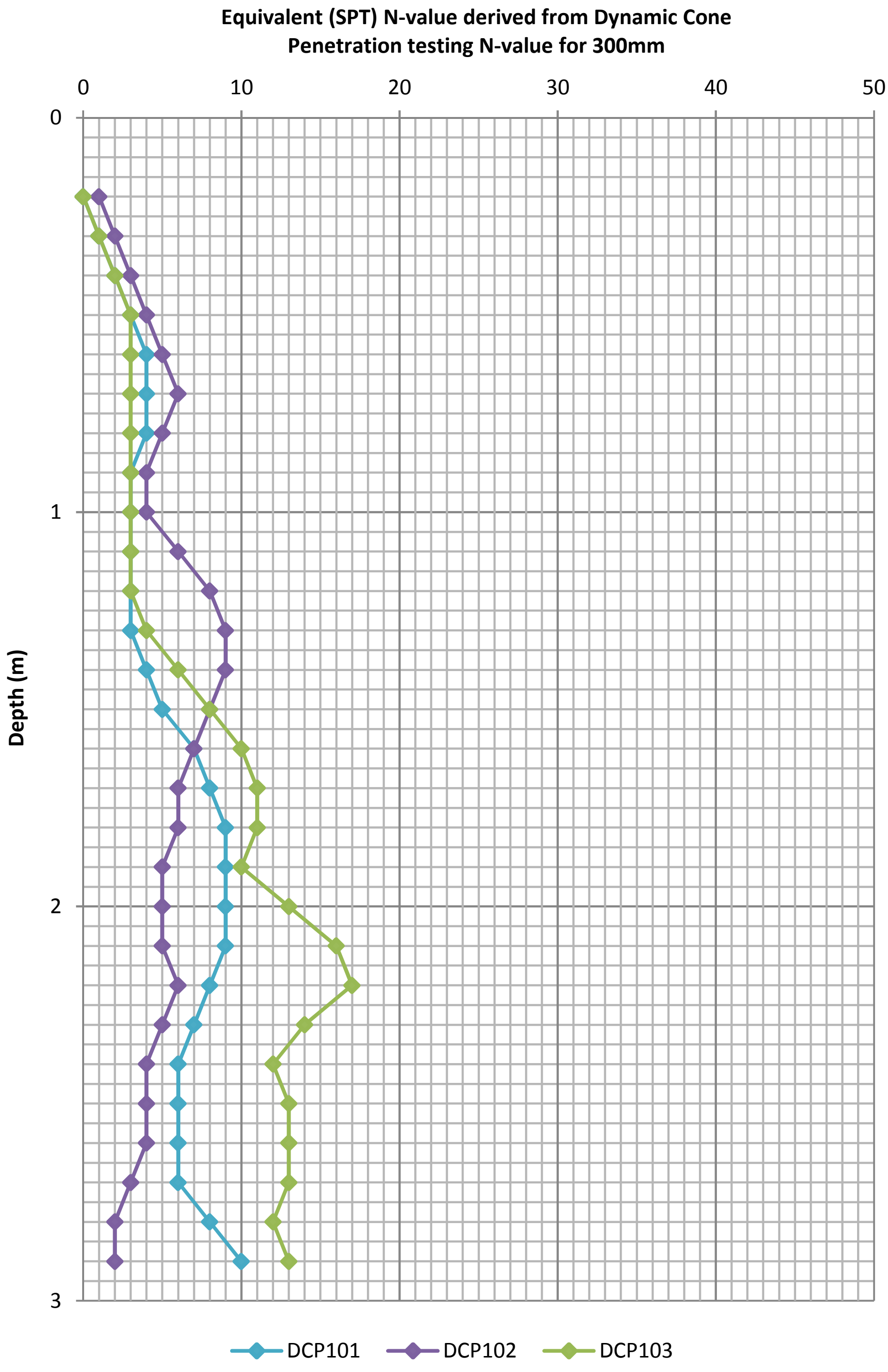


Title	Scale	Drawing number
Plot summarising results of shear vane determinations by location	As shown	05



Title	Scale	Drawing number
Plot summarising insitu density testing utilising dynamic cone penetration (DCP) techniques	As shown	06

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Definition of geotechnical terms used in this report - foundations

Strip foundations.
A foundation providing a continuous longitudinal ground bearing.

Trench fill concrete foundation.
A trench filled with mass concrete providing continuous longitudinal ground bearing.

Pad foundation.
An isolated foundation to spread a concentrated load.

Raft foundation.
A foundation continuous in two directions, usually covering an area equal to or greater than the base area of the structure.

Substructure.
That part of any structure (including building, road, runway or earthwork) which is below natural or artificial ground level. In a bridge this includes piers and abutments (and wing walls), whether below ground level or not, which support the superstructure.

Piled foundations and end bearing piles. A pile driven or formed in the ground for transmitting the weight of a structure to the soil by the resistance developed at the pile point or base and the friction along its surface. If the pile supports the load mainly by the resistance developed at its point or base, it is referred to as an end-bearing pile; if mainly by friction along its surface, as a friction pile.

Bored cast in place pile.
A pile formed with or without a casing by excavating or boring a hole in the ground and subsequently filling it with plain or reinforced concrete.

Driven pile.
A pile driven into the ground by the blows of a hammer or a vibrator.

Precast pile.
A reinforced or prestressed concrete pile cast before driving.

Driven cast in place pile.
A pile installed by driving a permanent or temporary casing, and filling the hole so formed with plan or reinforced concrete.

Displacement piles.
Piled formed by displacement of the soil or ground through which they are driven.

Skin friction.
The frictional resistance of the surrounding soil on the surface of cofferdam or caisson walls, and pile shafts.

Downdrag or negative skin friction. A downwards frictional force applied to the shaft of a pile caused by the consolidation of compressible strata, e.g. under recently placed fill. Downdrag has the effect of adding load to the pile and reducing the factor of safety.

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Definition of geotechnical terms used in this report – bearing values

Ultimate bearing capacity.
The value of the gross loading intensity for a particular foundation at which the resistance of the soil to displacement of the foundation is fully mobilised.

Presumed bearing value.
The net loading intensity considered appropriate to the particular type of ground for preliminary design purposes. The particular value is based on calculation from shear strength tests or other field tests incorporating a factor of safety against shear failure.

Allowable bearing pressure.
The maximum allowable net loading intensity at the base of the foundation, taking into account the ultimate bearing capacity, the amount and kind of settlement expected and our estimate of ability of the structure to accommodate this settlement.

Factor of safety.
The ratio of the ultimate bearing capacity to the intensity of the applied bearing pressure or the ratio of the ultimate load to the applied load.

Definition of geotechnical terms used in this report – road pavements

The following definitions are based on Transport and Road Research Laboratory (TRRL) Report LR1132.

Equilibrium CBR values.
A prediction of the CBR value, which will be attained under the completed pavement.

***Thin pavement*.**
A thin pavement (which includes both bound and unbound pavement construction materials 1 in 300mm thick and a thick pavement is 1200mm thick (typical of motorway construction).

Definition of geo-environmental terms used in this report

Conceptual model
Textual and/or schematic hypothesis of the nature and sources of contamination, potential migration pathways (including description of the ground and groundwater) and potential receptors, developed on the basis of the information obtained from the investigatory process.

Contamination
Presence of a substance which is in, on or under land, and which has the potential to cause harm or to cause pollution of controlled water.

Controlled water
Inland freshwater (any lake, pond or watercourse above the freshwater limit), water contained in underground strata and any coastal water between the limit of highest tide or the freshwater line to the three mile limit of territorial waters.

Harm
Adverse effect on the health of living organisms, or other interference with ecological systems of which they form part, and, in the case of humans, including property.

Pathway
Mechanism or route by which a contaminant comes into contact with, or otherwise affects, a receptor.

Receptor
Persons, living organisms, ecological systems, controlled waters, atmosphere, structures and utilities that could be adversely affected by the contaminant(s).

Risk
Probability of the occurrence of, and magnitude of the consequences of, an unwanted adverse effect on a receptor.

Risk Assessment
Process of establishing, to the extent possible, the existence, nature and significance of risk.

Definition of environmental risk/hazard terms used in this report.

Based on CIRIA report C552 '*Contaminated land risk assessment – A guide to good practice*'.

Potential hazard severity definition

Category	Definition
Severe	Acute risks to human health, catastrophic damage to buildings/property, major pollution of controlled waters
Medium	Chronic risk to human health, pollution of sensitive controlled waters, significant effects on sensitive ecosystems or species, significant damage to buildings or structures.
Mild	Pollution of non sensitive waters, minor damage to buildings or structures.
Minor	Requirement for protective equipment during site works to mitigate health effects, damage to non sensitive ecosystems or species.

Probability of risk definition

Category	Definition
High likelihood	Pollutant linkage may be present, and risk is almost certain to occur in long term, or there is evidence of harm to the receptor.
Likely	Pollutant linkage may be present, and it is probable that the risk will occur over the long term
Low likelihood	Pollutant linkage may be present, and there is a possibility of the risk occurring, although there is no certainty that it will do so.
Unlikely	Pollutant linkage may be present, but the circumstances under which harm would occur are improbable.

Level of risk for potential hazard definition

Probability of risk	Potential severity			
	Severe	Medium	Mild	Minor
High Likelihood	Very high	High	Moderate	Low/Moderate
Likely	High	Moderate	Low/Moderate	Low
Low Likelihood	Moderate	Low/Moderate	Low	Very low
Unlikely	Low/Moderate	Low	Very low	Very low

Refer sheet 2 for definitions of 'very high' to 'low'

Definition of environmental risk/hazard terms used in this report.

Based on CIRIA report C552 '*Contaminated land risk assessment – A guide to good practice'.*

Risk classifications and likely action required:

Very high risk
High probability that severe harm could arise to a designated receptor from an identified hazard OR there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised is likely to result in substantial liability. Urgent investigation and remediation are likely to be required.

High risk
Harm is likely to arise to a designated receptor from an identified hazard. This risk, if realised, is likely to result in substantial liability. Urgent investigation is required and remedial works may be necessary in the short term and are likely over the long term.

Moderate risk
It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is likely that the harm would be relatively mild. Investigation is normally required to clarify risks and to determine potential liability. Some remedial works may be required in the long term.

Low risk
It is possible that harm could arise to a designated receptor from an identified hazard but it is likely that this harm, if realised, would at worst normally be mild.

Very low risk
It is a low possibility that harm could arise to a designated receptor. On the event of such harm being realised it is not likely to be severe.

List of documents used in assessment of chemical contamination

No.	Title	Publication reference / publisher
1	Human health toxicological assessment of contaminants in soil	EA Science Report – SC050021/SR2
2	Updated technical background to the CLEA model	EA Science Report – SC050021/SR3
3	CLEA Software (Version 1.03 beta) Handbook	EA Science Report - SC050021/SR4
4	Guidance on comparing Soil Contamination Data with a Critical Concentration	CIEH
5	Generic Assessment Criteria for Human Health Risk Assessment	LQM/CIEH
6	Assessment of Risks to Human Health from Land Contamination: An overview of the development of soil guideline values and related research	R&D Publication, Contaminated Land Report CLR 7
7	Contaminants of Soil: Collation of Toxicological Data and Intake Values for Humans	R&D Publication, Contaminated Land Report CLR 9
8	The Contaminated Land Exposure Assessment Model (CLEA): Technical Basis and Algorithms	R&D Publication, Contaminated Land Report CLR 10
9	Model Procedures for the Management of Land Contamination	R&D Publication, Contaminated Land Report CLR 11
10	Contaminants in Soil: Collection of Toxicological Data and Intake Values for Human Values	R&D Publications, Tox. 6
11	Soil Guideline Values for Contamination (2002)	R&D Publications, SGV 10
12	Soil Guideline Values (2009)	EA Science Reports – SC050021

CIEH Chartered institute of Environmental Health
LQM Land Quality Management
EA Environment Agency

Key to legends

Composite materials, soils and lithology

Topsoil	Made Ground	Boulders
Chalk	Clay	Coal
Cobbles	Cobbles & Boulders	Concrete
Gravel	Limestone	Mudstone
Peat	Sand	Sand and Gravel
Sandstone	Silt	Silt / Clay
		Siltstone

Note: Composite soil types are signified by combined symbols.

Key to 'test results' and 'sampling' columns

Test result	
Depth	Records depth that the test was carried out (i.e.: at 2.10m or between 2.10m and 2.55m)
Result	PID - Photo Ionisation Detector result (ppm equivalent Isobutylene) PP – Pocket penetrometer result (kN/m^2) HVP – Hand held shear vane result (kN/m^2) *PP result converted to an equivalent undrained shear strength by applying a factor of 50. Where at least 3 results obtained at same depth then an average value may be reported.*

Sampling		
From (m) To (m)	Records depth of sampling	
Type	D	Disturbed sample
	B	Bulk disturbed sample
	ES	Environmental sample comprising plastic and/or glass container
	W	Water sample
	CBR	Undisturbed sample in mould (California Bearing Ratio)

Water observations

Described at foot of log and shown in the 'water strike' column.

▼	= water level observed after specified delay in excavation
▽	= water strike

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DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	TEST RESULTS RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
Grass onto soft medium strength brown gravelly very sandy CLAY with frequent rootlets. Gravel consists of fine to medium sandstone and quartzite. MADE GROUND *...masonry slab 0.2x0.3m in size at 0.2m depth.*		0.25		HVP 0.10	52	0.10		D
Medium dense brown gravelly very clayey SAND. Gravel consists of fine to medium sandstone, quartzite and brick. MADE GROUND		0.40				0.30		D
Firm high strength gravelly very sandy CLAY. Gravel consists of fine to medium sandstone, quartzite and brick. MADE GROUND *...0.1m diameter ceramic land drain running east to west at 0.6m depth.*		0.85		HVP 0.50	139	0.50		D
Medium dense grey clayey very gravelly SAND. Sand is fine to medium. Gravel consists of sandstone and occasional quartzite. MADE GROUND *...from 1m depth, becoming very clayey.*		1.40				0.90 0.90		D ES
Firm high becoming very high strength brown mottled grey slightly silty slightly gravelly CLAY. Gravel consists of medium sandstone and mudstone. DEVENSIAN TILL *...from 1.7m depth, becoming stiff.* *...from 2m depth, becoming friable.* *...from 2.4m depth, becoming very stiff.*		2.80		HVP 1.50 PP 1.50 HVP 1.90 PP 1.90 HVP 2.60 PP 2.60	116 83 201 197 213 217	1.50 1.90 2.60		D D D
TRIAL PIT TERMINATED AT 2.80m								

Notes: Trial pit sides remained upright and stable upon completion.

Ground level (mAOD)

Co-ordinates

Title
Trial pit record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Dimensions (W x L)
0.60m x 2.50m

Date of excavation (range if applicable)
16/02/2016

Appendix
C

Method of excavation
JCB 3CX

Location plan on drawing number
02b

TP101

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DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	RESULT	SAMPLING FROM (m)	TO (m)	TYPE
Grass onto medium dense brown gravelly very clayey organic SAND with frequent rootlets. Gravel consists of medium sandstone and mudstone. TOPSOIL						0.20		D
Firm high strength orangish brown slightly silty gravelly CLAY. Gravel consists of fine to coarse sandstone and mudstone. DEVENSIAN TILL		0.30						
...from 0.5m depth, becoming slightly gravelly.				HVP 0.50 PP 0.50	116 103	0.60		D
				HVP 1.00 PP 1.00	103 88	1.00		D
Stiff very high strength orangish brown mottled grey slightly gravelly friable CLAY. Gravel consists of fine to coarse sandstone and mudstone. DEVENSIAN TILL		1.20		HVP 1.30 PP 1.30	179 192			
...from 1.9m depth, mottling absent.				HVP 1.90 PP 1.90	266 225	1.90		D
Stiff very high strength brown silty CLAY with occasional gravels of medium sandstone and occasional cobbles of sandstone. DEVENSIAN TILL		2.50		HVP 2.70 PP 2.70	160 135	2.70		D
TRIAL PIT TERMINATED AT 3.10m		3.10						

Notes: Trial pit sides remained upright and stable upon completion.

Ground level (mAOD)

Co-ordinates

Title
Trial pit record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Dimensions (W x L)
0.60m x 2.50m

Date of excavation (range if applicable)
16/02/2016

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Method of excavation
JCB 3CX

Location plan on drawing number
02b

TP102

soiltechnics
environmental and geotechnical consultants

DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	RESULT	SAMPLING FROM (m)	TO (m)	TYPE
Grass onto soft very low strength brown sandy CLAY with frequent rootlets and occasional gravels of sandstone, mudstone and ceramic. MADE GROUND		0.15		PP 0.10	8	0.10		D
Firm high strength brown slightly silty slightly sandy CLAY with occasional gravels of medium sandstone and brick. MADE GROUND		0.45		HVP 0.30 PP 0.30	82 75	0.30		D
Loose dark brown clayey SAND with occasional gravels of medium sandstone. MADE GROUND ...*from 1.3m depth, becoming gravelly.*		1.50				0.70 1.40		D D
Soft to firm medium strength slightly gravelly sandy CLAY. Gravel consists of fine to medium sandstone and limestone. MADE GROUND ...*0.1m diameter wet ceramic land drain running north to south at 1.8m depth.*		2.00		HVP 1.60 PP 1.60	58 40	1.70		D
Stiff high and very high strength brown silty CLAY with occasional gravels of medium sandstone and mudstone and occasional cobbles of sandstone. DEVENSIAN TILL		3.10		HVP 2.20 PP 2.20 HVP 3.10 PP 3.10	134 188 122 207	2.60		D
TRIAL PIT TERMINATED AT 3.10m								

Notes: Trial pit sides remained upright and stable upon completion.

Ground level (mAOD)

Co-ordinates

Title
Trial pit record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Dimensions (W x L)
0.60m x 2.50m

Date of excavation (range if applicable)
16/02/2016

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Method of excavation
JCB 3CX

Location plan on drawing number
02b

TP103

soiltechnics
environmental and geotechnical consultants

DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	TEST RESULTS RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
Grass onto soft very low strength dark brown sandy organic CLAY with frequent rootlets. TOPSOIL						0.10		D
		0.25						
Soft to firm low strength brown sandy CLAY. DEVENSIAN TILL				HVP 0.40 PP 0.40	33 110	0.40		D
		0.60						
Firm high strength orangish brown sandy CLAY. DEVENSIAN TILL				HVP 0.70 PP 0.70	79 90	0.70		D
		1.05						
Stiff high becoming very high strength dark brown sandy CLAY. DEVENSIAN TILL				HVP 1.10 PP 1.10	125 110			
				HVP 1.50 PP 1.50	152 128	1.50		D
...from 1.7m depth, becoming very stiff.								
				HVP 2.10 PP 2.10	258 217			
		2.40						
Very stiff very high strength brown slightly silty CLAY. DEVENSIAN TILL				HVP 2.60 PP 2.60	228 225			
TRIAL PIT TERMINATED AT 2.80m		2.80				2.80		D

Notes: Trial pit sides remained upright and stable upon completion.

Ground level (mAOD)

Co-ordinates

Title
Trial pit record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Dimensions (W x L)
0.60m x 2.50m

Date of excavation (range if applicable)
16/02/2016

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Method of excavation
JCB 3CX

Location plan on drawing number
02b

TP104

soiltechnics
environmental and geotechnical consultants

DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	TEST RESULTS RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
Grass onto soft dark brown very sandy organic CLAY. TOPSOIL		0.35				0.10		B
Soft medium strength brown slightly silty slightly sandy CLAY. DEVENSIAN TILL		0.70		HVP 0.50 PP 0.50	52 60	0.50		B
Firm high strength brown slightly silty slightly sandy CLAY. DEVENSIAN TILL				HVP 0.90 PP 0.90	79 100	0.90		B
...from 1.3m depth, becoming stiff.		1.80		HVP 1.40 PP 1.40	99 105			
Stiff very high strength brown mottled grey CLAY with occasional gravels of fine to medium sandstone. DEVENSIAN TILL		2.30		HVP 2.00 PP 2.00	149 183	2.00 2.20		B B
Stiff brown slightly silty CLAY with occasional cobbles of sandstone. DEVENSIAN TILL								
...from 2.8m depth, becoming very stiff.		3.20						
TRIAL PIT TERMINATED AT 3.20m								

Notes: Trial pit sides remained upright and stable upon completion.

Ground level (mAOD)

Co-ordinates

Title
Trial pit record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Dimensions (W x L)
0.60m x 2.50m

Date of excavation (range if applicable)
16/02/2016

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Method of excavation
JCB 3CX

Location plan on drawing number
02b

TP105

soiltechnics
environmental and geotechnical consultants

DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	RESULT	SAMPLING FROM (m)	TO (m)	TYPE
Grass onto soft dark brown sandy organic CLAY with frequent rootlets. TOPSOIL						0.10		D
		0.40						
Firm to stiff medium and high strength grey brown slightly silty slightly sandy slightly gravelly CLAY. Gravel consists of medium to coarse sandstone and mudstone. DEVENSIAN TILL				HVP 0.50 PP 0.50	85 47	0.50		D
				HVP 0.80 PP 0.80	82 87			
		1.00						
Stiff very high strength brown mottled bluish grey CLAY. DEVENSIAN TILL						1.10		D
				HVP 1.20 PP 1.20	167 175			
...from 1.5m depth, becoming very stiff and friable.								
				HVP 2.10	167	2.10		D
		2.40						
Stiff high strength brown slightly silty CLAY with occasional gravels of fine mudstone. DEVENSIAN TILL								
TRIAL PIT TERMINATED AT 2.90m		2.90		HVP 2.90 PP 2.90	122 138	2.90		D

Notes: Trial pit sides remained upright and stable upon completion.

Ground level (mAOD)

Co-ordinates

Title
Trial pit record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Dimensions (W x L)
0.60m x 2.50m

Date of excavation (range if applicable)
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Method of excavation
JCB 3CX

Location plan on drawing number
02b

TP106

soiltechnics
environmental and geotechnical consultants

DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	TEST RESULTS RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
Grass onto soft dark brown sandy CLAY with frequent rootlets and occasional gravels of medium sandstone. TOPSOIL						0.10		D
		0.35						
Firm high strength orangish brown slightly sandy slightly gravelly silty CLAY. Gravel consists of fine to medium sandstone. DEVENSIAN TILL				HVP 0.50 PP 0.50	78 82	0.50		D
		0.85						
Firm high strength dark brown mottled bluish grey CLAY with occasional gravels of medium to coarse sandstone and mudstone. DEVENSIAN TILL				HVP 0.90 PP 0.90	103 110			
...from 1.2m depth, becoming stiff.								
...boulder of mudstone in southern end of pit at 1.4m depth.				HVP 1.40 PP 1.40	116 142	1.40		D
		2.50						
Stiff high strength brown slightly silty CLAY. DEVENSIAN TILL				HVP 2.60 PP 2.60	125 160			
		2.80						
TRIAL PIT TERMINATED AT 2.80m								

Notes: Trial pit sides remained upright and stable upon completion. Infiltration testing performed.

Ground level (mAOD)

Co-ordinates

Title
Trial pit record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Dimensions (W x L)
0.60m x 2.50m

Date of excavation (range if applicable)
17/02/2016

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Method of excavation
JCB 3CX

Location plan on drawing number
02b

TP107

soiltechnics
environmental and geotechnical consultants

DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	RESULT	SAMPLING FROM (m)	TO (m)	TYPE
Grass onto soft medium strength brown sandy gravelly CLAY with frequent rootlets. Gravel consists of medium to coarse brick, timber and sandstone. MADE GROUND		0.20		HVP 0.10 PP 0.10	15 60	0.10		D
Soft medium strength brown sandy gravelly CLAY. Gravel consists of fine to coarse brick, timber, ceramic, sandstone and occasional half brick. MADE GROUND *...cut sandstone blocks up to 0.1x0.4x0.2m in size at 0.3m depth.* *...cut sandstone blocks up to 0.2x0.2x0.2m in size at 1.1m depth.*		1.20		HVP 0.50 PP 0.50 HVP 1.00 PP 1.00	64 98 46 60	0.50 0.50		B D
Firm to stiff high and very high strength reddish brown slightly sandy slightly gravelly CLAY. Gravel consists of medium mudstone. DEVENSIAN TILL *...from 1.6m depth, becoming stiff.* *...from 2.5m depth, becoming very stiff.*		2.80		HVP 1.40 HVP 1.90 HVP 2.40 HVP 2.80	134 182 170 134	1.80 2.00		D D
TRIAL PIT TERMINATED AT 2.80m								

Notes: Some collapse of trial pit sides between 0.2m and 1.0m depth.

Ground level (mAOD)

Co-ordinates

Title
Trial pit record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Dimensions (W x L)
0.60m x 2.50m

Date of excavation (range if applicable)
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Method of excavation
JCB 3CX

Location plan on drawing number
02b

TP108

soiltechnics
environmental and geotechnical consultants

DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	TEST RESULTS RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
Grass onto soft dark brown very sandy organic CLAY with frequent rootlets and occasional roots. TOPSOIL						0.10		D
Firm medium strength brown mottled grey silty sandy CLAY. DEVENSIAN TILL		0.30		HVP 0.40	97	0.50		D
...from 0.6m depth, becoming soft with occasional roots.				HVP 0.70	46			
				HVP 1.00	59			
firm high strength brown mottled bluish grey CLAY with occasional gravels of medium mudstone and quartzite. DEVENSIAN TILL		1.20		HVP 1.30	90	1.30		D
...from 1.5m depth, becoming stiff.				HVP 1.60	190			
						1.90		D
Stiff high and very high strength brown slightly silty CLAY with occasional gravels of medium mudstone. DEVENSIAN TILL		2.20		HVP 2.30	155			
				HVP 3.10	140			
TRIAL PIT TERMINATED AT 3.30m		3.30						

Notes: Trial pit sides remained upright and stable upon completion.

Ground level (mAOD)

Co-ordinates

Title
Trial pit record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Dimensions (W x L)
0.60m x 2.50m

Date of excavation (range if applicable)
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Method of excavation
JCB 3CX

Location plan on drawing number
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TP109

soiltechnics
environmental and geotechnical consultants

DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	TEST RESULTS RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
Grass onto firm low strength dark brown sandy organic CLAY with frequent rootlets. TOPSOIL						0.10		D
Firm medium becoming high strength orangish brown slightly sandy silty CLAY. DEVENSIAN TILL		0.30		HVP 0.50 PP 0.50 HVP 0.80 PP 0.80	64 48 88 102	0.50		D
Stiff medium strength brown mottled bluish grey CLAY. DEVENSIAN TILL		1.10		HVP 1.20 PP 1.20	88 70	1.10		D
Stiff high strength brown mottled bluish grey slightly sandy gravelly CLAY. Gravel consists of fine to medium mudstone. DEVENSIAN TILL		1.60		HVP 1.70 PP 1.70	137 188	1.70		D
Very stiff high strength brown occasionally sandy occasionally gravelly CLAY. Gravel consists of medium sandstone and mudstone. DEVENSIAN TILL *...from 2m depth, becoming very stiff.*		2.00		HVP 2.20	143	3.00		D
TRIAL PIT TERMINATED AT 3.10m		3.10		HVP 3.10 PP 3.10	149 85			

Notes: Trial pit sides remained upright and stable upon completion.

Ground level (mAOD)

Co-ordinates

Title
Trial pit record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Dimensions (W x L)
0.60m x 2.50m

Date of excavation (range if applicable)
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Method of excavation
JCB 3CX

Location plan on drawing number
02b

TP110

soiltechnics
environmental and geotechnical consultants

DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	TEST RESULTS RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
Grass onto soft dark brown sandy CLAY with frequent rootlets. TOPSOIL		0.30				0.10		B
Soft to firm medium and high strength orangish brown silty CLAY with occasional gravels and cobbles of medium to coarse sandstone. DEVENSIAN TILL		1.10		HVP 0.40 PP 0.40 HVP 0.80 PP 0.80	94 50 76 40	0.50		B
Firm to stiff medium strength reddish brown mottled orange slightly gravelly CLAY. Gravel consists of medium sandstone and quartzite. DEVENSIAN TILL		1.50		HVP 1.20 PP 1.20	79 72	1.30		B
Stiff high and very high strength reddish brown mottled grey CLAY with occasional gravels of fine to medium sandstone and mudstone. DEVENSIAN TILL		2.50		HVP 1.70 HVP 2.10	149 175	1.70		B
Stiff brown CLAY with occasional medium to coarse gravels and cobbles of sandstone and mudstone. DEVENSIAN TILL		3.00						
TRIAL PIT TERMINATED AT 3.00m								

Notes: Trial pit sides remained upright and stable upon completion.

Ground level (mAOD)

Co-ordinates

Title
Trial pit record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Dimensions (W x L)
0.60m x 2.50m

Date of excavation (range if applicable)
17/02/2016

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Method of excavation
JCB 3CX

Location plan on drawing number
02b

TP111

soiltechnics
environmental and geotechnical consultants

DESCRIPTION	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	RESULT	SAMPLING FROM (m)	TO (m)	TYPE
Grass onto soft dark brown sandy organic CLAY with occasional gravels of medium sandstone and frequent rootlets. TOPSOIL					0.10		D
Firm medium strength slightly silty sandy orangish brown CLAY with occasional gravels of sandstone. DEVENSIAN TILL	0.30		HVP 0.50	73	0.50		D
...from 1.1m depth, becoming very sandy.			HVP 1.20	157			
Very stiff very high strength reddish brown mottled grey CLAY with occasional gravels and cobbles of medium to coarse sandstone and mudstone. DEVENSIAN TILL	1.80		HVP 2.00	198	2.00		D
...from 2.2m depth, becoming friable.							
Stiff very high strength brown slightly silty CLAY. DEVENSIAN TILL	2.60		HVP 2.80	198			
TRIAL PIT TERMINATED AT 3.00m	3.00						

Notes: Trial pit sides remained upright and stable upon completion.

Ground level (mAOD)

Co-ordinates

Title
Trial pit record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Dimensions (W x L)
0.60m x 2.50m

Date of excavation (range if applicable)
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Method of excavation
JCB 3CX

Location plan on drawing number
02b

TP112

soiltechnics
environmental and geotechnical consultants

DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	TEST RESULTS RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
Grass onto soft dark sandy organic CLAY with frequent rootlets. TOPSOIL						0.10		D
Firm medium strength orangish brown slightly sandy slightly gravelly silty CLAY. Gravel consists of fine to medium mudstone. DEVENSIAN TILL		0.40		HVP 0.50 PP 0.50	64 47	0.60		D
Stiff medium strength becoming high and very high strength reddish brown mottled bluish grey CLAY with occasional gravels of medium quartzite and sandstone. DEVENSIAN TILL		1.00		HVP 1.10 PP 1.10	91 60	1.10		D
...from 1.5m depth, becoming very stiff.				HVP 1.70	175			
				HVP 2.40	144	2.40		D
Stiff very high strength brown slightly silty CLAY. DEVENSIAN TILL		2.50				3.00		D
TRIAL PIT TERMINATED AT 3.20m		3.20		HVP 3.20	155			

Notes: Trial pit sides remained upright and stable upon completion.

Ground level (mAOD)	**Co-ordinates**	**Title** Trial pit record	**Surface breaking** No
Groundwater observations No groundwater encountered.	**Dimensions (W x L)** 0.60m x 2.50m	**Date of excavation (range if applicable)** 17/02/2016	**Appendix** C
	Method of excavation JCB 3CX	**Location plan on drawing number** 02b	**TP113**

DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	TEST RESULTS RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
Grass onto soft dark brown very sandy organic CLAY with frequent rootlets. TOPSOIL						0.10		D
Soft becoming firm medium strength orangish brown slightly silty slightly sandy CLAY. DEVENSIAN TILL		0.40		HVP 0.50 PP 0.50	65 88	0.50		D
				HVP 0.90 PP 0.90	58 70			
				HVP 1.30 PP 1.30	65 68	1.30		D
...from 1.5m depth, becoming stiff and friable.								
Firm high strength reddish brown CLAY with occasional gravels of medium mudstone. DEVENSIAN TILL		1.70		HVP 1.70	127	1.70		D
				HVP 2.30	120			
...no longer friable and occasional gravels of mudstone from 2.4m depth.								
TRIAL PIT TERMINATED AT 2.70m		2.70						

Notes: Trial pit sides remained upright and stable upon completion. Infiltration testing performed.

Ground level (mAOD)

Co-ordinates

Title
Trial pit record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Dimensions (W x L)
0.60m x 3.20m

Date of excavation (range if applicable)
17/02/2016

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Method of excavation
JCB 3CX

Location plan on drawing number
02b

TP114

DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	TEST RESULTS RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
Grass onto soft dark brown very sandy organic CLAY with frequent rootlets. TOPSOIL		0.30				0.10		B
Firm medium becoming high strength brown slightly gravelly silty CLAY with occasional cobbles of sandstone. Gravel consists of medium to coarse sandstone and quartzite. DEVENSIAN TILL		1.00		HVP 0.40 HVP 0.80	73 88	0.50		B
Firm to stiff medium becoming high strength reddish brown mottled bluish grey CLAY with occasional gravels of fine sandstone and mudstone. DEVENSIAN TILL *...from 1.6m depth, becoming stiff.*		2.50		HVP 1.20 HVP 1.80	76 119	1.10		B
Stiff high strength reddish brown CLAY with occasional cobbles of mudstone. DEVENSIAN TILL		3.10		HVP 2.70	140	2.70		B
TRIAL PIT TERMINATED AT 3.10m								

Notes: Trial pit sides remained upright and stable upon completion.

Ground level (mAOD)

Co-ordinates

Title
Trial pit record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Dimensions (W x L)
0.60m x 2.50m

Date of excavation (range if applicable)
17/02/2016

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Method of excavation
JCB 3CX

Location plan on drawing number
02b

TP115

soiltechnics
environmental and geotechnical consultants

DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	TEST RESULTS RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
Firm dark brown very sandy CLAY with occasional gravels of fine sandstone and frequent rootlets. TOPSOIL		0.30				0.10		D
Firm high strength dark brown gravelly CLAY. Gravel consists of fine to coarse sandstone and mudstone. DEVENSIAN TILL		0.60		HVP 0.40	94	0.40		D
Firm to stiff high strength orangish brown slightly silty CLAY with occasional gravels of medium sandstone. DEVENSIAN TILL		1.30		HVP 0.80 HVP 1.20	76 99	0.70		D
Firm medium strength brown mottled bluish grey CLAY. DEVENSIAN TILL		1.60		HVP 1.50	67	1.40		D
Stiff high becoming very high strength brown mottled bluish grey friable CLAY. DEVENSIAN TILL		3.00		HVP 1.80 HVP 2.60	140 198			
Stiff high strength reddish brown slightly silty CLAY with occasional gravels of medium mudstone. DEVENSIAN TILL		3.10		HVP 3.00	146			

TRIAL PIT TERMINATED AT 3.10m

Notes: Trial pit sides remained upright and stable upon completion.

Ground level (mAOD)

Co-ordinates

Title
Trial pit record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Dimensions (W x L)
0.60m x 2.50m

Date of excavation (range if applicable)
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Method of excavation
JCB 3CX

Location plan on drawing number
02b

TP116

soiltechnics
environmental and geotechnical consultants

DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	TEST RESULTS RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
Grass onto soft dark brown sandy organic CLAY with frequent rootlets. TOPSOIL						0.10		D
Firm medium strength orangish brown slightly silty CLAY with occasional gravels of coarse sandstone. DEVENSIAN TILL		0.25		HVP 0.40	76	0.50		D
...from 0.6m depth, becoming mottled grey in colour.				HVP 0.80	61			
Firm high strength orange mottled grey CLAY. DEVENSIAN TILL		1.10		HVP 1.20	84	1.20		D
				HVP 1.60	120			
Very stiff very high strength orange mottled grey friable CLAY. DEVONSIAN TILL		1.90		HVP 2.00	169	2.00		D
Stiff very high strength brown slightly silty CLAY with occasional gravels and cobbles of coarse mudstone. DEVENSIAN TILL		2.50						
TRIAL PIT TERMINATED AT 3.00m		3.00		HVP 3.00	182			

Notes: Trial pit sides remained upright and stable upon completion.

Ground level (mAOD)

Co-ordinates

Title
Trial pit record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Dimensions (W x L)
0.60m x 2.50m

Date of excavation (range if applicable)
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Method of excavation
JCB 3CX

Location plan on drawing number
02b

TP117

DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	RESULT	SAMPLING FROM (m)	TO (m)	TYPE
Grass onto soft dark brown very sandy organic CLAY with frequent rootlets TOPSOIL						0.10		D
Firm medium strength orangish brown slightly silty slightly sandy CLAY with occasional gravels of medium sandstone. DEVENSIAN TILL		0.20						
Stiff high strength brown mottled bluish grey slightly sandy CLAY with occasional gravels of medium mudstone. DEVENSIAN TILL		0.40		HVP 0.50 PP 0.50	100 90	0.50		D
				HVP 1.00 PP 1.00	109 100	1.10		D
				HVP 1.40	96			
...from 1.6m depth, becoming very stiff and friable.						1.80		D
				HVP 1.90	119			
Very stiff high strength brown slightly silty CLAY with occasional cobbles of sandstone. DEVENSIAN TILL		2.40		HVP 2.40	137			
						2.80		D
TRIAL PIT TERMINATED AT 3.00m		3.00						

Notes: Trial pit sides remained upright and stable upon completion.

Ground level (mAOD)

Co-ordinates

Title
Trial pit record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Dimensions (W x L)
0.60m x 2.50m

Date of excavation (range if applicable)
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Method of excavation
JCB 3CX

Location plan on drawing number
02b

TP118

DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	TEST RESULTS RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
Grass onto soft dark brown very sandy organic CLAY with frequent rootlets. TOPSOIL						0.10		D
Firm orangish brown slightly silty slightly sandy CLAY with occasional gravels of medium sandstone. DEVENSIAN TILL		0.35		HVP 0.60	79	0.50		D
Firm high strength greyish brown slightly gravelly CLAY. Gravel consists of medium sandstone. DEVENSIAN TILL *...boulder sized pockets of sand at south end of pit between 0.8m and 1.0m depth.*		0.80		HVP 0.90 HVP 1.10	79 144	1.00		D
Stiff very high becoming high strength reddish brown mottled grey CLAY with occasional gravels of coarse sandstone. DEVENSIAN TILL		1.30		HVP 1.50 HVP 2.10 HVP 2.80	195 175 109	1.40 2.80		D D
TRIAL PIT TERMINATED AT 3.00m		3.00						

Notes: Trial pit sides remained upright and stable upon completion.

Ground level (mAOD)

Co-ordinates

Title
Trial pit record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Dimensions (W x L)
0.60m x 2.50m

Date of excavation (range if applicable)
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Method of excavation
JCB 3CX

Location plan on drawing number
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TP119

soiltechnics
environmental and geotechnical consultants

DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	TEST RESULTS RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
Grass onto soft dark brown very sandy organic CLAY with frequent roots and occasional cobbles of sandstone. TOPSOIL						0.10		D
Firm medium strength orangish brown slightly silty sandy CLAY with occasional gravels and cobbles of medium sandstone. DEVENSIAN TILL		0.40		HVP 0.50 PP 0.50	70 65	0.50		D
Firm to stiff medium to high strength orangish brown mottled bluish grey sandy CLAY. DEVENSIAN TILL		1.00		HVP 1.10 PP 1.10 HVP 1.50	79 75 94	1.10		D
Stiff high strength brown mottled bluish grey slightly sandy friable CLAY with occasional coarse gravels and cobbles of mudstone and quartzite. DEVENSIAN TILL		1.70		HVP 1.90 HVP 2.40	137 143	1.90 2.00		D D
Very stiff very high strength brown mottled bluish grey slightly silty slightly sandy friable CLAY with occasional coarse gravels and cobbles of mudstone and quartzite. DEVENSIAN TILL		2.50		HVP 2.90	167			
TRIAL PIT TERMINATED AT 3.20m		3.20		HVP 3.20	213			

Notes: Trial pit sides remained upright and stable upon completion.

Ground level (mAOD)

Co-ordinates

Title
Trial pit record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Dimensions (W x L)
0.60m x 2.50m

Date of excavation (range if applicable)
18/02/2016

Appendix
-

Method of excavation
JCB 3CX

Location plan on drawing number
02b

TP120

soiltechnics
environmental and geotechnical consultants

DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	RESULT	SAMPLING FROM (m)	TO (m)	TYPE
Grass onto soft dark brown very sandy organic CLAY with frequent rootlets and occasional gravels of medium sandstone. TOPSOIL						0.10		B
Firm low to medium strength orangish brown slightly sandy CLAY with occasional gravels and cobbles of coarse sandstone. DEVENSIAN TILL ...pockets of grey sandy at north end of pit between 0.5m and 0.9m depth.		0.35		HVP 0.40	38	0.50		B
				HVP 0.80	61			
Firm medium strength brown mottled grey sandy CLAY DEVENSIAN TILL		0.90				1.00		B
				HVP 1.10	58			
Stiff high strength brown mottled grey and bluish grey CLAY. DEVENSIAN TILL		1.30		HVP 1.40	94	1.50		B
				HVP 1.80	134			
Very stiff very high strength brown mottled grey and bluish grey friable CLAY. DEVENSIAN TILL		1.90		HVP 2.20	160			
Stiff high strength brown slightly silty CLAY with occasional gravels of medium mudstone. DEVENSIAN TILL		2.70		HVP 2.90	140			
TRIAL PIT TERMINATED AT 3.10m		3.10				3.10		B

Notes: Trial pit sides remained upright and stable upon completion.

Ground level (mAOD)

Co-ordinates

Title
Trial pit record

Surface breaking
No

Groundwater observations
Slight seepage in sand between 0.5m and 0.7m depth.

Dimensions (W x L)
0.60m x 2.50m

Method of excavation
JCB 3CX

Date of excavation (range if applicable)
18/02/2016

Location plan on drawing number
02b

Appendix
C

TP121

DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	RESULT	SAMPLING FROM (m)	TO (m)	TYPE
Grass onto high strength dark brown very sandy organic CLAY with occasional gravels of medium sandstone and quartzite and frequent rootlets. TOPSOIL		0.25				0.10		D
Firm high strength brown mottled grey slightly silty slightly gravelly sandy CLAY. Gravel consists of medium to coarse sandstone and quartzite. DEVENSIAN TILL		0.80		HVP 0.50 PP 0.50	75 100	0.50		D
Stiff high strength brown mottled bluish grey slightly sandy slightly gravelly CLAY. Gravel consists of sandstone and quartzite. DEVENSIAN TILL		1.40		HVP 0.90 PP 0.90	114 130	0.90		D
Very stiff very high strength brown mottled bluish grey slightly gravelly sandy CLAY. Gravel consists of sandstone and quartzite. DEVENSIAN TILL				HVP 1.50 PP 1.50	186 193	1.80		D
...from 2.1m depth, becoming slightly silty.				HVP 2.20	170			
TRIAL PIT TERMINATED AT 3.10m		3.10		HVP 3.10	179			

Notes: Trial pit sides remained upright and stable upon completion.

Ground level (mAOD)

Co-ordinates

Title
Trial pit record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Dimensions (W x L)
0.60m x 2.50m

Date of excavation (range if applicable)
18/02/2016

Appendix
C

Method of excavation
JCB 3CX

Location plan on drawing number
02b

TP122

DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	TEST RESULTS RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
Grass onto soft dark brown sandy organic CLAY with frequent rootlets. TOPSOIL						0.10		D
		0.25						
Firm medium strength orangish brown slightly silty slightly sandy CLAY with occasional gravels of fine to medium sandstone. DEVENSIAN TILL				HVP 0.50	71	0.50		D
				HVP 1.00	61			
		1.10						
Firm to stiff medium strength orangish brown mottled grey slightly silty CLAY with occasional gravels of medium sandstone and quartzite. DEVENSIAN TILL						1.20		D
				HVP 1.40	56			
				HVP 1.70	52			
		1.90						
Stiff very high strength reddish brown mottled bluish grey slightly sandy CLAY with occasional gravels of sandstone and medium quartzite. DEVENSIAN TILL				HVP 2.10	172	2.10		D
				HVP 2.20	155			
...from 2.6m depth, becoming stiff and friable.				HVP 2.60	179			
TRIAL PIT TERMINATED AT 3.10m		3.10						

Notes: Trial pit sides remained upright and stable upon completion.

Ground level (mAOD)

Co-ordinates

Title
Trial pit record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Dimensions (W x L)
0.60m x 2.50m

Date of excavation (range if applicable)
18/02/2016

Appendix
C

Method of excavation
JCB 3CX

Location plan on drawing number
02b

TP123

soiltechnics
environmental and geotechnical consultants

DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	TEST RESULTS RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
Grass onto soft high strength dark brown sandy organic CLAY with frequent rootlets. TOPSOIL						0.10		D
Firm medium strength orangish brown mottled grey slightly silty slightly sandy CLAY with occasional gravels of medium to coarse sandstone and quartzite. DEVENSIAN TILL		0.30		HVP 0.40 PP 0.40	88 75	0.50		D
				HVP 0.80 PP 0.80	73 70			
...boulder of grey mudstone at 1.1m depth..				HVP 1.10 PP 1.10	68 50	1.10		D
				HVP 1.50 PP 1.50	100 90			
Firm orangish brown mottled grey CLAY with occasional gravels of medium sandstone and mudstone. DEVENSIAN TILL		1.60						
Stiff high becoming very high strength brown mottled bluish grey slightly sandy friable CLAY with occasional gravels of medium sandstone. DEVENSIAN TILL		1.80				1.90		D
				HVP 2.00 PP 2.00	135 155			
...from 2.4m depth, becoming very stiff.				HVP 2.40 PP 2.40	213 225			
						2.90		D
TRIAL PIT TERMINATED AT 3.00m		3.00		HVP 3.00 PP 3.00	213 225			

Notes: Trial pit sides remained upright and stable upon completion.

Ground level (mAOD)

Co-ordinates

Title
Trial pit record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Dimensions (W x L)
0.60m x 2.50m

Date of excavation (range if applicable)
18/02/2016

Appendix
C

Method of excavation
JCB 3CX

Location plan on drawing number
02b

TP124

soiltechnics
environmental and geotechnical consultants

DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	TEST RESULTS RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
Grass onto soft medium strength dark brown slightly gravelly very sandy CLAY. Gravel consists of sandstone, limestone and timber. MADE GROUND				HVP 0.10	67	0.10		D
Soft medium strength reddish brown slightly sandy gravelly CLAY. Gravel consists of fine to coarse brick, sandstone, loose wire and glass. MADE GROUND		0.35		HVP 0.50	58	0.50 0.51		D ES
Firm high strength brown CLAY with occasional gravels of sandstone and occasional rootlets. MADE GROUND		1.00		HVP 1.10	122	1.20		D
Stiff high strength orangish brown slightly silty CLAY. DEVENSIAN TILL		1.40		HVP 1.50	94	1.70		B
...from 1.8m depth, becoming very stiff.				HVP 1.90	141			
Stiff very high strength reddish brown mottled grey occasionally sandy CLAY with occasional gravels of medium sandstone. DEVENSIAN TILL		2.20		HVP 2.40	190			
TRIAL PIT TERMINATED AT 3.10m		3.10		HVP 3.10	198	3.10		B

Notes: Trial pit sides remained upright and stable upon completion.

Ground level (mAOD)	**Co-ordinates**	**Title** Trial pit record	**Surface breaking** No
Groundwater observations No groundwater encountered.	**Dimensions (W x L)** 0.60m x 2.50m	**Date of excavation (range if applicable)** 18/02/2016	**Appendix** C
	Method of excavation JCB 3CX	**Location plan on drawing number** 02b	**TP125**

Key to legends

Composite materials, soils and lithology		
Topsoil	Made Ground	Boulders
Chalk	Clay	Coal
Cobbles	Cobbles & Boulders	Concrete
Gravel	Limestone	Mudstone
Peat	Sand	Sand and Gravel
Sandstone	Silt	Silt / Clay
		Siltstone

Note: Composite soil types are signified by combined symbols.

Key to 'test results' and 'sampling' columns

Test result	
Depth	Records depth that the test was carried out *(i.e.: at 2.10m or between 2.10m and 2.55m)*
Result	PID - Photo Ionisation Detector result (ppm equivalent Isobutylene) PP – Pocket penetrometer result (kN/m^2) HVP – Hand held shear vane result (kN/m^2) *PP result converted to an equivalent undrained shear strength by applying a factor of 50. Where at least 3 results obtained at same depth then an average value may be reported.*
	SPT – Standard Penetration Test result (uncorrected) *SPT(c) – Standard Penetration Test result (solid cone) (uncorrected)*

Sampling		
From (m) To (m)	Records depth of sampling	
Type	D	Disturbed sample
	B	Bulk disturbed sample
	ES	Environmental sample comprising plastic and/or glass container
	W	Water sample
	U (32)	Undisturbed sample 100mm diameter sampler with number of blows of driving equipment required to obtain sample

Water observations

Described at foot of log and shown in the 'water strike' column.

▼	= water level observed after specified delay in drilling
▽	= water strike

Standpipe details

Gravel filter	Arisings
Bentonite	
Slotted pipe	
Unslotted pipe	

Density

Density recorded in brackets inferred from density testing and soil descriptions from across the site (i.e.: [Medium dense]).

WELL	DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	TEST RESULTS RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
	Grass onto soft dark brown organic CLAY with frequent rootlets and occasional sub-angular gravels of medium sandstone. TOPSOIL						0.10		D
	Firm high strength brown slightly silty slightly sandy CLAY with occasional gravels of medium sandstone. DEVENSIAN TILL		0.30		PP 0.50	80	0.50		D
					PP 0.90	75			
	Stiff very high becoming high strength brown slightly gravelly CLAY. Gravel consists of medium to coarse sandstone and mudstone. DEVENSIAN TILL		1.30		HVP 1.40 PP 1.40	140 165	1.50		D
	...from 1.6m depth, becoming very stiff.								
					HVP 1.80 PP 1.80	213 220			
					HVP 2.35 PP 2.35	94 113			
					PP 2.70	120	2.70		D
	Firm medium strength light reddish brown CLAY with occasional gravels of medium mudstone. DEVENSIAN TILL		3.00		PP 3.10	73			
					PP 3.50	75			
					HVP 3.70	64			
							3.80		D
					PP 3.90	63			
	BOREHOLE TERMINATED AT 4.00m		4.00						

Notes: For Dynamic Cone Penetration testing, refer to DCP101.

Ground level (mAOD)

Co-ordinates

Title
Driven tube sampler borehole record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Date of excavation (range if applicable)
16/02/2016

Appendix
D

Location plan on drawing number
02b

DTS101

soiltechnics
environmental and geotechnical consultants

WELL	DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	TEST RESULTS RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
	Grass onto soft dark brown sandy organic CLAY with frequent rootlets. TOPSOIL						0.20		D
	Firm medium strength orangish brown slightly sandy silty CLAY DEVENSIAN TILL		0.25				0.40		D
	...from 0.5m depth, becoming soft.				HVP 0.60	77			
	Firm brown slightly sandy slightly gravelly CLAY. Gravel consists of medium to coarse sandstone and mudstone. DEVENSIAN TILL		0.80				0.90		D
	Stiff high strength brown CLAY. DEVENSIAN TILL		1.30		PP 1.35	137	1.40		D
					HVP 1.50	128			
					PP 1.70	113			
					PP 2.10	123			
					PP 2.50	97			
	Soft to firm medium strength reddish brown slightly silty CLAY. DEVENSIAN TILL		2.60						
					HVP 2.80	65			
					PP 2.80	48			
					PP 3.20	62			
							3.50		D
					PP 3.60	52			
	BOREHOLE TERMINATED AT 4.00m		4.00		PP 4.00	38			

Notes: For Dynamic Cone Penetration testing, refer to DCP102.

Ground level (mAOD)

Co-ordinates

Title
Driven tube sampler borehole record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Date of excavation (range if applicable)
16/02/2016

Appendix
D

Location plan on drawing number
02b

DTS102

WELL	DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	TEST RESULTS RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
	Grass onto soft dark brown slightly sandy slightly gravelly organic CLAY with frequent rootlets. Gravel consists of medium mudstone. TOPSOIL		0.30				0.10		D
	Firm medium and high strength brown slightly gravelly CLAY. Gravel consists of medium sandstone and mudstone. DEVENSIAN TILL *...cobble of sandstone at 0.4m depth.*		1.10		PP 0.40 HVP 0.60 PP 0.80	85 63 55	0.70		D
	Firm medium strength orangish brown silty CLAY. DEVENSIAN TILL *...from 2m depth, becoming dark brown mottled bluish grey in colour.*		2.60		PP 1.20 HVP 1.40 PP 1.60 PP 2.10 HVP 2.50 PP 2.50	72 94 68 63 56 48	1.50		D
	Stiff high strength reddish brown slightly silty CLAY. DEVENSIAN TILL		4.00		PP 2.80 HVP 2.90 PP 3.20 HVP 3.30 PP 3.60 PP 3.90	112 122 185 119 158 115	3.00		D
	BOREHOLE TERMINATED AT 4.00m								

Notes:

Ground level (mAOD)

Co-ordinates

Title
Driven tube sampler borehole record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Date of excavation (range if applicable)
16/02/2016

Appendix
D

Location plan on drawing number
02b

DTS103

soiltechnics
environmental and geotechnical consultants

WELL	DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	TEST RESULTS RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
	Grass onto soft dark brown sandy organic CLAY with occasional gravels of fine sandstone and frequent rootlets. TOPSOIL						0.20		D
	Firm medium becoming high strength orangish brown silty CLAY. DEVENSIAN TILL		0.30		PP 0.40	45			
							0.70		D
					HVP 0.80	87			
					PP 0.80	92			
	Stiff high strength brown mottled bluish grey occasionally sandy friable CLAY. DEVENSIAN TILL		1.10		PP 1.20	75			
							1.40		D
					HVP 1.50	213			
					PP 1.60	137			
	Very stiff very high strength becoming medium strength at 4.0m depth reddish brown slightly silty CLAY. DEVENSIAN TILL		1.80		PP 2.00	200			
					PP 2.40	197			
					PP 2.80	192			
					HVP 2.90	106			
							3.00		D
					PP 3.20	188			
					PP 3.60	143			
	BOREHOLE TERMINATED AT 4.00m		4.00		PP 4.00	67			

Notes:

Ground level (mAOD)

Co-ordinates

Title
Driven tube sampler borehole record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Date of excavation (range if applicable)
16/02/2016

Appendix
D

Location plan on drawing number
02b

DTS104

soiltechnics
environmental and geotechnical consultants

WELL	DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	TEST RESULTS RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
	Grass onto soft dark brown slightly sandy organic CLAY with frequent rootlets. TOPSOIL						0.15		D
			0.25		PP 0.30	83			
	Firm medium and high strength orangish brown slightly silty slightly sandy CLAY. DEVENSIAN TILL				PP 0.70	63	0.70		D
					PP 1.10	77			
			1.20						
	Stiff very high becoming high strength brown mottled bluish grey slightly sandy CLAY. DEVENSIAN TILL				PP 1.40	192	1.40		D
					PP 1.80	220			
					PP 2.20	177			
					PP 2.60	157			
					PP 3.00	93	3.00		D
			3.20						
	Stiff high strength reddish brown slightly silty CLAY with occasional gravels of coarse sandstone. DEVENSIAN TILL				PP 3.40	107			
					PP 3.80	77			
	BOREHOLE TERMINATED AT 4.00m		4.00						

Notes:

Ground level (mAOD)

Co-ordinates

Title
Driven tube sampler borehole record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Date of excavation (range if applicable)
16/02/2016

Appendix
D

Location plan on drawing number
02b

DTS105

soiltechnics
environmental and geotechnical consultants

WELL	DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	TEST RESULTS RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
	Grass onto soft dark brown slightly sandy organic CLAY with frequent rootlets. TOPSOIL						0.10		D
	Firm to stiff medium and high strength orangish brown mottled dark brown slightly silty CLAY. DEVENSIAN TILL		0.30		PP 0.40	80			
					HVP 0.60	101			
					HVP 0.80	213	0.80		D
					PP 0.80	60			
					PP 1.20	70			
	Stiff very high strength brown mottled bluish grey CLAY. DEVENSIAN TILL		1.40		PP 1.60	180			
	...from 1.8m depth, becoming very stiff.						1.80		D
					PP 2.00	217			
	...from 2.3m depth, becoming slightly gravelly with medium to coarse gravels of sandstone.				PP 2.40	200			
					PP 2.80	170			
	Stiff high and very high strength reddish brown slightly silty CLAY. DEVENSIAN TILL		3.00		PP 3.20	138	3.20		D
					HVP 3.50	149			
					PP 3.60	170			
	BOREHOLE TERMINATED AT 4.00m		4.00		PP 4.00	123			

Notes: For Dynamic Cone Penetration testing, refer to DCP103.

Ground level (mAOD)

Co-ordinates

Title
Driven tube sampler borehole record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Date of excavation (range if applicable)
16/02/2016

Appendix
D

Location plan on drawing number
02b

DTS106

soiltechnics
environmental and geotechnical consultants

WELL	DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	TEST RESULTS RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
	Grass onto soft dark brown sandy organic CLAY with frequent rootlets. TOPSOIL						0.20		D
	Soft medium strength orangish brown silty CLAY. DEVENSIAN TILL		0.25		PP 0.30	42			
					PP 0.70	42	0.70		D
	...from 0.8m depth, becoming firm.								
					PP 1.00	85			
					PP 1.20	47			
	Stiff very high strength brown friable CLAY. DEVENSIAN TILL		1.40						
							1.70		D
					PP 2.00	198			
					PP 2.40	212			
							2.50		D
					PP 2.80	192			
	...from 3m depth, becoming stiff.								
					PP 3.20	175			
					PP 3.60	100			
	Firm medium strength brown CLAY. DEVENSIAN TILL		3.80						
							3.90		D
	...from 3.8m depth, becoming firm.		4.00		PP 4.00	75			
	BOREHOLE TERMINATED AT 4.00m								

Notes:

Ground level (mAOD)

Co-ordinates

Title
Driven tube sampler borehole record

Surface breaking
No

Groundwater observations
No groundwater encountered.

Date of excavation (range if applicable)
16/02/2016

Appendix
D

Location plan on drawing number
02b

DTS107

soiltechnics
environmental and geotechnical consultants

WELL	DESCRIPTION	LEGEND	DEPTH (m)	WATER STRIKE	TEST RESULTS TYPE/ DEPTH (m)	TEST RESULTS RESULT	SAMPLING FROM (m)	SAMPLING TO (m)	SAMPLING TYPE
	Grass onto soft dark brown sandy organic CLAY with frequent rootlets. TOPSOIL		0.20				0.10		D
	Firm low becoming medium strength orangish brown slightly silty CLAY. DEVENSIAN TILL		1.10		PP 0.30	37			
					PP 0.70	63	0.70		D
					PP 1.00	138			
	Stiff medium and high strength brown mottled grey slightly gravelly friable CLAY. Gravel consists of medium mudstone. DEVENSIAN TILL		2.60		PP 1.30	120			
					PP 1.70	72	1.70		D
					PP 2.10	107			
					PP 2.50	97			
	Firm medium strength reddish brown slightly silty CLAY. DEVENSIAN TILL		4.00		PP 2.80	55			
							3.00		D
					PP 3.20	38			
					PP 3.60	47			
					PP 4.00	58			
	BOREHOLE TERMINATED AT 4.00m								

Notes:

Ground level (mAOD)

Co-ordinates

Title
Driven tube sampler borehole record

Surface breaking
No

Groundwater observations
No groundwater encountered.

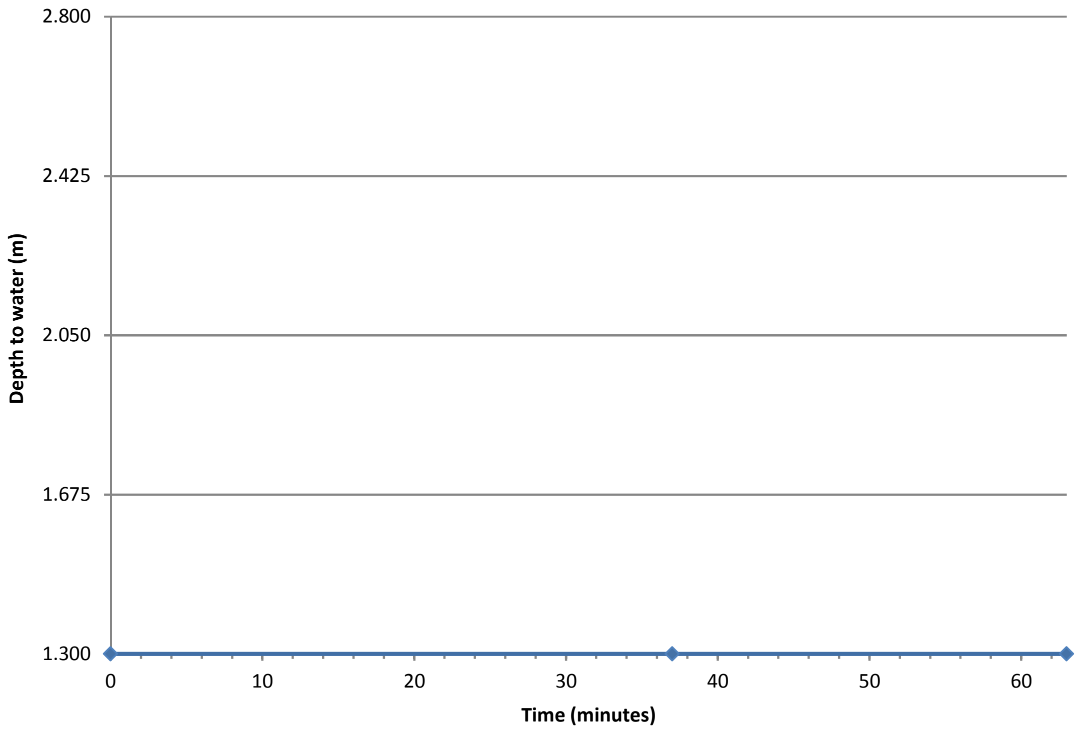
Date of excavation (range if applicable)
16/02/2016

Appendix
D

Location plan on drawing number
02b

DTS108

Plot showing time against depth to water:



Test observations:

TIME (mins)	DEPTH TO WATER (m)	TIME (mins)	DEPTH TO WATER (m)
0	1.3		
37	1.3		
63	1.3		

Calculations:

No movement in water level over 63 minutes of monitoring therefore unable to calculate soil infiltration rate.

Groundwater observations
No groundwater encountered.

Title
Soil infiltration test (following principles of the Building Research Establishment Digest 365 2007)

Trial pit dimensions (width x length)
0.6m x 2.5m

Ground level
N/A

Location plan on drawing number
02

Depth of trial pit at start of test (m)
2.8

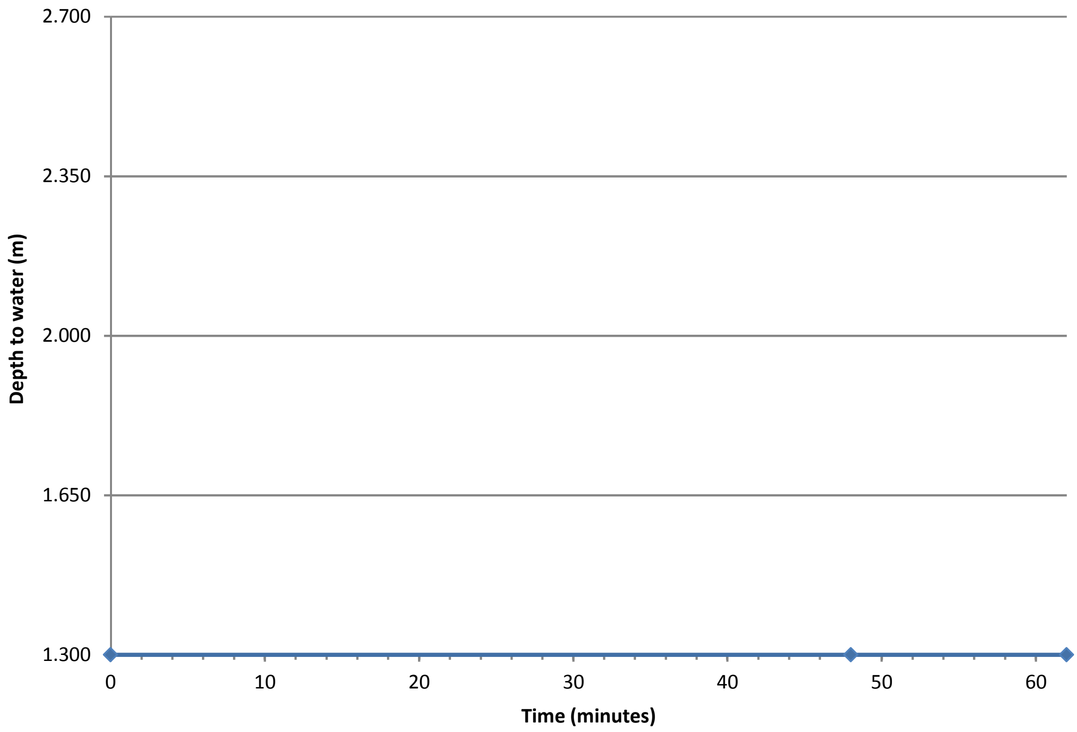
Co-ordinates
-

Trial pit number
TP107

Cycle number
1

Date of excavation
17/02/2016

Plot showing time against depth to water:



Test observations:

TIME (mins)	DEPTH TO WATER (m)	TIME (mins)	DEPTH TO WATER (m)
0	1.3		
48	1.3		
62	1.3		

Calculations:

No movement in water level over 62 minutes of monitoring therefore unable to calculate soil infiltration rate.

Groundwater observations
No groundwater encountered.

Title
Soil infiltration test (following principles of the Building Research Establishment Digest 365 2007)

Trial pit dimensions (width x length)	Ground level	Location plan on drawing number		
0.6m x 3.2m	N/A	02		
Depth of trial pit at start of test (m)	Co-ordinates	Trial pit number	Cycle number	Date of excavation
2.7	-	TP114	1	17/02/2016

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0001

TEST REPORT

Determination of Moisture Content and Atterberg Limits

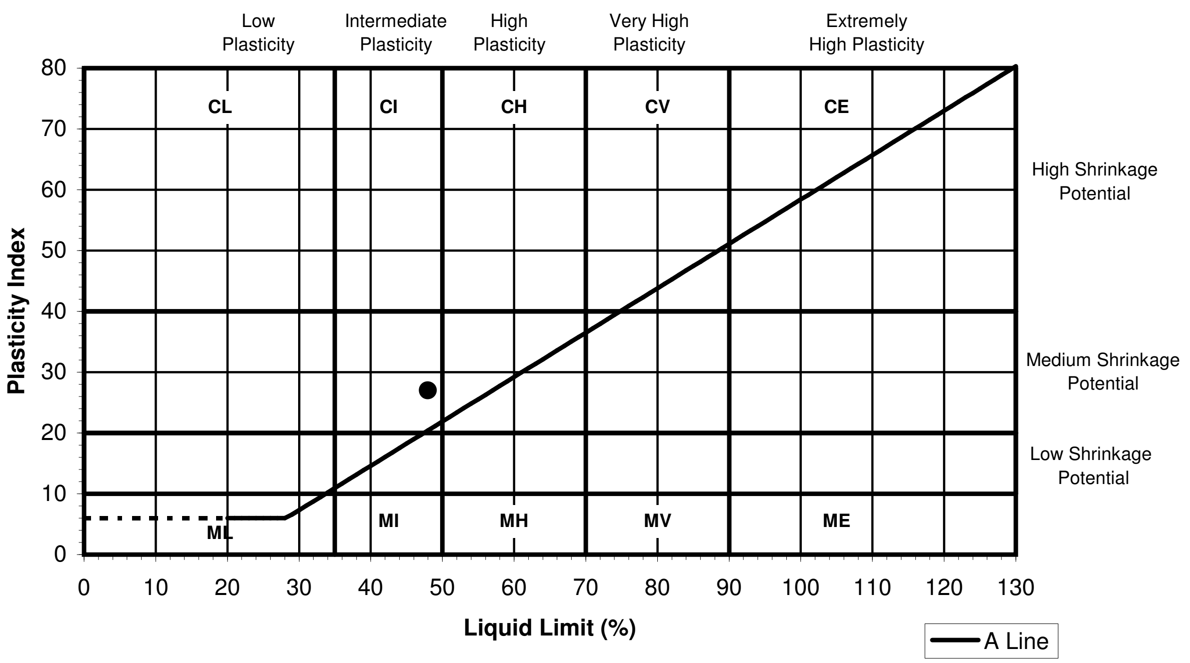
Client: Soiltechnics Limited
Client Address: Cedar Barn, White Lodge, Walgrave
Postcode: NN6 9PY
Contact: Andy Keeler
Site: Chipping Lane, Longbridge

Report No: 51021428/16/09
Batch Number: DAM0059571
Client Reference: STN3505NM
Sampled by: Client
Date Sampled: 16.02.16
Date Received: 21.03.16
Tested From: 23.03.16-24.03.16
Sample Type: Disturbed

Test Results:

Description: Brown CLAY with Silt

Laboratory Reference	Location	Depth (m)	As Received Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing 425µm
45274323	TP102	0.60	N/A	48	21	27	100



Sample Preparation: As Received, Coarse particles removed by hand prior to test
Estimated % passing 425µm BS Test Sieve

Certified that the laboratory testing was carried out in accordance with BS 1377-2: 1990: Method 3.2, 4.4 and 5

Page: 1 of 1
Date: 04.04.16

Signed

[ ] M. Carr - Section Manager
[✓] D. Berrill - Laboratory Manager

For and on behalf of Environmental Scientifics Group

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Telephone: +44 (0) 1327 703828
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TEST REPORT

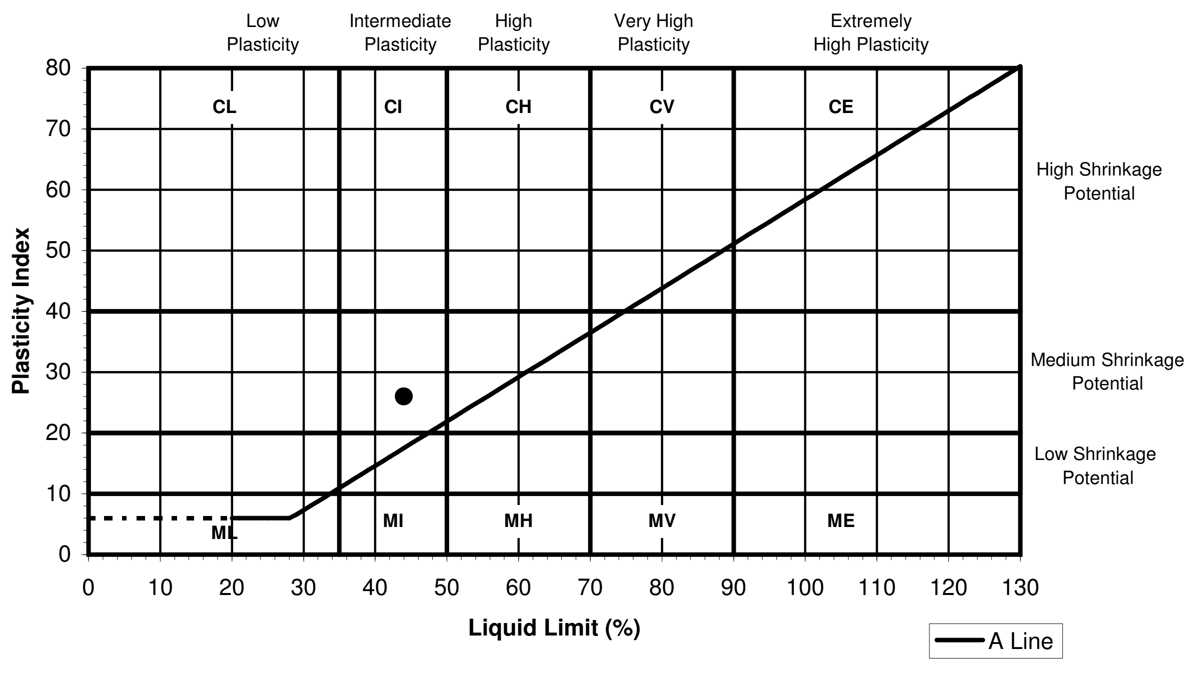
Determination of Moisture Content and Atterberg Limits

Client:	Soiltechnics Limited	Report No:	51021428/16/10
Client Address:	Cedar Barn,	Batch Number:	DAM0059571
	White Lodge		
	Walgrave	Client Reference:	STN3505NM
Postcode:	NN6 9PY	Sampled by:	Client
Contact:	Andy Keeler	Date Sampled:	16.02.16
		Date Received:	21.03.16
Site:	Chipping Lane, Longbridge	Tested From:	23.03.16-24.03.16
		Sample Type:	Disturbed

Test Results:

Description: Brown CLAY

Laboratory Reference	Location	Depth (m)	As Received Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing 425µm
45274324	TP106	2.10	N/A	44	18	26	100



Sample Preparation: As Received, Coarse particles removed by hand prior to test
Estimated % passing 425µm BS Test Sieve

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Page: 1 of 1
Date: 04.04.16

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TEST REPORT

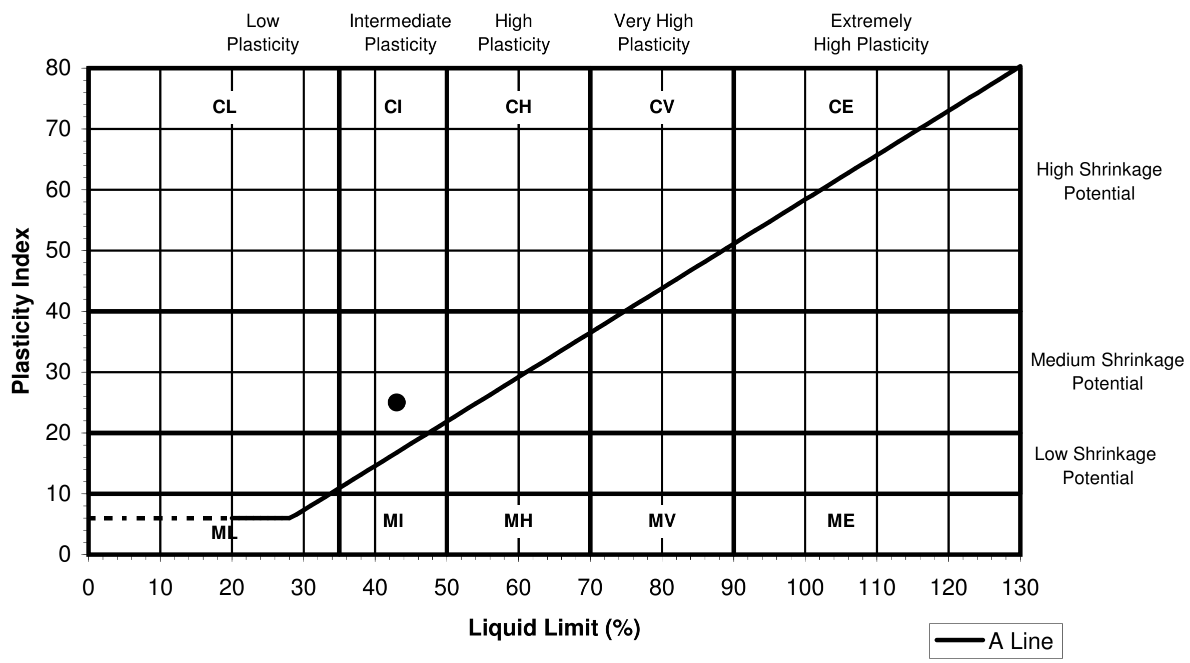
Determination of Moisture Content and Atterberg Limits

Client:	Soiltechnics Limited	Report No:	51021428/16/11
Client Address:	Cedar Barn,	Batch Number:	DAM0059571
	White Lodge		
	Walgrave	Client Reference:	STN3505NM
Postcode:	NN6 9PY	Sampled by:	Client
Contact:	Andy Keeler	Date Sampled:	16.02.16
		Date Received:	21.03.16
Site:	Chipping Lane, Longbridge	Tested From:	23.03.16-24.03.16
		Sample Type:	Disturbed

Test Results:

Description: Brown CLAY with Silt

Laboratory Reference	Location	Depth (m)	As Received Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing 425µm
45274325	TP107	0.50	N/A	43	18	25	100



Sample Preparation: As Received, Coarse particles removed by hand prior to test
Estimated % passing 425µm BS Test Sieve

Certified that the laboratory testing was carried out in accordance with BS 1377-2: 1990: Method 3.2, 4.4 and 5

Page: 1 of 1
Date: 04.04.16

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TEST REPORT

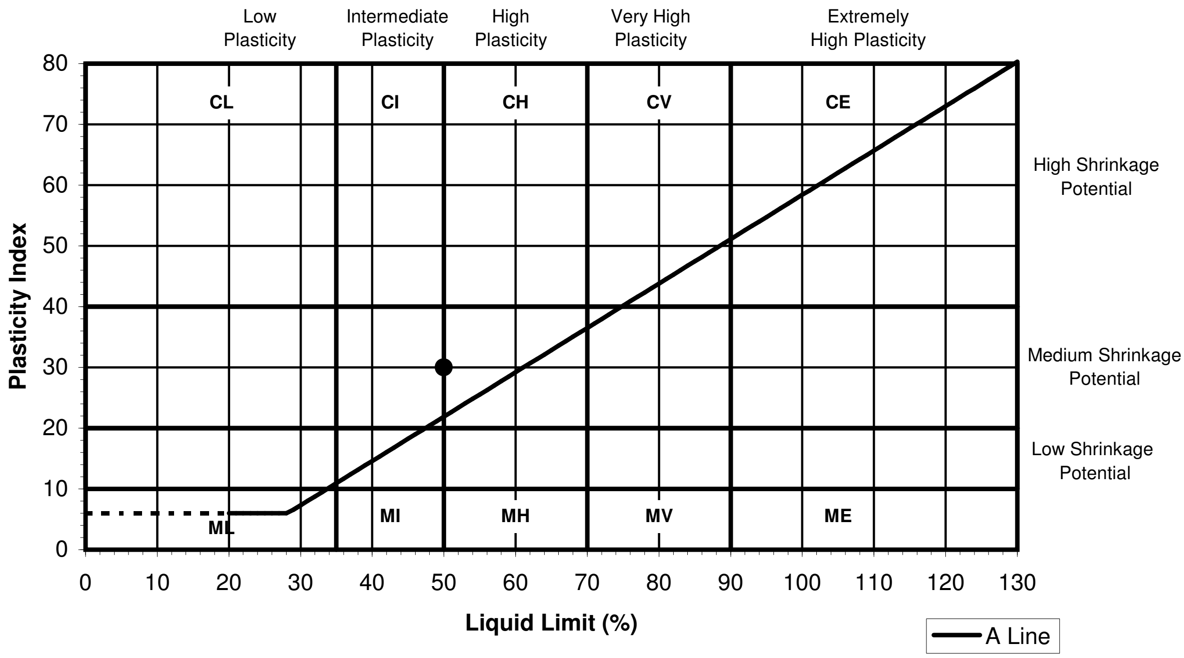
Determination of Moisture Content and Atterberg Limits

Client:	Soiltechnics Limited	Report No:	51021428/16/12
Client Address:	Cedar Barn,	Batch Number:	DAM0059571
	White Lodge		
	Walgrave	Client Reference:	STN3505NM
Postcode:	NN6 9PY	Sampled by:	Client
Contact:	Andy Keeler	Date Sampled:	16.02.16
		Date Received:	21.03.16
Site:	Chipping Lane, Longbridge	Tested From:	23.03.16-24.03.16
		Sample Type:	Disturbed

Test Results:

Description: Brown CLAY

Laboratory Reference	Location	Depth (m)	As Received Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing 425µm
45274326	TP109	1.30	N/A	50	20	30	100



Sample Preparation: As Received, Coarse particles removed by hand prior to test
Estimated % passing 425µm BS Test Sieve

Certified that the laboratory testing was carried out in accordance with BS 1377-2: 1990: Method 3.2, 4.4 and 5

Page: 1 of 1
Date: 04.04.16

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TEST REPORT

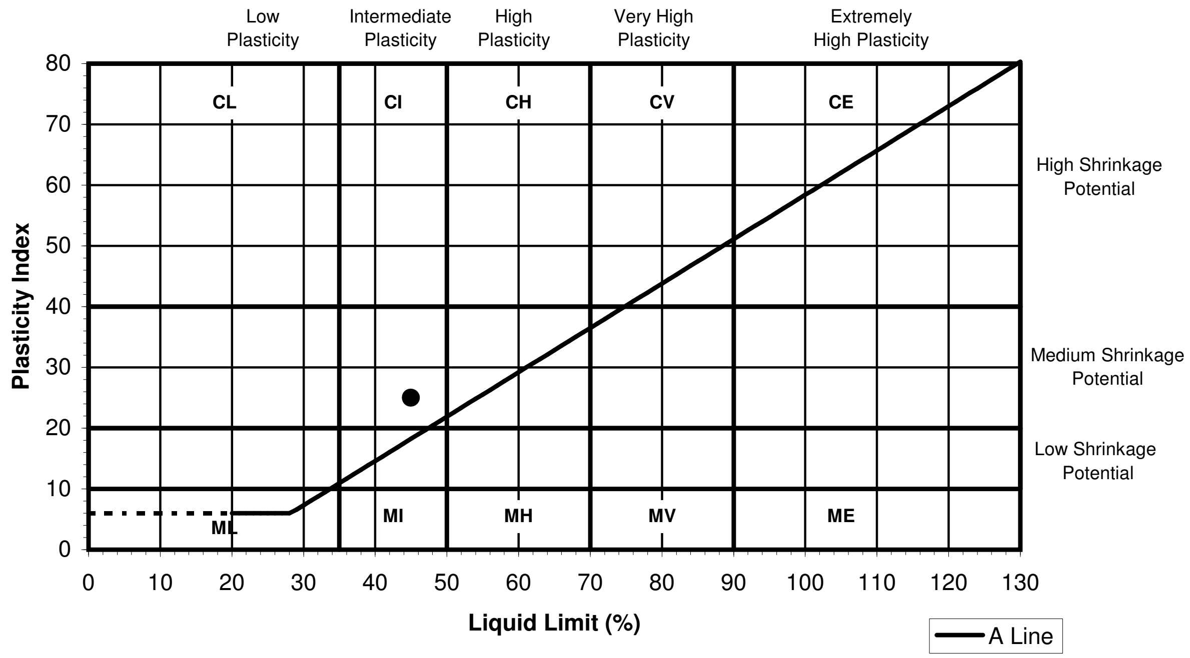
Determination of Moisture Content and Atterberg Limits

Client:	Soiltechnics Limited	Report No:	51021428/16/13
Client Address:	Cedar Barn,	Batch Number:	DAM0059571
	White Lodge		
	Walgrave	Client Reference:	STN3505NM
Postcode:	NN6 9PY	Sampled by:	Client
Contact:	Andy Keeler	Date Sampled:	16.02.16
		Date Received:	21.03.16
Site:	Chipping Lane, Longbridge	Tested From:	23.03.16-24.03.16
		Sample Type:	Disturbed

Test Results:

Description: Brown CLAY

Laboratory Reference	Location	Depth (m)	As Received Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing 425µm
45274327	TP113	1.10	N/A	45	20	25	100



Sample Preparation: As Received, Coarse particles removed by hand prior to test
Estimated % passing 425µm BS Test Sieve

Certified that the laboratory testing was carried out in accordance with BS 1377-2: 1990: Method 3.2, 4.4 and 5

Page: 1 of 1
Date: 04.04.16

Signed

[ ] M. Carr - Section Manager
[✓] D. Berrill - Laboratory Manager

For and on behalf of Environmental Scientifics Group

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TEST REPORT

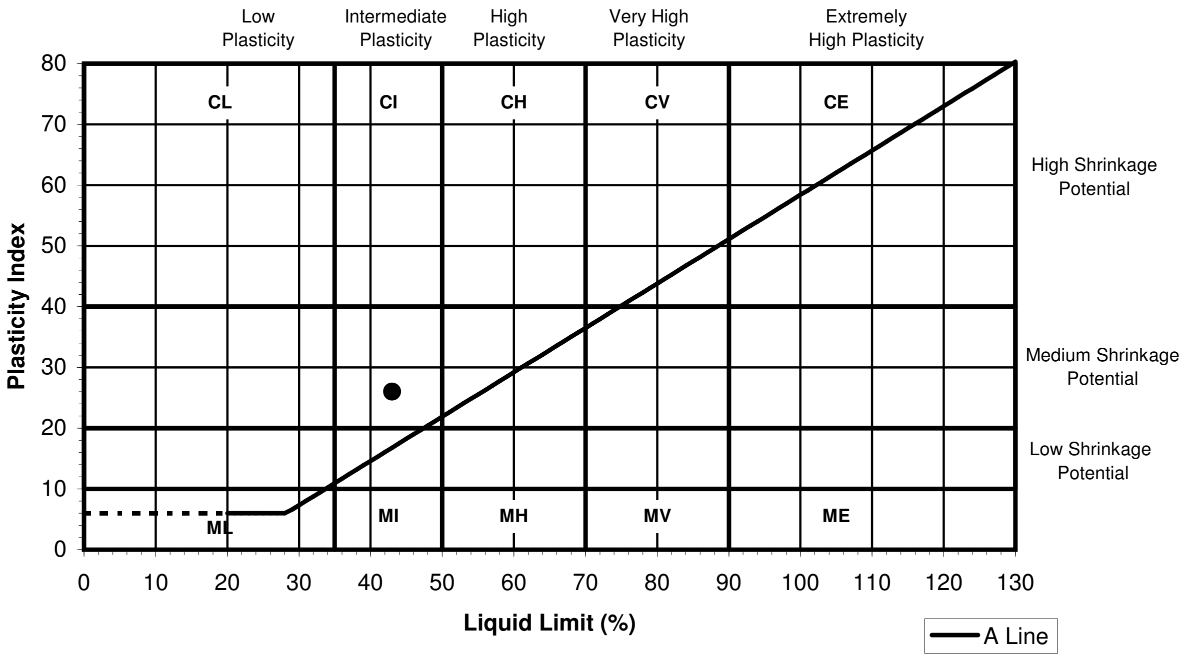
Determination of Moisture Content and Atterberg Limits

Client:	Soiltechnics Limited	Report No:	51021428/16/14
Client Address:	Cedar Barn,	Batch Number:	DAM0059571
	White Lodge		
	Walgrave	Client Reference:	STN3505NM
Postcode:	NN6 9PY	Sampled by:	Client
Contact:	Andy Keeler	Date Sampled:	16.02.16
		Date Received:	21.03.16
Site:	Chipping Lane, Longbridge	Tested From:	23.03.16-24.03.16
		Sample Type:	Disturbed

Test Results:

Description: Brown CLAY

Laboratory Reference	Location	Depth (m)	As Received Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing 425µm
45274328	TP119	1.40	N/A	43	17	26	100



Sample Preparation: As Received, Coarse particles removed by hand prior to test
Estimated % passing 425µm BS Test Sieve

Certified that the laboratory testing was carried out in accordance with BS 1377-2: 1990: Method 3.2, 4.4 and 5

Page: 1 of 1
Date: 04.04.16

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[ ] M. Carr - Section Manager
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Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

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TEST REPORT

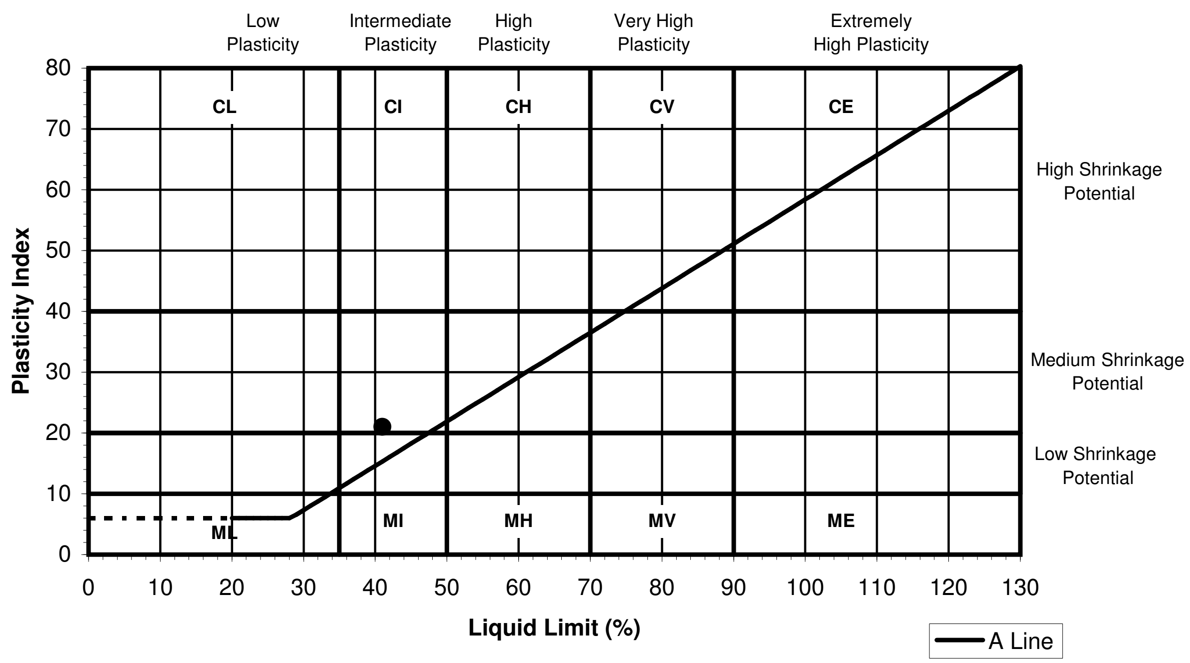
Determination of Moisture Content and Atterberg Limits

Client: Soiltechnics Limited
Client Address: Cedar Barn, White Lodge, Walgrave
Postcode: NN6 9PY
Contact: Andy Keeler
Site: Chipping Lane, Longbridge

Report No: 51021428/16/15
Batch Number: DAM0059571
Client Reference: STN3505NM
Sampled by: Client
Date Sampled: 16.02.16
Date Received: 21.03.16
Tested From: 23.03.16-24.03.16
Sample Type: Disturbed

Test Results:
Description: Brown CLAY

Laboratory Reference	Location	Depth (m)	As Received Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing 425µm
45274329	TP120	1.90	N/A	41	20	21	100



Sample Preparation: As Received, Coarse particles removed by hand prior to test
Estimated % passing 425µm BS Test Sieve

Certified that the laboratory testing was carried out in accordance with BS 1377-2: 1990: Method 3.2, 4.4 and 5

Date: 04.04.16

Signed

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TEST REPORT

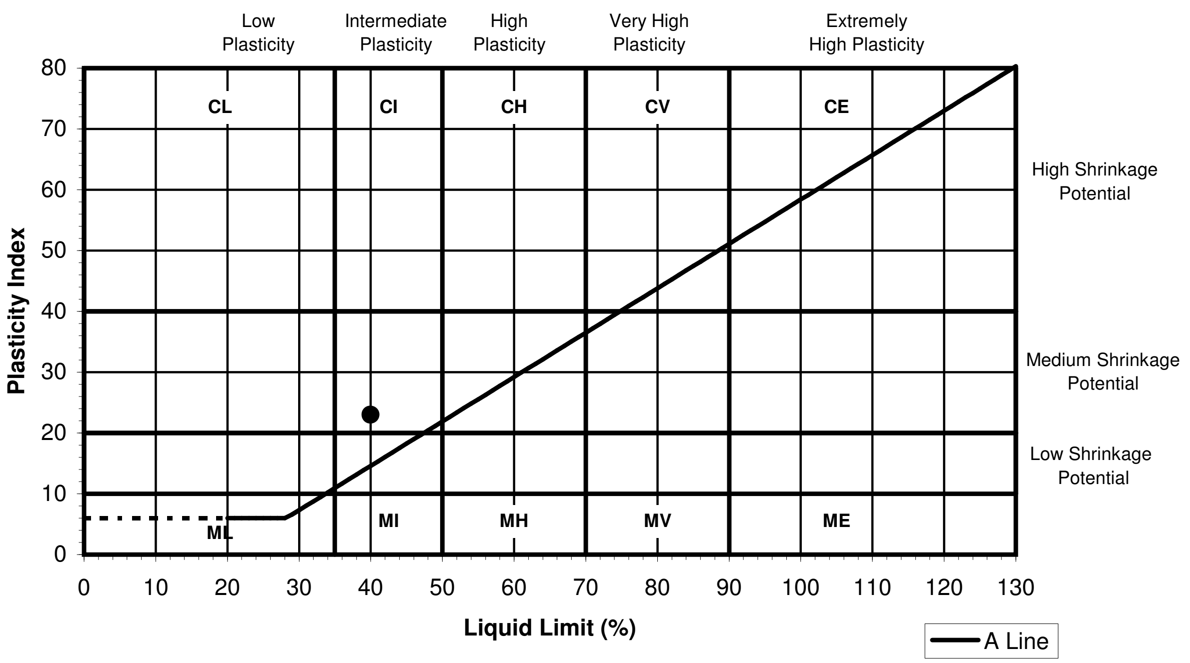
Determination of Moisture Content and Atterberg Limits

Client:	Soiltechnics Limited	Report No:	51021428/16/16
Client Address:	Cedar Barn,	Batch Number:	DAM0059571
	White Lodge		
	Walgrave	Client Reference:	STN3505NM
Postcode:	NN6 9PY	Sampled by:	Client
Contact:	Andy Keeler	Date Sampled:	16.02.16
		Date Received:	21.03.16
Site:	Chipping Lane, Longbridge	Tested From:	23.03.16-24.03.16
		Sample Type:	Disturbed

Test Results:

Description: Brown CLAY with occasional Gravel

Laboratory Reference	Location	Depth (m)	As Received Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index	% Passing 425µm
45274330	TP124	1.90	N/A	40	17	23	95



Sample Preparation: As Received, Coarse particles removed by hand prior to test
Estimated % passing 425µm BS Test Sieve

Certified that the laboratory testing was carried out in accordance with BS 1377-2: 1990: Method 3.2, 4.4 and 5

Date: 04.04.16

Signed

[ ] M. Carr - Section Manager
[✓] D. Berrill - Laboratory Manager

For and on behalf of Environmental Scientifics Group

UKAS TESTING
2183

Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.co.uk

Final Report

Report No.:	16-04814-1		
Initial Date of Issue:	02-Mar-2016		
Client	Soiltechnics Limited		
Client Address:	Cedar Barn White Lodge Walgrave Northampton Northamptonshire NN6 9PY		
Contact(s):	Rachel Brown		
Project	STN3505NM - Chipping Lane		
Quotation No.:		**Date Received:**	29-Feb-2016
Order No.:	21026	**Date Instructed:**	29-Feb-2016
No. of Samples:	3	**Target Date:**	02-Mar-2016
Turnaround (Wkdays):	5	**Results Due:**	04-Mar-2016
Date Approved:	02-Mar-2016		

Approved By:

Details: Martin Dyer, Laboratory Manager

Chemtest
The right chemistry to deliver results

Results - Soil

Project: STN3505NM - Chipping Lane

Client: Soiltechnics Limited				**Chemtest Job No.:**	16-04814	16-04814	16-04814
Quotation No.:				**Chemtest Sample ID.:**	261045	261046	261047
Order No.: 21026				Client Sample Ref.:	TP101	TP108	TP125
				Client Sample ID.:	7-001	7-003	7-005
				Sample Type:	SOIL	SOIL	SOIL
				Top Depth (m):	0.90	0.50	0.50
				Date Sampled:	16-Feb-2016	17-Feb-2016	18-Feb-2016
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Moisture	N	2030	%	0.020	15	17	21
Soil Colour	N	2040		N/A	Grey	Brown	Brown
Other Material	N	2040		N/A	Stones	Stones	Stones
Soil Texture	N	2040		N/A	Clay	Clay	Clay
Organic Matter	M	2625	%	0.40	1.4	1.2	3.3
Total Organic Carbon	M	2625	%	0.20	0.81	0.70	1.9
Aliphatic TPH >C5-C6	N	2680	mg/kg	0.010	< 0.010	< 0.010	< 0.010
Aliphatic TPH >C6-C8	N	2680	mg/kg	0.010	< 0.010	< 0.010	< 0.010
Aliphatic TPH >C8-C10	N	2680	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C10-C12	N	2680	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C12-C16	N	2680	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C16-C21	N	2680	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Aliphatic TPH >C21-C35	N	2680	mg/kg	0.10	< 0.10	< 0.10	30
Aliphatic TPH >C35-C44	N	2680	mg/kg	0.10	< 0.10	< 0.10	2.3
Total Aliphatic Hydrocarbons	N	2680	mg/kg	1.0	< 1.0	< 1.0	32
Aromatic TPH >C5-C7	N	2680	mg/kg	0.010	< 0.010	< 0.010	< 0.010
Aromatic TPH >C7-C8	N	2680	mg/kg	0.010	< 0.010	< 0.010	< 0.010
Aromatic TPH >C8-C10	N	2680	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C10-C12	N	2680	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C12-C16	N	2680	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C16-C21	N	2680	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Aromatic TPH >C21-C35	N	2680	mg/kg	0.10	< 0.10	< 0.10	14
Aromatic TPH >C35-C44	N	2680	mg/kg	0.10	< 0.10	< 0.10	1.4
Total Aromatic Hydrocarbons	N	2680	mg/kg	1.0	< 1.0	< 1.0	15
Total Petroleum Hydrocarbons	N	2680	mg/kg	2.0	< 2.0	< 2.0	47
Dichlorodifluoromethane	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Chloromethane	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Vinyl Chloride	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Bromomethane	M	2760	µg/kg	20	< 20	< 20	< 20
Chloroethane	U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Trichlorofluoromethane	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Trans 1,2-Dichloroethene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1-Dichloroethane	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
cis 1,2-Dichloroethene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Bromochloromethane	U	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0
Trichloromethane	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1,1-Trichloroethane	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Tetrachloromethane	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0

Results - Soil

Project: STN3505NM - Chipping Lane

Client: Soiltechnics Limited				**Chemtest Job No.:**	16-04814	16-04814	16-04814
Quotation No.:				**Chemtest Sample ID.:**	261045	261046	261047
Order No.: 21026				Client Sample Ref.:	TP101	TP108	TP125
				Client Sample ID.:	7-001	7-003	7-005
				Sample Type:	SOIL	SOIL	SOIL
				Top Depth (m):	0.90	0.50	0.50
				Date Sampled:	16-Feb-2016	17-Feb-2016	18-Feb-2016
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
1,1-Dichloropropene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Benzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloroethane	M	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Trichloroethene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2-Dichloropropane	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Dibromomethane	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Bromodichloromethane	M	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0
cis-1,3-Dichloropropene	N	2760	µg/kg	10	< 10	< 10	< 10
Toluene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Trans-1,3-Dichloropropene	N	2760	µg/kg	10	< 10	< 10	< 10
1,1,2-Trichloroethane	M	2760	µg/kg	10	< 10	< 10	< 10
Tetrachloroethene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,3-Dichloropropane	U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Dibromochloromethane	U	2760	µg/kg	10	< 10	< 10	< 10
1,2-Dibromoethane	M	2760	µg/kg	5.0	< 5.0	< 5.0	< 5.0
Chlorobenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,1,1,2-Tetrachloroethane	M	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Ethylbenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
m & p-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
o-Xylene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Styrene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Tribromomethane	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Isopropylbenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Bromobenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichloropropane	N	2760	µg/kg	50	< 50	< 50	< 50
N-Propylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
2-Chlorotoluene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,3,5-Trimethylbenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
4-Chlorotoluene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Tert-Butylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2,4-Trimethylbenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
Sec-Butylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,3-Dichlorobenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
4-Isopropyltoluene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,4-Dichlorobenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
N-Butylbenzene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2-Dichlorobenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2-Dibromo-3-Chloropropane	U	2760	µg/kg	50	< 50	< 50	< 50
1,2,4-Trichlorobenzene	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0

Chemtest
The right chemistry to deliver results

Results - Soil

Project: STN3505NM - Chipping Lane

Client: Soiltechnics Limited				**Chemtest Job No.:**	16-04814	16-04814	16-04814
Quotation No.:				**Chemtest Sample ID.:**	261045	261046	261047
Order No.: 21026				Client Sample Ref.:	TP101	TP108	TP125
				Client Sample ID.:	7-001	7-003	7-005
				Sample Type:	SOIL	SOIL	SOIL
				Top Depth (m):	0.90	0.50	0.50
				Date Sampled:	16-Feb-2016	17-Feb-2016	18-Feb-2016
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Hexachlorobutadiene	U	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
1,2,3-Trichlorobenzene	U	2760	µg/kg	2.0	< 2.0	< 2.0	< 2.0
Carbon Disulphide	N	2760	µg/kg	50	< 50	< 50	< 50
Methyl Tert-Butyl Ether	M	2760	µg/kg	1.0	< 1.0	< 1.0	< 1.0
N-Nitrosodimethylamine	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Phenol	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
2-Chlorophenol	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Bis-(2-Chloroethyl)Ether	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
1,3-Dichlorobenzene	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
1,4-Dichlorobenzene	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
1,2-Dichlorobenzene	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
2-Methylphenol	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Bis(2-Chloroisopropyl)Ether	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Hexachloroethane	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
N-Nitrosodi-n-propylamine	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
4-Methylphenol	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Nitrobenzene	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Isophorone	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
2-Nitrophenol	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
2,4-Dimethylphenol	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Bis(2-Chloroethoxy)Methane	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
2,4-Dichlorophenol	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
1,2,4-Trichlorobenzene	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Naphthalene	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
4-Chloroaniline	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Hexachlorobutadiene	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
4-Chloro-3-Methylphenol	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
2-Methylnaphthalene	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Hexachlorocyclopentadiene	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
2,4,6-Trichlorophenol	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
2,4,5-Trichlorophenol	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
2-Chloronaphthalene	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
2-Nitroaniline	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Acenaphthylene	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Dimethylphthalate	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
2,6-Dinitrotoluene	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Acenaphthene	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Dibenzofuran	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
4-Chlorophenylphenylether	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50

Chemtest
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Results - Soil

Project: STN3505NM - Chipping Lane

Client: Soiltechnics Limited				**Chemtest Job No.:**	16-04814	16-04814	16-04814
Quotation No.:				**Chemtest Sample ID.:**	261045	261046	261047
Order No.: 21026				Client Sample Ref.:	TP101	TP108	TP125
				Client Sample ID.:	7-001	7-003	7-005
				Sample Type:	SOIL	SOIL	SOIL
				Top Depth (m):	0.90	0.50	0.50
				Date Sampled:	16-Feb-2016	17-Feb-2016	18-Feb-2016
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
2,4-Dinitrotoluene	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Fluorene	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Diethyl Phthalate	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
4-Nitroaniline	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
2-Methyl-4,6-Dinitrophenol	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Azobenzene	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
4-Bromophenylphenyl Ether	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Hexachlorobenzene	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Pentachlorophenol	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Phenanthrene	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Anthracene	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Carbazole	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Di-N-Butyl Phthalate	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Fluoranthene	N	2790	mg/kg	0.50	< 0.50	0.55	< 0.50
Pyrene	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Butylbenzyl Phthalate	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Benzo[a]anthracene	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Chrysene	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Bis(2-Ethylhexyl)Phthalate	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Di-N-Octyl Phthalate	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Benzo[b]fluoranthene	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Benzo[k]fluoranthene	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Benzo[a]pyrene	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Indeno(1,2,3-c,d)Pyrene	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Dibenz(a,h)Anthracene	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Benzo[g,h,i]perylene	N	2790	mg/kg	0.50	< 0.50	< 0.50	< 0.50
Naphthalene	M	2800	mg/kg	0.10	< 0.10	0.37	0.20
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Fluorene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	M	2800	mg/kg	0.10	< 0.10	0.76	0.35
Anthracene	M	2800	mg/kg	0.10	< 0.10	0.13	< 0.10
Fluoranthene	M	2800	mg/kg	0.10	< 0.10	0.22	0.78
Pyrene	M	2800	mg/kg	0.10	< 0.10	0.21	0.67
Benzo[a]anthracene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.15
Chrysene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.19
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.16
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.15

Chemtest
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Results - Soil

Project: STN3505NM - Chipping Lane

Client: Soiltechnics Limited				**Chemtest Job No.:**	16-04814	16-04814	16-04814
Quotation No.:				**Chemtest Sample ID.:**	261045	261046	261047
Order No.: 21026				Client Sample Ref.:	TP101	TP108	TP125
				Client Sample ID.:	7-001	7-003	7-005
				Sample Type:	SOIL	SOIL	SOIL
				Top Depth (m):	0.90	0.50	0.50
				Date Sampled:	16-Feb-2016	17-Feb-2016	18-Feb-2016
Determinand	**Accred.**	**SOP**	**Units**	**LOD**			
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	N	2800	mg/kg	2.0	< 2.0	< 2.0	2.7

Chemtest
The right chemistry to deliver results

Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at our Coventry laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container

Sample Retention and Disposal

All soil samples will be retained for a period of 60 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.co.uk

Chemtest
The right chemistry to deliver results
Chemtest Ltd.
Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070
Email: info@chemtest.co.uk

UKAS TESTING 2183

mCERTS THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME

Final Report

Report No.:	16-06222-1
Initial Date of Issue:	23-Mar-2016
Client	Soiltechnics Limited
Client Address:	Cedar Barn White Lodge Walgrave Northampton Northamptonshire NN6 9PY
Contact(s):	Rachel Brown
Project	STN3505NM - Chipping Lane

Quotation No.:		**Date Received:**	16-Mar-2016
Order No.:	21137	**Date Instructed:**	21-Mar-2016
No. of Samples:	29	**Target Date:**	23-Mar-2016
Turnaround (Wkdays):	3	**Results Due:**	23-Mar-2016
Date Approved:	23-Mar-2016		

Approved By:

Details: Robert Monk, Technical Development Chemist

Results - Leachate

Project: STN3505NM - Chipping Lane

Client: Soiltechnics Limited				**Chemtest Job No.:**	16-06222	16-06222	16-06222	16-06222
Quotation No.:				**Chemtest Sample ID.:**	267964	267975	267979	267990
Order No.: 21137				Client Sample Ref.:	TP102	TP110	TP114	TP125
				Client Sample ID.:	9-043	9-080	9-098	9-148
				Sample Type:	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.20	0.10	0.10	0.50
				Date Sampled:	16-Feb-2016	17-Feb-2016	17-Feb-2016	18-Feb-2016
Determinand	**Accred.**	**SOP**	**Units**	**LOD**				
pH	U	1010		N/A	7.9	6.2	6.5	8.3
Nitrate	U	1220	mg/l	0.50	6.5	4.8	2.4	2.0
Sulphate	U	1220	mg/l	1.0	10	4.2	2.7	2.4
Cyanide (Total)	U	1300	mg/l	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Cyanide (Free)	U	1300	mg/l	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Cyanide (Complex)	U	1300	mg/l	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Sulphide	U	1325	mg/l	0.050	< 0.050	< 0.050	< 0.050	< 0.050
Arsenic (Dissolved)	U	1450	µg/l	1.0	2.5	2.7	5.6	1.4
Boron (Dissolved)	U	1450	µg/l	20	< 20	26	< 20	< 20
Beryllium (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Cadmium (Dissolved)	U	1450	µg/l	0.080	0.13	0.26	0.18	< 0.080
Chromium (Dissolved)	U	1450	µg/l	1.0	2.4	4.5	6.6	< 1.0
Copper (Dissolved)	U	1450	µg/l	1.0	6.3	13	13	5.7
Mercury (Dissolved)	U	1450	µg/l	0.50	< 0.50	< 0.50	< 0.50	< 0.50
Nickel (Dissolved)	U	1450	µg/l	1.0	1.9	4.3	4.2	< 1.0
Lead (Dissolved)	U	1450	µg/l	1.0	6.8	11	10	1.2
Selenium (Dissolved)	U	1450	µg/l	1.0	< 1.0	< 1.0	< 1.0	< 1.0
Vanadium (Dissolved)	U	1450	µg/l	1.0	6.4	7.6	18	2.4
Zinc (Dissolved)	U	1450	µg/l	1.0	5.3	17	18	1.9
Naphthalene	U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Anthracene	U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluoranthene	U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Pyrene	U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]anthracene	U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[g,h,i]perylene	U	1800	µg/l	0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	U	1800	µg/l	2.0	< 2.0	< 2.0	< 2.0	< 2.0
Total Phenols	U	1920	mg/l	0.030	< 0.030	< 0.030	< 0.030	< 0.030

Results - Soil

Project: STN3505NM - Chipping Lane

Client: Soiltechnics Limited	Chemtest Job No.:				16-06222	16-06222	16-06222	16-06222	16-06222	16-06222	16-06222	16-06222	16-06222
Quotation No.:	Chemtest Sample ID.:				267963	267964	267965	267966	267967	267968	267969	267970	267971
Order No.: 21137	Client Sample Ref.:				TP101	TP102	TP102	TP103	TP103	TP104	TP106	TP106	TP107
	Client Sample ID.:				9-037	9-043	9-045	9-048	9-049	9-054	9-064	9-066	9-069
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.30	0.20	1.00	0.10	0.30	0.10	0.10	1.10	0.10
	Date Sampled:				16-Feb-2016	16-Feb-2016	16-Feb-2016	16-Feb-2016	16-Feb-2016	16-Feb-2016	16-Feb-2016	16-Feb-2016	17-Feb-2016
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
Moisture	N	2030	%	0.020	20	32	18	31	17	31	31	16	26
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A	Roots	Roots	NONE	NONE	Roots	Roots	Roots	NONE	NONE
Soil Texture	N	2040		N/A	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay
pH	M	2010		N/A	8.2	7.6	7.5	7.2	8.3	6.0	5.0	8.0	6.2
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	< 0.40	0.43		< 0.40	< 0.40	< 0.40	< 0.40		< 0.40
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010			< 0.010					< 0.010	
Total Sulphur	M	2175	%	0.010			0.016					0.040	
Cyanide (Complex)	M	2300	mg/kg	0.50	< 0.50	< 0.50		< 0.50	< 0.50	< 0.50	< 0.50		< 0.50
Cyanide (Free)	M	2300	mg/kg	0.50	< 0.50	< 0.50		< 0.50	< 0.50	< 0.50	< 0.50		< 0.50
Cyanide (Total)	M	2300	mg/kg	0.50	< 0.50	< 0.50		< 0.50	< 0.50	< 0.50	< 0.50		< 0.50
Sulphate (Acid Soluble)	M	2430	%	0.010			< 0.010					0.016	
Arsenic	M	2450	mg/kg	1.0	15	14		11	14	13	13		11
Beryllium	U	2450	mg/kg	1.0	< 1.0	< 1.0		< 1.0	1.0	< 1.0	< 1.0		< 1.0
Cadmium	M	2450	mg/kg	0.10	0.20	0.30		0.27	0.18	0.25	0.36		0.18
Chromium	M	2450	mg/kg	1.0	23	33		30	41	29	30		27
Copper	M	2450	mg/kg	0.50	110	59		24	24	17	24		20
Mercury	M	2450	mg/kg	0.10	0.25	0.22		0.20	0.11	0.14	0.22		0.13
Nickel	M	2450	mg/kg	0.50	25	27		25	47	21	23		23
Lead	M	2450	mg/kg	0.50	71	74		56	21	42	60		38
Selenium	M	2450	mg/kg	0.20	< 0.20	0.40		0.37	< 0.20	0.35	0.52		0.33
Vanadium	U	2450	mg/kg	5.0	29	48		37	43	36	40		36
Zinc	M	2450	mg/kg	0.50	110	110		78	57	64	86		47
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50		< 0.50	< 0.50	< 0.50	< 0.50		< 0.50
Organic Matter	M	2625	%	0.40	2.9	7.6		6.4	1.1	6.0	7.4		5.9
Naphthalene	M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10		< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10		< 0.10
Acenaphthene	M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10		< 0.10
Fluorene	M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10		< 0.10
Phenanthrene	M	2800	mg/kg	0.10	1.6	1.5		0.10	< 0.10	< 0.10	< 0.10		< 0.10
Anthracene	M	2800	mg/kg	0.10	0.31	0.35		< 0.10	< 0.10	< 0.10	< 0.10		< 0.10
Fluoranthene	M	2800	mg/kg	0.10	2.3	3.6		0.25	< 0.10	< 0.10	0.11		< 0.10
Pyrene	M	2800	mg/kg	0.10	2.0	3.5		0.23	< 0.10	< 0.10	0.14		< 0.10
Benzo[a]anthracene	M	2800	mg/kg	0.10	0.58	1.5		< 0.10	< 0.10	< 0.10	< 0.10		< 0.10
Chrysene	M	2800	mg/kg	0.10	0.70	1.9		< 0.10	< 0.10	< 0.10	< 0.10		< 0.10
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	0.96	2.6		< 0.10	< 0.10	< 0.10	< 0.10		< 0.10
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	0.18	0.84		< 0.10	< 0.10	< 0.10	< 0.10		< 0.10
Benzo[a]pyrene	M	2800	mg/kg	0.10	0.65	2.0		< 0.10	< 0.10	< 0.10	< 0.10		< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	0.39	1.4		< 0.10	< 0.10	< 0.10	< 0.10		< 0.10

Results - Soil

Project: STN3505NM - Chipping Lane

Client: Soiltechnics Limited				**Chemtest Job No.:**	16-06222	16-06222	16-06222	16-06222	16-06222	16-06222	16-06222	16-06222	16-06222
Quotation No.:				**Chemtest Sample ID.:**	267963	267964	267965	267966	267967	267968	267969	267970	267971
Order No.: 21137				Client Sample Ref.:	TP101	TP102	TP102	TP103	TP103	TP104	TP106	TP106	TP107
				Client Sample ID.:	9-037	9-043	9-045	9-048	9-049	9-054	9-064	9-066	9-069
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.30	0.20	1.00	0.10	0.30	0.10	0.10	1.10	0.10
				Date Sampled:	16-Feb-2016	16-Feb-2016	16-Feb-2016	16-Feb-2016	16-Feb-2016	16-Feb-2016	16-Feb-2016	16-Feb-2016	17-Feb-2016
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10	< 0.10	< 0.10	< 0.10		< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	0.38	1.3		< 0.10	< 0.10	< 0.10	< 0.10		< 0.10
Total Of 16 PAH's	N	2800	mg/kg	2.0	10	21		< 2.0	< 2.0	< 2.0	< 2.0		< 2.0
Total Phenols	M	2920	mg/kg	0.30	< 0.30	< 0.30		< 0.30	< 0.30	< 0.30	< 0.30		< 0.30

Results - Soil

Project: STN3505NM - Chipping Lane

Client: Soiltechnics Limited				Chemtest Job No.:	16-06222	16-06222	16-06222	16-06222	16-06222	16-06222	16-06222	16-06222	16-06222
Quotation No.:				Chemtest Sample ID.:	267972	267973	267974	267975	267976	267977	267978	267979	267980
Order No.: 21137				Client Sample Ref.:	TP108	TP108	TP108	TP110	TP110	TP112	TP113	TP114	TP114
				Client Sample ID.:	9-072	7-003	9-073	9-080	9-083	9-089	9-093	9-098	9-100
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.10	0.50	1.80	0.10	1.70	0.10	0.10	0.10	1.30
				Date Sampled:	17-Feb-2016	17-Feb-2016	17-Feb-2016	17-Feb-2016	17-Feb-2016	17-Feb-2016	17-Feb-2016	17-Feb-2016	17-Feb-2016
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
Moisture	N	2030	%	0.020	27	18	15	30	17	28	23	34	19
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A	Roots	NONE	NONE	NONE	Roots	NONE	Roots	NONE	NONE
Soil Texture	N	2040		N/A	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay
pH	M	2010		N/A	7.3	8.2	8.0	5.2	8.3	5.8	5.5	5.5	8.0
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	< 0.40	< 0.40		0.85		0.71	0.42	< 0.40	
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010			< 0.010		< 0.010				< 0.010
Total Sulphur	M	2175	%	0.010			0.014		< 0.010				0.016
Cyanide (Complex)	M	2300	mg/kg	0.50	< 0.50	< 0.50		< 0.50		< 0.50	< 0.50	< 0.50	
Cyanide (Free)	M	2300	mg/kg	0.50	< 0.50	< 0.50		< 0.50		< 0.50	< 0.50	< 0.50	
Cyanide (Total)	M	2300	mg/kg	0.50	< 0.50	< 0.50		< 0.50		< 0.50	< 0.50	< 0.50	
Sulphate (Acid Soluble)	M	2430	%	0.010			< 0.010		< 0.010				< 0.010
Arsenic	M	2450	mg/kg	1.0	13	13		16		12	11	11	
Beryllium	U	2450	mg/kg	1.0	< 1.0	< 1.0		1.1		< 1.0	1.0	< 1.0	
Cadmium	M	2450	mg/kg	0.10	0.27	0.17		0.36		0.27	0.29	0.25	
Chromium	M	2450	mg/kg	1.0	36	26		33		29	29	29	
Copper	M	2450	mg/kg	0.50	27	29		29		21	21	23	
Mercury	M	2450	mg/kg	0.10	0.16	0.12		0.18		0.17	0.17	0.18	
Nickel	M	2450	mg/kg	0.50	33	29		29		25	25	22	
Lead	M	2450	mg/kg	0.50	52	35		80		53	47	54	
Selenium	M	2450	mg/kg	0.20	0.26	< 0.20		0.49		0.43	0.38	0.46	
Vanadium	U	2450	mg/kg	5.0	39	28		42		33	34	38	
Zinc	M	2450	mg/kg	0.50	74	63		80		63	75	74	
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50		< 0.50		< 0.50	< 0.50	< 0.50	
Organic Matter	M	2625	%	0.40	3.5	2.8		5.7		4.8	4.3	8.1	
Naphthalene	M	2800	mg/kg	0.10	< 0.10	0.17		< 0.10		< 0.10	< 0.10	< 0.10	
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	< 0.10	< 0.10	
Acenaphthene	M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	< 0.10	< 0.10	
Fluorene	M	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	< 0.10	< 0.10	
Phenanthrene	M	2800	mg/kg	0.10	< 0.10	0.72		< 0.10		< 0.10	< 0.10	< 0.10	
Anthracene	M	2800	mg/kg	0.10	< 0.10	0.13		< 0.10		< 0.10	< 0.10	< 0.10	
Fluoranthene	M	2800	mg/kg	0.10	< 0.10	1.9		< 0.10		< 0.10	< 0.10	0.21	
Pyrene	M	2800	mg/kg	0.10	< 0.10	1.5		< 0.10		< 0.10	< 0.10	0.23	
Benzo[a]anthracene	M	2800	mg/kg	0.10	< 0.10	0.41		< 0.10		< 0.10	< 0.10	< 0.10	
Chrysene	M	2800	mg/kg	0.10	< 0.10	0.70		< 0.10		< 0.10	< 0.10	< 0.10	
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	< 0.10	0.82		< 0.10		< 0.10	< 0.10	< 0.10	
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	< 0.10	0.21		< 0.10		< 0.10	< 0.10	< 0.10	
Benzo[a]pyrene	M	2800	mg/kg	0.10	< 0.10	0.49		< 0.10		< 0.10	< 0.10	< 0.10	
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	< 0.10	0.32		< 0.10		< 0.10	< 0.10	< 0.10	

Chemtest
The right chemistry to deliver results

Results - Soil

Project: STN3505NM - Chipping Lane

Client: Soiltechnics Limited				**Chemtest Job No.:**	16-06222	16-06222	16-06222	16-06222	16-06222	16-06222	16-06222	16-06222	16-06222
Quotation No.:				**Chemtest Sample ID.:**	267972	267973	267974	267975	267976	267977	267978	267979	267980
Order No.: 21137				Client Sample Ref.:	TP108	TP108	TP108	TP110	TP110	TP112	TP113	TP114	TP114
				Client Sample ID.:	9-072	7-003	9-073	9-080	9-083	9-089	9-093	9-098	9-100
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.10	0.50	1.80	0.10	1.70	0.10	0.10	0.10	1.30
				Date Sampled:	17-Feb-2016	17-Feb-2016	17-Feb-2016	17-Feb-2016	17-Feb-2016	17-Feb-2016	17-Feb-2016	17-Feb-2016	17-Feb-2016
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	< 0.10		< 0.10		< 0.10	< 0.10	< 0.10	
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	< 0.10	0.29		< 0.10		< 0.10	< 0.10	< 0.10	
Total Of 16 PAH's	N	2800	mg/kg	2.0	< 2.0	7.7		< 2.0		< 2.0	< 2.0	< 2.0	
Total Phenols	M	2920	mg/kg	0.30	< 0.30	< 0.30		< 0.30		< 0.30	< 0.30	< 0.30	

Results - Soil

Project: STN3505NM - Chipping Lane

Client: Soiltechnics Limited	**Chemtest Job No.:**				16-06222	16-06222	16-06222	16-06222	16-06222	16-06222	16-06222	16-06222	16-06222
Quotation No.:	**Chemtest Sample ID.:**				267981	267982	267983	267984	267985	267986	267987	267988	267989
Order No.: 21137	Client Sample Ref.:				TP116	TP117	TP118	TP118	TP119	TP120	TP122	TP123	TP124
	Client Sample ID.:				9-106	9-110	9-114	9-117	9-119	9-124	9-137	9-138	9-142
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m):				0.10	0.10	0.10	1.80	0.10	0.10	1.80	0.10	0.10
	Date Sampled:				17-Feb-2016	17-Feb-2016	18-Feb-2016	18-Feb-2016	18-Feb-2016	18-Feb-2016	18-Feb-2016	18-Feb-2016	18-Feb-2016
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
Moisture	N	2030	%	0.020	24	25	25	16	39	30	15	32	27
Soil Colour	N	2040		N/A	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown	Brown
Other Material	N	2040		N/A	Roots	Roots	Roots	Roots	Roots	Roots	NONE	Roots	Roots
Soil Texture	N	2040		N/A	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay
pH	M	2010		N/A	5.8	5.8	5.3	8.3	5.6	5.5	8.3	5.9	5.6
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	0.45	0.56	0.53		0.61	0.77		0.72	0.72
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010				< 0.010			< 0.010		
Total Sulphur	M	2175	%	0.010				0.014			0.013		
Cyanide (Complex)	M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50		< 0.50	< 0.50		< 0.50	< 0.50
Cyanide (Free)	M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50		< 0.50	< 0.50		< 0.50	< 0.50
Cyanide (Total)	M	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50		< 0.50	< 0.50		< 0.50	< 0.50
Sulphate (Acid Soluble)	M	2430	%	0.010				< 0.010			< 0.010		
Arsenic	M	2450	mg/kg	1.0	12	11	14		22	14		10	10
Beryllium	U	2450	mg/kg	1.0	1.1	1.1	1.1		1.3	1.2		1.0	1.0
Cadmium	M	2450	mg/kg	0.10	0.30	0.21	0.29		0.50	0.32		0.28	0.26
Chromium	M	2450	mg/kg	1.0	35	35	37		46	36		32	32
Copper	M	2450	mg/kg	0.50	36	27	32		44	26		22	20
Mercury	M	2450	mg/kg	0.10	0.23	0.17	0.20		0.25	0.18		0.16	0.16
Nickel	M	2450	mg/kg	0.50	29	30	26		31	29		27	25
Lead	M	2450	mg/kg	0.50	65	41	61		96	57		42	42
Selenium	M	2450	mg/kg	0.20	0.34	0.32	0.41		0.67	0.38		0.37	0.39
Vanadium	U	2450	mg/kg	5.0	44	40	49		59	42		37	43
Zinc	M	2450	mg/kg	0.50	110	59	83		120	82		62	54
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50		< 0.50	< 0.50		< 0.50	< 0.50
Organic Matter	M	2625	%	0.40	4.3	5.2	6.6		10	5.5		5.7	4.3
Naphthalene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10		< 0.10	< 0.10
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10		< 0.10	< 0.10
Acenaphthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10		< 0.10	< 0.10
Fluorene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10		< 0.10	< 0.10
Phenanthrene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.75		0.11	< 0.10		< 0.10	< 0.10
Anthracene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.16		< 0.10	< 0.10		< 0.10	< 0.10
Fluoranthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	1.5		0.36	< 0.10		< 0.10	< 0.10
Pyrene	M	2800	mg/kg	0.10	< 0.10	< 0.10	1.4		0.31	< 0.10		< 0.10	< 0.10
Benzo[a]anthracene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.29		< 0.10	< 0.10		< 0.10	< 0.10
Chrysene	M	2800	mg/kg	0.10	< 0.10	< 0.10	0.33		< 0.10	< 0.10		< 0.10	< 0.10
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10		< 0.10	< 0.10
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10		< 0.10	< 0.10
Benzo[a]pyrene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10		< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10		< 0.10	< 0.10

Results - Soil

Project: STN3505NM - Chipping Lane

Client: Soiltechnics Limited				**Chemtest Job No.:**	16-06222	16-06222	16-06222	16-06222	16-06222	16-06222	16-06222	16-06222	16-06222
Quotation No.:				**Chemtest Sample ID.:**	267981	267982	267983	267984	267985	267986	267987	267988	267989
Order No.: 21137				Client Sample Ref.:	TP116	TP117	TP118	TP118	TP119	TP120	TP122	TP123	TP124
				Client Sample ID.:	9-106	9-110	9-114	9-117	9-119	9-124	9-137	9-138	9-142
				Sample Type:	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
				Top Depth (m):	0.10	0.10	0.10	1.80	0.10	0.10	1.80	0.10	0.10
				Date Sampled:	17-Feb-2016	17-Feb-2016	18-Feb-2016	18-Feb-2016	18-Feb-2016	18-Feb-2016	18-Feb-2016	18-Feb-2016	18-Feb-2016
Determinand	**Accred.**	**SOP**	**Units**	**LOD**									
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10		< 0.10	< 0.10
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	< 0.10	< 0.10	< 0.10		< 0.10	< 0.10		< 0.10	< 0.10
Total Of 16 PAH's	N	2800	mg/kg	2.0	< 2.0	< 2.0	4.4		< 2.0	< 2.0		< 2.0	< 2.0
Total Phenols	M	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30		< 0.30	< 0.30		< 0.30	< 0.30

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Results - Soil

Project: STN3505NM - Chipping Lane

Client: Soiltechnics Limited				**Chemtest Job No.:**	16-06222	16-06222
Quotation No.:				**Chemtest Sample ID.:**	267990	267991
Order No.: 21137				Client Sample Ref.:	TP125	TP125
				Client Sample ID.:	9-148	9-149
				Sample Type:	SOIL	SOIL
				Top Depth (m):	0.50	1.20
				Date Sampled:	18-Feb-2016	18-Feb-2016
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Moisture	N	2030	%	0.020	21	21
Soil Colour	N	2040		N/A	Brown	Brown
Other Material	N	2040		N/A	Roots	Roots
Soil Texture	N	2040		N/A	Clay	Clay
pH	M	2010		N/A	7.9	6.5
Boron (Hot Water Soluble)	M	2120	mg/kg	0.40	< 0.40	
Sulphate (2:1 Water Soluble) as SO4	M	2120	g/l	0.010		< 0.010
Total Sulphur	M	2175	%	0.010		0.022
Cyanide (Complex)	M	2300	mg/kg	0.50	< 0.50	
Cyanide (Free)	M	2300	mg/kg	0.50	< 0.50	
Cyanide (Total)	M	2300	mg/kg	0.50	< 0.50	
Sulphate (Acid Soluble)	M	2430	%	0.010		0.030
Arsenic	M	2450	mg/kg	1.0	11	
Beryllium	U	2450	mg/kg	1.0	< 1.0	
Cadmium	M	2450	mg/kg	0.10	0.18	
Chromium	M	2450	mg/kg	1.0	32	
Copper	M	2450	mg/kg	0.50	18	
Mercury	M	2450	mg/kg	0.10	0.10	
Nickel	M	2450	mg/kg	0.50	31	
Lead	M	2450	mg/kg	0.50	26	
Selenium	M	2450	mg/kg	0.20	0.23	
Vanadium	U	2450	mg/kg	5.0	32	
Zinc	M	2450	mg/kg	0.50	46	
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	
Organic Matter	M	2625	%	0.40	2.8	
Naphthalene	M	2800	mg/kg	0.10	< 0.10	
Acenaphthylene	N	2800	mg/kg	0.10	< 0.10	
Acenaphthene	M	2800	mg/kg	0.10	< 0.10	
Fluorene	M	2800	mg/kg	0.10	< 0.10	
Phenanthrene	M	2800	mg/kg	0.10	< 0.10	
Anthracene	M	2800	mg/kg	0.10	< 0.10	
Fluoranthene	M	2800	mg/kg	0.10	< 0.10	
Pyrene	M	2800	mg/kg	0.10	< 0.10	
Benzo[a]anthracene	M	2800	mg/kg	0.10	< 0.10	
Chrysene	M	2800	mg/kg	0.10	< 0.10	
Benzo[b]fluoranthene	M	2800	mg/kg	0.10	< 0.10	
Benzo[k]fluoranthene	M	2800	mg/kg	0.10	< 0.10	
Benzo[a]pyrene	M	2800	mg/kg	0.10	< 0.10	
Indeno(1,2,3-c,d)Pyrene	M	2800	mg/kg	0.10	< 0.10	

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Results - Soil

Project: STN3505NM - Chipping Lane

Client: Soiltechnics Limited				**Chemtest Job No.:**	16-06222	16-06222
Quotation No.:				**Chemtest Sample ID.:**	267990	267991
Order No.: 21137				Client Sample Ref.:	TP125	TP125
				Client Sample ID.:	9-148	9-149
				Sample Type:	SOIL	SOIL
				Top Depth (m):	0.50	1.20
				Date Sampled:	18-Feb-2016	18-Feb-2016
Determinand	**Accred.**	**SOP**	**Units**	**LOD**		
Dibenz(a,h)Anthracene	N	2800	mg/kg	0.10	< 0.10	
Benzo[g,h,i]perylene	M	2800	mg/kg	0.10	< 0.10	
Total Of 16 PAH's	N	2800	mg/kg	2.0	< 2.0	
Total Phenols	M	2920	mg/kg	0.30	< 0.30	

Chemtest

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Report Information

Key

U	UKAS accredited
M	MCERTS and UKAS accredited
N	Unaccredited
S	This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
SN	This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
T	This analysis has been subcontracted to an unaccredited laboratory
I/S	Insufficient Sample
U/S	Unsuitable Sample
N/E	not evaluated
<	"less than"
>	"greater than"

Comments or interpretations are beyond the scope of UKAS accreditation
The results relate only to the items tested
Uncertainty of measurement for the determinands tested are available upon request
None of the results in this report have been recovery corrected
All results are expressed on a dry weight basis
The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols
For all other tests the samples were dried at < 37°C prior to analysis
All Asbestos testing is performed at our Coventry laboratory
Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

A - Date of sampling not supplied
B - Sample age exceeds stability time (sampling to extraction)
C - Sample not received in appropriate containers
D - Broken Container

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt
All water samples will be retained for 14 days from the date of receipt
Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.co.uk

soiltechnics
environmental and geotechnical consultants

Analysis of test data in relation to concentrations of inorganic chemical contaminants

Adopted Model: **Residential without plant uptake**
Receptor: **Current site user**

Test procedure		Summary of test data						Initial comparison	Outlier test					Normality test			UCL	
Contaminant	Guideline source	Guideline value mg/kg	No. of tests	Min. mg/kg	Max. mg/kg	Mean mg/kg	No. of tests above guideline value	Initial screening	Pass outlier test?	Number of outliers	Location of outlier	Depth	Concentration mg/kg	Shapiro-Wilk Normality test	Probability plot test	Data normally distributed?	95% UCL of mean mg/kg	Contaminant
Arsenic	S4UL	40	21	10.0	22.0	12.9	0	Mean value below guideline	n					not normal	not normal	n	15.4	**Arsenic**
Beryllium	S4UL	1.7	21	1.0	1.3	1.0	0	Mean value below guideline	n					not normal	not normal	n	1.1	**Beryllium**
Boron	S4UL	11000	21	0.4	0.9	0.5	0	Mean value below guideline	y					not normal	not normal	n	0.7	**Boron**
Cadmium	S4UL	85	21	0.2	0.5	0.3	0	Mean value below guideline	n					not normal	not normal	n	0.3	**Cadmium**
Chromium	S4UL	910	21	23.0	46.0	32.4	0	Mean value below guideline	n					normal	normal	y	34.3	**Chromium**
Copper	S4UL	7100	21	17.0	110.0	31.1	0	Mean value below guideline	n					not normal	not normal	n	50.6	**Copper**
Cyanide (total)	ATK	34	21	0.5	0.5	0.5	0	Mean value below guideline	y					not normal	not normal	n	0.5	**Cyanide (total)**
Lead	ATK	383	21	21.0	96.0	53.0	0	Mean value below guideline	y					normal	normal	y	59.8	**Lead**
Mercury#	S4UL	1.2	21	0.1	0.3	0.2	0	Mean value below guideline	y					normal	normal	y	0.2	**Mercury#**
Nickel	S4UL	180	21	21.0	47.0	27.7	0	Mean value below guideline	n					not normal	not normal	n	32.9	**Nickel**
Selenium	S4UL	430	21	0.2	0.7	0.4	0	Mean value below guideline	n					normal	normal	y	0.4	**Selenium**
Vanadium	S4UL	1200	21	28.0	59.0	39.5	0	Mean value below guideline	n					normal	normal	y	42.2	**Vanadium**
Zinc	S4UL	40000	21	46.0	120.0	76.0	0	Mean value below guideline	y					normal	normal	y	84.1	**Zinc**

C4SL	Category 4 Screening Level
S4UL	Suitable for Use Level as published by LQM/CIEH
SGV	Soil Guideline Value as published by the Environment Agency 2009
GAC	Generic Assessment Criterion as published by LQM and CIEH
SSV	Soil Screening Value as derived by Soiltechnics
ATK	Soil Screening Value derived by Atkins
NGV	No Guideline Value
BPG5	Guideline from BPG Note 5 as published by Forest Research
#	Assumed to be elemental mercury as initial screening value

Title	Table number
Analysis of test data in relation to concentrations of inorganic chemical contaminants.	1

Analysis of test data in relation to concentrations of organic chemical contaminants

Adopted model: Residential without plant uptake
Receptor: Current site user

Test procedure			Summary of test data					Initial Screening	Outlier test					Normality test			UCL	
Contaminant	Guideline source	Guideline value mg/kg	No. of tests	Min. mg/kg	Max. mg/kg	Mean mg/kg	No. of tests above guideline value	Initial screening	Pass outlier test?	Number of outliers	Location of outlier	Depth	Concentration mg/kg	Shapiro-Wilk Normality test	Probability plot test	Data normally distributed?	95% UCL of mean mg/kg	Contaminant
Acenaphthene	S4UL	210	21	0.1	0.1	0.1	0	Mean value below guideline	y					not normal	not normal	n	0.1	**Acenaphthene**
Acenaphthylene	S4UL	170	21	0.1	0.1	0.1	0	Mean value below guideline	y					not normal	not normal	n	0.1	**Acenaphthylene**
Anthracene	S4UL	2400	21	0.1	0.4	0.1	0	Mean value below guideline	n					not normal	not normal	n	0.2	**Anthracene**
Benzo(a)anthracene	S4UL	7.2	21	0.1	1.5	0.2	0	Mean value below guideline	n					not normal	not normal	n	0.5	**Benzo(a)anthracene**
Benzo(a)pyrene	S4UL	2.2	21	0.1	2.0	0.2	0	Mean value below guideline	n					not normal	not normal	n	0.6	**Benzo(a)pyrene**
Benzo(b)fluoranthene	S4UL	2.6	21	0.1	2.6	0.3	0	Mean value below guideline	n					not normal	not normal	n	0.8	**Benzo(b)fluoranthene**
Benzo(g,h,i)perylene	S4UL	320	21	0.1	1.3	0.2	0	Mean value below guideline	n					not normal	not normal	n	0.4	**Benzo(g,h,i)perylene**
Benzo(k)fluoranthene	S4UL	77	21	0.1	0.8	0.1	0	Mean value below guideline	n					not normal	not normal	n	0.3	**Benzo(k)fluoranthene**
Chrysene	S4UL	15	21	0.1	1.9	0.3	0	Mean value below guideline	n					not normal	not normal	n	0.7	**Chrysene**
Dibenzo(a,h)anthracene	S4UL	0.24	21	0.1	0.1	0.1	0	Mean value below guideline	y					not normal	not normal	n	0.1	**Dibenzo(a,h)anthracene**
Fluoranthene	S4UL	280	21	0.1	3.6	0.5	0	Mean value below guideline	n					not normal	not normal	n	1.5	**Fluoranthene**
Fluorene	S4UL	170	21	0.1	0.1	0.1	0	Mean value below guideline	y					not normal	not normal	n	0.1	**Fluorene**
Indeno(1,2,3-cd)pyrene	S4UL	27	21	0.1	1.4	0.2	0	Mean value below guideline	n					not normal	not normal	n	0.5	**Indeno(1,2,3-cd)pyrene**
Naphthalene	S4UL	2.3	21	0.1	0.2	0.1	0	Mean value below guideline	n					not normal	not normal	n	0.1	**Naphthalene**
Phenanthrene	S4UL	95	21	0.1	1.6	0.3	0	Mean value below guideline	n					not normal	not normal	n	0.7	**Phenanthrene**
Phenols	S4UL	280	21	0.3	0.3	0.3	0	Mean value below guideline	y					not normal	not normal	n	0.3	**Phenols**
Pyrene	S4UL	620	21	0.1	3.5	0.5	0	Mean value below guideline	n					not normal	not normal	n	1.3	**Pyrene**

Notes

C4SL	Category 4 Screening Level
S4UL	Suitable for Use Level as published by LQM/CIEH
SGV	Soil Guideline Value as published by the Environment Agency 2009
GAC	Generic Assessment Criterion as published by LQM and CIEH
SSV	Soil Screening Value as derived by Soiltechnics
ATK	Soil Screening Value derived by Atkins
NGV	No Guideline Value

Title	Table number
Analysis of test data in relation to concentrations of organic chemical contaminants.	2

soiltechnics
environmental and geotechnical consultants

Analysis of test data in relation to concentrations of inorganic chemical contaminants

Adopted Model: **Residential**
Receptor: **Proposed site user**

Test procedure		Summary of test data						Initial comparison	Outlier test					Normality test			UCL	
Contaminant	Guideline source	Guideline value mg/kg	No. of tests	Min. mg/kg	Max. mg/kg	Mean mg/kg	No. of tests above guideline value	Initial screening	Pass outlier test?	Number of outliers	Location of outlier	Depth	Concentration mg/kg	Shapiro-Wilk Normality test	Probability plot test	Data normally distributed?	95% UCL of mean mg/kg	Contaminant
Arsenic	S4UL	37	21	10.0	22.0	12.9	0	Mean value below guideline	n					not normal	not normal	n	15.4	**Arsenic**
Beryllium	S4UL	1.7	21	1.0	1.3	1.0	0	Mean value below guideline	n					not normal	not normal	n	1.1	**Beryllium**
Boron	S4UL	290	21	0.4	0.9	0.5	0	Mean value below guideline	y					not normal	not normal	n	0.7	**Boron**
Cadmium	S4UL	11	21	0.2	0.5	0.3	0	Mean value below guideline	n					not normal	not normal	n	0.3	**Cadmium**
Chromium	S4UL	910	21	23.0	46.0	32.4	0	Mean value below guideline	n					normal	normal	y	34.3	**Chromium**
Copper	S4UL	2400	21	17.0	110.0	31.1	0	Mean value below guideline	n					not normal	not normal	n	50.6	**Copper**
Cyanide (total)	ATK	34	21	0.5	0.5	0.5	0	Mean value below guideline	y					not normal	not normal	n	0.5	**Cyanide (total)**
Lead	ATK	276	21	21.0	96.0	53.0	0	Mean value below guideline	y					normal	normal	y	59.8	**Lead**
Mercury#	S4UL	1.2	21	0.1	0.3	0.2	0	Mean value below guideline	y					normal	normal	y	0.2	**Mercury#**
Nickel	S4UL	180	21	21.0	47.0	27.7	0	Mean value below guideline	n					not normal	not normal	n	32.9	**Nickel**
Selenium	S4UL	250	21	0.2	0.7	0.4	0	Mean value below guideline	n					normal	normal	y	0.4	**Selenium**
Vanadium	S4UL	410	21	28.0	59.0	39.5	0	Mean value below guideline	n					normal	normal	y	42.2	**Vanadium**
Zinc	S4UL	3700	21	46.0	120.0	76.0	0	Mean value below guideline	y					normal	normal	y	84.1	**Zinc**

C4SL Category 4 Screening Level
S4UL Suitable for Use Level as published by LQM/CIEH
SGV Soil Guideline Value as published by the Environment Agency 2009
GAC Generic Assessment Criterion as published by LQM and CIEH
SSV Soil Screening Value as derived by Soiltechnics
ATK Soil Screening Value derived by Atkins
NGV No Guideline Value
BPG5 Guideline from BPG Note 5 as published by Forest Research

Assumed to be elemental mercury as initial screening value

Title	Table number
Analysis of test data in relation to concentrations of inorganic chemical contaminants.	3

soiltechnics
environmental and geotechnical consultants

Analysis of test data in relation to concentrations of organic chemical contaminants

Adopted model: **Residential**
Receptor: **Proposed site user**

Test procedure			Summary of test data					Initial Screening	Outlier test					Normality test			UCL	
Contaminant	Guideline source	Guideline value mg/kg	No. of tests	Min. mg/kg	Max. mg/kg	Mean mg/kg	No. of tests above guideline value	Initial screening	Pass outlier test?	Number of outliers	Location of outlier	Depth	Concentration mg/kg	Shapiro-Wilk Normality test	Probability plot test	Data normally distributed?	95% UCL of mean mg/kg	Contaminant
Acenaphthene	S4UL	3000	21	0.1	0.1	0.1	0	Mean value below guideline	y					not normal	not normal	n	0.1	**Acenaphthene**
Acenaphthylene	S4UL	2900	21	0.1	0.1	0.1	0	Mean value below guideline	y					not normal	not normal	n	0.1	**Acenaphthylene**
Anthracene	S4UL	31000	21	0.1	0.4	0.1	0	Mean value below guideline	n					not normal	not normal	n	0.2	**Anthracene**
Benzo(a)anthracene	S4UL	11	21	0.1	1.5	0.2	0	Mean value below guideline	n					not normal	not normal	n	0.5	**Benzo(a)anthracene**
Benzo(a)pyrene	S4UL	3.2	21	0.1	2.0	0.2	0	Mean value below guideline	n					not normal	not normal	n	0.6	**Benzo(a)pyrene**
Benzo(b)fluoranthene	S4UL	3.9	21	0.1	2.6	0.3	0	Mean value below guideline	n					not normal	not normal	n	0.8	**Benzo(b)fluoranthene**
Benzo(g,h,i)perylene	S4UL	360	21	0.1	1.3	0.2	0	Mean value below guideline	n					not normal	not normal	n	0.4	**Benzo(g,h,i)perylene**
Benzo(k)fluoranthene	S4UL	110	21	0.1	0.8	0.1	0	Mean value below guideline	n					not normal	not normal	n	0.3	**Benzo(k)fluoranthene**
Chrysene	S4UL	30	21	0.1	1.9	0.3	0	Mean value below guideline	n					not normal	not normal	n	0.7	**Chrysene**
Dibenzo(a,h)anthracene	S4UL	0.31	21	0.1	0.1	0.1	0	Mean value below guideline	y					not normal	not normal	n	0.1	**Dibenzo(a,h)anthracene**
Fluoranthene	S4UL	1500	21	0.1	3.6	0.5	0	Mean value below guideline	n					not normal	not normal	n	1.5	**Fluoranthene**
Fluorene	S4UL	2800	21	0.1	0.1	0.1	0	Mean value below guideline	y					not normal	not normal	n	0.1	**Fluorene**
Indeno(1,2,3-cd)pyrene	S4UL	45	21	0.1	1.4	0.2	0	Mean value below guideline	n					not normal	not normal	n	0.5	**Indeno(1,2,3-cd)pyrene**
Naphthalene	S4UL	2.3	21	0.1	0.2	0.1	0	Mean value below guideline	n					not normal	not normal	n	0.1	**Naphthalene**
Phenanthrene	S4UL	1300	21	0.1	1.6	0.3	0	Mean value below guideline	n					not normal	not normal	n	0.7	**Phenanthrene**
Phenols	S4UL	750	21	0.3	0.3	0.3	0	Mean value below guideline	y					not normal	not normal	n	0.3	**Phenols**
Pyrene	S4UL	3700	21	0.1	3.5	0.5	0	Mean value below guideline	n					not normal	not normal	n	1.3	**Pyrene**

Notes

C4SL	Category 4 Screening Level
S4UL	Suitable for Use Level as published by LQM/CIEH
SGV	Soil Guideline Value as published by the Environment Agency 2009
GAC	Generic Assessment Criterion as published by LQM and CIEH
SSV	Soil Screening Value as derived by Soiltechnics
ATK	Soil Screening Value derived by Atkins
NGV	No Guideline Value
BPG5	Guideline from BPG Note 5 as published by Forest Research

Assumed to be elemental mercury as initial screening value

Title	Table number
Analysis of test data in relation to concentrations of organic chemical contaminants.	4

soiltechnics
environmental and geotechnical consultants

Analysis of test data in relation to concentrations of inorganic chemical contaminants

Adopted Model: Industrial/Commercial
Receptor: Construction operative

Test procedure		Summary of test data						Initial comparison	Outlier test					Normality test			UCL	
Contaminant	Guideline source	Guideline value mg/kg	No. of tests	Min. mg/kg	Max. mg/kg	Mean mg/kg	No. of tests above guideline value	Initial screening	Pass outlier test?	Number of outliers	Location of outlier	Depth	Concentration mg/kg	Shapiro-Wilk Normality test	Probability plot test	Data normally distributed?	95% UCL of mean mg/kg	Contaminant
Arsenic	SGV	640	21	10.0	22.0	12.9	0	Mean value below guideline	n					not normal	not normal	n	15.4	**Arsenic**
Beryllium	GAC	420	21	1.0	1.3	1.0	0	Mean value below guideline	n					not normal	not normal	n	1.1	**Beryllium**
Boron	GAC	192000	21	0.4	0.9	0.5	0	Mean value below guideline	y					not normal	not normal	n	0.7	**Boron**
Cadmium	SGV	230	21	0.2	0.5	0.3	0	Mean value below guideline	n					not normal	not normal	n	0.3	**Cadmium**
Chromium	GAC	30400	21	23.0	46.0	32.4	0	Mean value below guideline	n					normal	normal	y	34.3	**Chromium**
Copper	GAC	71700	21	17.0	110.0	31.1	0	Mean value below guideline	n					not normal	not normal	n	50.6	**Copper**
Cyanide (total)	ATK	34	21	0.5	0.5	0.5	0	Mean value below guideline	y					not normal	not normal	n	0.5	**Cyanide (total)**
Lead	ATK	6490	21	21.0	96.0	53.0	0	Mean value below guideline	y					normal	normal	y	59.8	**Lead**
Mercury#	SGV	26	21	0.1	0.3	0.2	0	Mean value below guideline	y					normal	normal	y	0.2	**Mercury#**
Nickel	SGV	1800	21	21.0	47.0	27.7	0	Mean value below guideline	n					not normal	not normal	n	32.9	**Nickel**
Selenium	SGV	13000	21	0.2	0.7	0.4	0	Mean value below guideline	n					normal	normal	y	0.4	**Selenium**
Vanadium	GAC	3160	21	28.0	59.0	39.5	0	Mean value below guideline	n					normal	normal	y	42.2	**Vanadium**
Zinc	GAC	665000	21	46.0	120.0	76.0	0	Mean value below guideline	y					normal	normal	y	84.1	**Zinc**

C4SL	Category 4 Screening Level
S4UL	Suitable for Use Level as published by LQM/CIEH
SGV	Soil Guideline Value as published by the Environment Agency 2009
GAC	Generic Assessment Criterion as published by LQM and CIEH
SSV	Soil Screening Value as derived by Soiltechnics
ATK	Soil Screening Value derived by Atkins
NGV	No Guideline Value
BPG5	Guideline from BPG Note 5 as published by Forest Research
#	Assumed to be elemental mercury as initial screening value

Title	Table number
Analysis of test data in relation to concentrations of inorganic chemical contaminants.	5

soiltechnics
environmental and geotechnical consultants

Analysis of test data in relation to concentrations of organic chemical contaminants

Adopted model: Industrial/Commercial
Receptor: Construction operative and vegetation

Test procedure			Summary of test data					Initial Screening	Outlier test					Normality test			UCL	
Contaminant	Guideline source	Guideline value mg/kg	No. of tests	Min. mg/kg	Max. mg/kg	Mean mg/kg	No. of tests above guideline value	Initial screening	Pass outlier test?	Number of outliers	Location of outlier	Depth	Concentration mg/kg	Shapiro-Wilk Normality test	Probability plot test	Data normally distributed?	95% UCL of mean mg/kg	Contaminant
Acenaphthene	S4UL	3000	21	0.1	0.1	0.1	0	Mean value below guideline	y					not normal	not normal	n	0.1	**Acenaphthene**
Acenaphthylene	S4UL	2900	21	0.1	0.1	0.1	0	Mean value below guideline	y					not normal	not normal	n	0.1	**Acenaphthylene**
Anthracene	S4UL	31000	21	0.1	0.4	0.1	0	Mean value below guideline	n					not normal	not normal	n	0.2	**Anthracene**
Benzo(a)anthracene	S4UL	11	21	0.1	1.5	0.2	0	Mean value below guideline	n					not normal	not normal	n	0.5	**Benzo(a)anthracene**
Benzo(a)pyrene	S4UL	3.2	21	0.1	2.0	0.2	0	Mean value below guideline	n					not normal	not normal	n	0.6	**Benzo(a)pyrene**
Benzo(b)fluoranthene	S4UL	3.9	21	0.1	2.6	0.3	0	Mean value below guideline	n					not normal	not normal	n	0.8	**Benzo(b)fluoranthene**
Benzo(g,h,i)perylene	S4UL	360	21	0.1	1.3	0.2	0	Mean value below guideline	n					not normal	not normal	n	0.4	**Benzo(g,h,i)perylene**
Benzo(k)fluoranthene	S4UL	110	21	0.1	0.8	0.1	0	Mean value below guideline	n					not normal	not normal	n	0.3	**Benzo(k)fluoranthene**
Chrysene	S4UL	30	21	0.1	1.9	0.3	0	Mean value below guideline	n					not normal	not normal	n	0.7	**Chrysene**
Dibenzo(a,h)anthracene	S4UL	0.31	21	0.1	0.1	0.1	0	Mean value below guideline	y					not normal	not normal	n	0.1	**Dibenzo(a,h)anthracene**
Fluoranthene	S4UL	1500	21	0.1	3.6	0.5	0	Mean value below guideline	n					not normal	not normal	n	1.5	**Fluoranthene**
Fluorene	S4UL	2800	21	0.1	0.1	0.1	0	Mean value below guideline	y					not normal	not normal	n	0.1	**Fluorene**
Indeno(1,2,3-cd)pyrene	S4UL	45	21	0.1	1.4	0.2	0	Mean value below guideline	n					not normal	not normal	n	0.5	**Indeno(1,2,3-cd)pyrene**
Naphthalene	S4UL	2.3	21	0.1	0.2	0.1	0	Mean value below guideline	n					not normal	not normal	n	0.1	**Naphthalene**
Phenanthrene	S4UL	1300	21	0.1	1.6	0.3	0	Mean value below guideline	n					not normal	not normal	n	0.7	**Phenanthrene**
Phenols	S4UL	750	21	0.3	0.3	0.3	0	Mean value below guideline	y					not normal	not normal	n	0.3	**Phenols**
Pyrene	S4UL	3700	21	0.1	3.5	0.5	0	Mean value below guideline	n					not normal	not normal	n	1.3	**Pyrene**

Notes

C4SL	Category 4 Screening Level
S4UL	Suitable for Use Level as published by LQM/CIEH
SGV	Soil Guideline Value as published by the Environment Agency 2009
GAC	Generic Assessment Criterion as published by LQM and CIEH
SSV	Soil Screening Value as derived by Soiltechnics
ATK	Soil Screening Value derived by Atkins
NGV	No Guideline Value
BPG5	Guideline from BPG Note 5 as published by Forest Research

Title	Table number
Analysis of test data in relation to concentrations of organic chemical contaminants.	6

soiltechnics
environmental and geotechnical consultants

Analysis of test data in relation to concentrations of inorganic chemical contaminants

Adopted Model: Industrial/Commercial and BPG5
Receptor: Vegetation

Test procedure		Summary of test data						Initial comparison	Outlier test					Normality test			UCL	
Contaminant	Guideline source	Guideline value mg/kg	No. of tests	Min. mg/kg	Max. mg/kg	Mean mg/kg	No. of tests above guideline value	Initial screening	Pass outlier test?	Number of outliers	Location of outlier	Depth	Concentration mg/kg	Shapiro-Wilk Normality test	Probability plot test	Data normally distributed?	95% UCL of mean mg/kg	Contaminant
Arsenic	S4UL	640	21	10.0	22.0	12.9	0	Mean value below guideline	n					not normal	not normal	n	15.4	**Arsenic**
Beryllium	S4UL	12	21	1.0	1.3	1.0	0	Mean value below guideline	n					not normal	not normal	n	1.1	**Beryllium**
Boron	S4UL	240000	21	0.4	0.9	0.5	0	Mean value below guideline	y					not normal	not normal	n	0.7	**Boron**
Cadmium	S4UL	190	21	0.2	0.5	0.3	0	Mean value below guideline	n					not normal	not normal	n	0.3	**Cadmium**
Chromium	S4UL	8600	21	23.0	46.0	32.4	0	Mean value below guideline	n					normal	normal	y	34.3	**Chromium**
Copper	BPG5	130	21	17.0	110.0	31.1	0	Mean value below guideline	n					not normal	not normal	n	50.6	**Copper**
Cyanide (total)	ATK	34	21	0.5	0.5	0.5	0	Mean value below guideline	y					not normal	not normal	n	0.5	**Cyanide (total)**
Lead	ATK	6490	21	21.0	96.0	53.0	0	Mean value below guideline	y					normal	normal	y	59.8	**Lead**
Mercury#	S4UL	58	21	0.1	0.3	0.2	0	Mean value below guideline	y					normal	normal	y	0.2	**Mercury#**
Nickel	S4UL	980	21	21.0	47.0	27.7	0	Mean value below guideline	n					not normal	not normal	n	32.9	**Nickel**
Selenium	S4UL	12000	21	0.2	0.7	0.4	0	Mean value below guideline	n					normal	normal	y	0.4	**Selenium**
Vanadium	S4UL	9000	21	28.0	59.0	39.5	0	Mean value below guideline	n					normal	normal	y	42.2	**Vanadium**
Zinc	BPG5	300	21	46.0	120.0	76.0	0	Mean value below guideline	y					normal	normal	y	84.1	**Zinc**

C4SL	Category 4 Screening Level
S4UL	Suitable for Use Level as published by LQM/CIEH
SGV	Soil Guideline Value as published by the Environment Agency 2009
GAC	Generic Assessment Criterion as published by LQM and CIEH
SSV	Soil Screening Value as derived by Soiltechnics
ATK	Soil Screening Value derived by Atkins
NGV	No Guideline Value
BPG5	Guideline from BPG Note 5 as published by Forest Research
#	Assumed to be elemental mercury as initial screening value

Title	Table number
Analysis of test data in relation to concentrations of inorganic chemical contaminants.	7

Summary of petroleum hydrocarbon test results

BTEX (Red highlights indicate exceedance of guideline value)

Indicator	unit	S4UL	Concentration		
			TP101	TP108	TP125
			0.90	0.50	0.50
Benzene	mg/kg	0.33	< 0.001	< 0.001	< 0.001
Toluene	mg/kg	610	< 0.001	< 0.001	< 0.001
Ethylbenzene	mg/kg	350	< 0.001	< 0.001	< 0.001
o-Xylene	mg/kg	250	< 0.001	< 0.001	< 0.001
m,p-Xylene	mg/kg	230	< 0.001	< 0.001	< 0.001

Hydrocarbon banding (Red highlights indicate exceedance of GAC value)

Fraction	unit	S4UL	Concentration		
			TP101	TP108	TP125
			0.90	0.50	0.50
Aliphatic					
EC 5 - 6	mg/kg	30	< 0.010	< 0.010	< 0.010
EC >6 - 8	mg/kg	73	< 0.010	< 0.010	< 0.010
EC >8 - 10	mg/kg	19	< 0.10	< 0.10	< 0.10
EC >10 - 12	mg/kg	93	< 0.10	< 0.10	< 0.10
EC >12 - 16	mg/kg	740	< 0.10	< 0.10	< 0.10
EC >16 - 35	mg/kg	45000	< 0.10	< 0.10	30
EC >35 - 44	mg/kg	45000	< 0.10	< 0.10	2.3
Aromatic					
EC 5 - 7 (benzene)	mg/kg	65	< 0.010	< 0.010	< 0.010
EC >7 - 8 (toluene)	mg/kg	120	< 0.010	< 0.010	< 0.010
EC >8 - 10	mg/kg	27	< 0.10	< 0.10	< 0.10
EC >10 - 12	mg/kg	69	< 0.10	< 0.10	< 0.10
EC >12 - 16	mg/kg	140	< 0.10	< 0.10	< 0.10
EC >16 - 21	mg/kg	250	< 0.10	< 0.10	< 0.10
EC >21 - 35	mg/kg	890	< 0.10	< 0.10	14
EC >35 - 44	mg/kg	890	< 0.10	< 0.10	1.4

Notes

S4UL Suitable for Use Level as published by LQM/CIEH

Title	Table number
Comparison of measured concentrations of petroleum hydrocarbons with guideline values.	8

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Summary of leachate test results

Receptor	**Groundwater**		
Water type	**Freshwater**		
Fish type	**Cyprinid**		
Water hardness	**50-100**	**mg/l**	**(Based on information presented on the Drinking Water Inspectorate website)**

Contaminant	Guideline value (µg/l)	Guideline source	Location / Depth (m)	TP102 / 0.20	TP110 / 0.10	TP114 / 0.10	TP125 / 0.50
Inorganics (µg/l)							
Arsenic	50	EQS (f)		2.5	2.7	5.6	1.4
Boron	2000	EQS (f)		< 20	26.0	< 20	< 20
Cadmium	5	EQS (f)		0.1	0.3	0.2	< 0.080
Chromium	175	EQS (f)		2.4	4.5	6.6	< 1.0
Copper	6	EQS (f)		6.3	13.0	13.0	5.7
Lead	125	EQS (f)		6.8	11.0	10.0	1.2
Mercury	1	EQS (f)		< 0.50	< 0.50	< 0.50	< 0.50
Nickel	100	EQS (f)		1.9	4.3	4.2	< 1.0
Selenium[1]	10	UKDWS		< 1.0	< 1.0	< 1.0	< 1.0
Vanadium[2]	20	EQS (f)		6.4	7.6	18.0	2.4
Zinc	175	EQS (f)		5.3	17.0	18.0	1.9
Free Cyanide[1]	50	UKDWS		< 50	< 50	< 50	< 50
Nitrate as N	50000	UKDWS		6500	4800	2400	2000
Sulphate as SO4	400000	EQS(f)		10000	4200	2700	2400
PAH (µg/l)							
Benzo(a)pyrene[1,4]	0.01	UKDWS		< 0.10	< 0.10	< 0.10	< 0.10
Naphthalene[2]	10	EQS (f)		< 0.10	< 0.10	< 0.10	< 0.10
Sum of 4 PAH[1]	0.1	UKDWS		<0.1*	<0.1*	<0.1*	<0.1*

Notes

1 EQS values not available
2 UKDWS not available
3 Lower detectable limit above UKDWS. Concentrations below detectable limits are not considered further.
* Taken as lower detection limit
# Taken as lower detection limit of a single compound

UKDWS UK Drinking Water Standard Guideline taken from "The Water Supply (Water Quality) Regulations 2000"
EQS (f) Environmental Quality Standard for freshwater published by the Environment Agency
EQS (s) Environmental Quality Standard for saltwater published by the Environment Agency

Title	Table number
Comparison of measured concentrations with guideline values for water receptors.	9

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Initial Conceptual Model

Current site use commercial/industrial
Proposed site use residential

Source	Pathway										Receptor		Risk assessment to CIRIA C552	
	Humans						Vegetation	Water					Consequence of risk occurring via most likely pathway	Risk
	Ingestion of air-borne dusts	Ingestion of soil	Ingestion of vegetables and soil attached to vegetables	Inhalation of air-borne dusts	Inhalation of vapours	Dermal contact with soil and dust	Root uptake, deposition to shoots and foliage contact	Percolation of water through contaminated soils	Near-surface water run-off through contaminated soils	Saturation of contaminated soils by flood waters				
Soils														
Made Ground - Inorganic and organic contmainants	Likely	Likely	Unlikely	Likely	Likely	Likely	-	-	-	-	Current site users	Adult	Medium	Moderate
	Likely	Likely	Likely	Likely	Likely	Likely	-	-	-	-	Proposed site users	Child	Medium	Moderate
	Likely	Likely	Unlikely	Likely	Likely	Likely	-	-	-	-	Construction operatives	Adult	Medium	Moderate
	-	-	-	-	-	-	Likely	-	-	-	Vegetation (current and proposed)	-	Mild	Low/moderate
	-	-	-	-	-	-	-	Unlikely	Likely	Unlikely	Water (current and proposed)	-	Mild	Low/moderate

Final Conceptual Model

Current site use commercial/industrial
Proposed site use residential

Source	Pathway										Receptor		Risk assessment to CIRIA C552	
	Humans						Vegetation	Water					Consequence of risk occurring via most likely pathway	Risk
	Ingestion of air-borne dusts	Ingestion of soil	Ingestion of vegetables and soil attached to vegetables	Inhalation of air-borne dusts	Inhalation of vapours	Dermal contact with soil and dust	Root uptake, deposition to shoots and foliage contact	Percolation of water through contaminated soils	Near-surface water run-off through contaminated soils	Saturation of contaminated soils by flood waters				
Soils														
No measured exceedances of inorganic or organic contaminants	Likely	Likely	Unlikely	Likely	Likely	Likely	-	-	-	-	Current site users	Adult	Minor	Low
	Likely	Likely	Likely	Likely	Likely	Likely	-	-	-	-	Proposed site users	Child	Minor	Low
	Likely	Likely	Unlikely	Likely	Likely	Likely	-	-	-	-	Construction operatives	Adult	Minor	Low
	-	-	-	-	-	-	Likely	-	-	-	Vegetation (current and proposed)	-	Minor	Low
	-	-	-	-	-	-	-	Unlikely	Likely	Unlikely	Water (current and proposed)	-	Minor	Low
Leachate														
Elevated leachable concentrations of copper in Topsoil	-	-	-	-	-	-	-	Unlikely	Likely	Unlikely	Water (current and proposed)	-	Mild	Low-moderate

Title	Table number
Conceptual Site Model	1

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Proposed residential development
Land east of Chipping Lane
Longridge, Preston

Ground Investigation Report
(Phase 3)

Ivy Mill Business Centre, Crown Street, Failsworth, Manchester M35 9BG

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Proposed residential development
Phase 3
Land East of Chipping Lane
Longridge
Preston
PR3 2NA

GROUND INVESTIGATION REPORT

Soiltechnics Ltd. Ivy Mill Business Centre, Crown Street, Failsworth, Manchester, M35 9BG
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RAILWAY INDUSTRY SUPPLIER QUALIFICATION SCHEME RISQS AUDITED

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Aerial photograph of site

Approximate Phase 3 site boundaries edged in pink

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Report status and format

Report section	Principal coverage	Report status	
		Revision	Comments
1	Executive summary		
2	Introduction		
3	Desk study information		
4	Chemical contamination		
5	Gaseous contamination		
6	Future investigations		
7	Drawings		

List of drawings

Drawing	Principal coverage	Status	
		Revision	Comments
01	Site location plan		
02	Plan showing existing site features and location and extent of development phases		

List of appendices

Appendix	Content
A	Definitions of geo-environmental terms used in this report
B	Copies of Statutory Undertakers replies
C	Copy of Phase 1 Desk Study report undertaken by Curtins Consulting Ltd
D	Illustrative masterplan showing indicative development layout
E	Copy of correspondence received from Environmental Health
F	Conceptual site model

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1 Executive summary

We recommend the following executive summary is not read in isolation to the main report which follows.

Topic		Summary				Abnormals
Site conditions		The site comprised three open grassed fields separated by mature hedgerows and sporadic trees, positioned on the north-western outskirts of Longridge, Preston. It is understood that the land is currently used by livestock for grazing. Higgin Brook is also recorded along part of the south-western boundary of the site.				
Proposals		We understand the scheme in its entirety will consist of redevelopment as areas of Public Open Space and recreational grounds.				
Investigations		Limited at this stage to collection, presentation and review of desk study information.				
History of the site		Historically the site has remained undeveloped farm land.				
Ground conditions	**Soils (geological sequence)**	**Strata.**	**Typical Soil type**	**Approximate thickness**		
		Alluvium (NW of site only)	Clays and silts	<3m		
		Devensian Till	Clay	>5m		
		Pendleside Sandstone Member	Sandstone with mudstone and siltstones	Up to 50m		
		Bowland Shale Formation	Mudstone, siltstone with sandstones	Up to 200m		
	Groundwater and Geohydrology	**Strata.**	**Aquifer designation**	**Likely permeability**	**Groundwater**	
		Alluvium	Secondary A	Low-moderate	Possibly in basal deposits	
		Devensian Till	Unproductive strata (r)	Low	Unlikely	
		Pendleside Sandstone Member	Secondary A aquifer (r)	Low to moderate	Possibly at depth	
		Bowland Shale Formation	Secondary A and secondary undifferentiated aquifers (r)	Low to moderate	Possibly at depth	
		Site not recorded in a source protection zone (SPZ)				
Land stability		Site levels gently fall to the north-west and thus not considered to be at risk of instability. Site not affected by opencast workings or past mine workings				
Soil classification		N/A				
Possible foundation solution		N/A				
Soakaway feasibility		N/A				
Contamination	**Chemical**	Risks considered low on site and based on adjacent land uses.				
	Gas	Alluvium present in the north-western part of the site may contain organic matter which would provide a source of gasses. Given the nature of the development, site considered at low risk.				
Future investigations		Site considered to pose a low risk of causing harm to identified receptors. Intrusive investigations not considered necessary. As a precaution hardness of water in Higgin Brook should be determined, to enable a more detailed risk assessment to be completed in relation to water receptors				
Statement with respect to NPPF paragraphs 120 and 121		Site not considered to present unacceptable risks from pollution and land instability. Remediation to render the site fit for purpose with respect to chemical/gaseous contamination considered unlikely.				

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2 Introduction

2.1 Objectives

2.1.1 This report describes a ground investigation carried out for the Phase 3 area of a proposed residential development located on land east of Chipping Lane, Longridge, Preston PR3 2NA.

2.1.2 The Phase 3 development of the Chipping Lane site incorporates areas of Public Open Space (POS) and recreational grounds. This report addresses issues relating to the health of identified human receptors and risks to controlled waters from ground conditions at the site.

2.1.3 A Phase 1 Desk Study Assessment has been previously undertaken for the site by Curtins Consulting Ltd (ref EB1355/GL/3692 Revision A dated April 2014). A copy of their report is presented in Appendix L. We understand that we have the benefit of using such information and have provided a summary of the data in Section 3 of this report. This will also form a basis for our interpretative chemical and gaseous contamination assessments presented in Sections 4 and 5 respectively.

2.1.4 The investigation has also been produced to support a planning application for the site (ref 3/2014/0764) by satisfying National Planning Policies Framework sections 120 and 121.

2.2 Client instructions and confidentiality

2.2.1 This report was prepared in June 2016 acting on instructions received from our client Barratt Homes (Manchester).

2.2.2 This report has been prepared for the sole benefit of our above named instructing client, but this report, and its contents, remains the property of Soiltechnics Limited until payment in full of our invoices in connection with production of this report.

2.2.3 Our original investigation proposals were outlined in our correspondence to Barratt Homes of 20th January 2016. The investigation generally followed our original investigation proposals. The investigation process was also determined to maintain as far as possible the original investigation budget costs.

2.3 Site location and scheme proposals

2.3.1 The National Grid reference for the site is 360447, 437970. A plan showing the location of the site is presented on Drawing 01, with the extent of the development phases presented on Drawing 02.

2.3.2 We understand the scheme in its entirety will comprise the construction of up to 363 dwellings within what is termed Phases 1 and 2 (refer to Drawing 02 for details), with associated landscaping, gardens, hardstanding and access roads. This report refers to the Phase 3 area in which areas of POS and recreational grounds are proposed in the northern and eastern areas of the development site.

2.3.3 We have received layout drawings of the proposed scheme with the indicative layout presented in Appendix D.

2.4 Report format and investigation standards

2.4.1 Sections 2 to 3 of this report describe the factual aspects of the investigation with Section 4 providing a risk assessment of likely chemical contamination with section 5 describing a similar risk assessment in relation to gaseous contamination. Section 6 outlines a strategy for any future investigations required to progress the scheme to detailed design and construction.

2.4.2 This report describes both contamination and geotechnical aspects of the site. The desk study process followed the principles of BS10175: 2011 *'Investigation of potentially Contaminated Sites – Code of Practice'* and limited to a preliminary investigation as described in this document.

2.4.3 The extent and result of the preliminary investigation (desk study) undertaken by Curtins Consulting Ltd, in addition to site reconnaissance undertaken by Soiltechnics Ltd, is reported in Section 3.

2.5 Status of this report

2.5.1 This report is final based on our current instructions.

2.5.2 This investigation has been carried out and reported based on our understanding of best practice. Improved practices, technology, new information and changes in legislation may necessitate an alteration to the report in whole or part after publication. Hence, should the development commence after expiry of one year from the publication date of this report then we would recommend the report be referred back to Soiltechnics for reassessment. Equally, if the nature of the development changes, Soiltechnics should be advised and a reassessment carried out if considered appropriate.

2.6 Report distribution

2.6.1 This report has been prepared to assist in the design and planning process of the development and normally will require distribution to the following parties, although this list may not be exhaustive:

Table summarising parties likely to require information contained in this report

Party	Reason
Client	For information/reference and cost planning.
Developer/Contractor/project manager	To ensure procedures are implemented, programmed and costed.
Planning department	Potentially to discharge planning conditions.
Environment Agency	If ground controlled waters are affected and obtain approvals to any remediation strategies.
Independent inspectors such as Building Control	To ensure procedures are implemented and compliance with building regulations.
Project design team	To progress the design.
Principal Designer (PD)	To advise in construction risk identification and management under the Construction (Design and Management) Regulations.

Table 2.6

3 Desk study information and site observations

3.1 General

3.1.1 A Phase 1 Detailed Desk Top Study has been previously undertaken for the site by Curtins Consulting Ltd (reference EB1355/GL/3692, revision A, issue 01, dated 14th April 2014). A copy of their report is presented in Appendix C. We understand that we have the benefit of using such information and have provided a summary of the data in following paragraphs, together with our own site observations. It should be noted that we have tailored the information to suite the current site boundary for the Phase 3 development area, which is shown in a slightly different position in the Curtins report.

3.2 Description of the site

3.2.1 The site is positioned on the north-western outskirts of Longridge, Preston, at an elevation of between approximately 101m and 122m AOD and with the topography of the site falling in a north-westerly direction. The site comprised of three open grassed fields separated by hedgerows and trees between approximately 2m and 15m in height. Localised ponding of surface water was evident, with two small ponds present along the eastern boundary of the most north-westerly located parcel of land. Higgin Brook is also recorded along part of the south-western boundary of this parcel of land, flowing in a north-westerly direction and culverted beyond the location of the adjacent cricket pavilion.

3.2.2 The site was bound to the north and east by further open grassed fields. Chipping Lane, further fields and a cricket pitch were located to the west. The grassed fields which form the Phase 1 and Phase 2 development areas are present to the south, with residential housing and Willows Farm present to the south-east.

3.2.3 A plan showing existing site features and location of exploratory points is presented as Drawing 02.

3.3 Injurious and invasive weeds and asbestos

3.3.1 Injurious and invasive weeds

3.3.1.1 The following weeds are controlled under the Weeds Act 1959:

- Common ragwort
- Spear thistle
- Creeping (or field) thistle
- Broad-leaved dock
- Curled dock

3.3.1.2 Whilst it is not an offence to have the above weeds growing on your land, you must:

- Stop them spreading to agricultural land, particularly grazing areas or land used for forage, like silage and hay
- Choose the most appropriate control method for the your site
- Not plant them in the wild

3.3.1.3 Should you allow the spread of these weeds to another parties land, Natural England could serve you with an Enforcement Notice. You can also be prosecuted if you allow animals to suffer by eating these weeds.

3.3.1.4 In addition to the above, you must not plant in the wild or cause certain invasive and non-native plants to grow in the wild as outlined in the Wildlife and Countryside Act 1981. It is an offence under section 14(2) of the act to *'plant or otherwise cause to grow in the wild'* any plants listed in schedule 9, part II. This can include moving contaminated soil or plant cuttings. The offence carries a fine or custodial sentence of up to two years. The most commonly found invasive, non-native plants include:

- Japanese knotweed
- Giant hogweed
- Himalayan balsam
- Rhododendron ponticum
- New Zealand pigmyweed

3.3.1.5 You are not legally obliged to remove these plants or to control them. However, if you allow Japanese knotweed to spread to another party's land, you could be prosecuted for causing a private nuisance.

3.3.1.6 The presence of such weeds on site may have considerable effects on the cost/ timescale in developing the site. Japanese knotweed can cause significant damage to buildings, roads and pavements following development, if untreated prior to development.

3.3.1.7 Our investigations exclude surveys to identify the presence of injurious and invasive weeds. We did not observe any obvious evidence the above species; however, we recommend specialists in the identification and procedures to deal with injurious and invasive weeds are appointed prior to commencement of any works on site.

3.3.2 Asbestos

3.3.2.1 Our investigations exclude surveys to identify the presence or absence of asbestos on site. It should be noted, however, that where intrusive investigations were undertaken we did not observe any obvious evidence of potential asbestos containing materials. This information does not constitute a site-specific risk assessment and we recommend specialists in the identification and control/disposal of asbestos are appointed prior to commencement of any works on site.

3.3.2.2 The presence of asbestos on site may have considerable effects on the cost/timescale in developing the site. There is good guidance in relation to asbestos available on the Health and Safety Executive (HSE) website.

3.4 History of the site

3.4.1 The recent pertinent history of the site, updated from the Curtins summary to reflect the current site boundary, is presented in the following table:

Summary description of site history

Date	On site	Off site
1847	Open fields including a number of small ponds and marshy areas.	Surrounding land predominantly agricultural. Quarrying works recorded between 500m and 1000m east of the site.
1893 to 1914	No significant change	Pitt Street Mills (Corn & Bone) and a smithy are some 300m to the south. An iron and brass foundry present 350m to the south-west of the site. Victoria Mill and gasometer present 100m to south-eastern boundary. Tan Yard 500m to the south-east.
1932 to 1956	No significant change	The Pitt Street Mills (Corn & Bone) and smithy buildings recorded as a Bobbin works. Tank recorded at Willow Farm to the south-east of the site.
1961 to 1967	No significant change	The Bobbin works is no longer recorded and the site has been redeveloped as Ashley Dairy. Some residential development has also occurred to the south and west.
1968 to 1975	No significant change	The iron and brass foundry was labelled as a works. Significant development is occurring to the south of the site (Longridge).
1975 to 1996	No significant change	No significant changes
2001 to 2013	No significant change	Ashley Dairy has been redeveloped as a superstore.

Table 3.4.1

3.5 Geology and geohydrology of the area

3.5.1 Geology of the area

3.5.1.1 The geology of the area, updated from the Curtins summary to reflect the current site boundary, is presented in the following table:

Summary of geology and likely aquifer-containing strata

Stratum	Bedrock or superficial	Approximate thickness	Typical soil type	Likely permeability	Aquifer designation
Alluvium (north-western part of site)	Superficial	<3m	Clay, silt, sand	Low to moderate	Secondary A aquifer (r)
Devensian Till	Superficial	>5m	Clay with silt and sand	Low	Unproductive strata (r)
Pendleside Sandstone Member	Bedrock	Up to 50m	Sandstone with mudstone and siltstones	Low to moderate	Secondary A aquifer (r)
Bowland Shale Formation	Bedrock	Up to 200m	Mudstone, siltstone with sandstones	Low to moderate	Secondary A and secondary undifferentiated aquifers (r)

Table 3.5.1

(r) recorded aquifer designation
(a) assumed aquifer designation

3.5.1.2 Unproductive strata are defined as deposits exhibiting low permeability with negligible significance for water supply or river base flow. Unproductive strata are generally regarded as not containing groundwater in exploitable quantities.

3.5.1.3 Secondary A aquifers are predominantly permeable layers capable of supporting water supplies at a local, rather than strategic, scale. In some cases, Secondary A aquifers can form an important source of base flow to rivers.

3.5.1.4 Secondary undifferentiated aquifer is a designation used when it is not possible to attribute fully one of either Secondary A or Secondary B, due to the variable nature of the soils. The unit will therefore be a mix of both, which are defined as follows:

- Secondary A can be defined as: Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.
- Secondary B can be defined as: layers which may store limited amounts of ground water. These groundwater stores are generally the water bearing parts of former aquifers.

3.5.2 Water abstractions

3.5.2.1 There are no potable groundwater abstraction licences within 2km of the site. The only surface water abstraction within a 2km radius of the site is associated with field drains located approximately 450m to the south of the site. Details of the water's use are not supplied.

3.5.2.2 There are two groundwater abstractions within a 2km radius of the site. They are both associated with Singletons Dairy (Mill Farm, Preston) and are located approximately 900m and 1km to the south of the site. The abstracted water is used for general purposes.

3.5.2.3 The site is not located within a zone protecting a potable water supply abstracting from a principal aquifer (i.e. a source protection zone).

3.5.3 Coal mining and brine extraction

3.5.3.1 The site is not recorded to be within an area affected by past or present coal mining, minerals worked in association with coal, or brine extraction (within the Cheshire Brine Compensation District). The site does not lie within a coal mining referral area and, as such, a Coal Authority report is not required.

3.5.4 Shallow mining and natural subsidence hazards

3.5.4.1 The British Geological Survey presents hazard ratings for shallow mining and natural subsidence hazards. The site has the following ratings:

Table summarising mining and subsidence hazards

Hazard	Rating
Mining hazard in non-coal mining areas	Highly unlikely
Potential for collapsible ground stability hazard	Very low / no hazard
Potential for compressible ground stability hazard	Moderate / no hazard
Potential for ground dissolution stability hazard	Low / very low
Potential for landslide ground stability hazard	Very low
Potential for running sand ground stability hazard	Low / very low
Potential for shrinking or swelling clay ground stability hazard	Very low

Table 3.5.4

3.5.4.2 The moderate potential for compressible ground stability hazards is likely to be associated with the deposits of Alluvium recorded in northern-western most parcel of land at the site.

3.5.5 Borehole records

3.5.5.1 The British Geological Survey (BGS) retains records of boreholes formed from ground investigations carried out on a nationwide basis. However, there are no BGS borehole records in the vicinity of the site.

3.6 Landfill and infilled ground

3.6.1 Within a 2km radius of the site, there are no BGS recorded or historical landfill sites; however, there are two registered landfill sites. Lords Delph (Forty Acre Lane, Longridge) is located approximately 500m to the east of the site and has been accepting non-biodegradable waste since at least 1982. Chapel Hill Quarry is located approximately 900m to the south of the site and accepted non-biodegradable waste; in 1992, the site was recorded as dormant.

3.6.2 In addition, we have reviewed old Ordnance Survey maps and there is no obvious evidence of significant quarrying in the area, other than a small number of BGS mineral sites, recorded between 250m and 700m of the subject site which exploited the underlying clays and grits. The geological map of the area indicates areas of infilled ground which approximately coincide with such areas.

3.7 Radon

3.7.1 Envirocheck uses the British Geological Survey database to review reported radon levels in the area in which the site is located, to establish recommended radon protection levels for new dwellings. The database presented in the Curtins report indicates that the site is located in an area where no protection is considered necessary.

3.7.2 Building Research Establishment (BRE) publication BR211 '*Radon: guidance on protective measures for new buildings*' (2007) applies to all new buildings, conversions and refurbishments, whether they be for domestic or non-domestic use.

3.7.3 It is noteworthy that the BRE information is based on statistical analysis of measurements made in dwellings, in combination with geological units which are known to emit radon. Therefore there is a risk that actual radon levels at the site will exceed the levels assessed by the BRE. Currently, the only true method of checking actual radon levels is by measurement within a building on the site over a period of several months. It should be noted that it is not currently a requirement of the Building Regulations to test new buildings for radon; however, the BRE recommends testing on completion or occupation of all new buildings (domestic and non-domestic), extensions and conversions. Should you wish to undertake radon monitoring following completion of the development, we can provide proposals.

3.8 Flood risk

3.8.1 Based on the information provided within the Curtins report, the site is not located within a fluvial or tidal flood plain. It should be noted that this information does not constitute a site-specific Flood Risk Assessment (FRA) and that a full FRA may be required for the development to support a planning application or to satisfy planning conditions.

3.9 Enquiries with Statutory Undertakers

3.9.1 We have been provided with the following Statutory Undertaker (SU) records in order to avoid damaging their apparatus during our fieldwork activities:

a) BT Openreach
b) Electricity North West
c) ESP Utilities Group
d) National Grid Gas
e) United Utilities

3.9.2 Copies of these records are presented in Appendix B. These records have been obtained solely for the purposes described above.

3.9.3 Normally Statutory Undertakers' drawings record the approximate location of their services. We recommend further on-site investigations be undertaken to confirm the position of the apparatus and thus establish the effect on the proposed development and the necessity or otherwise for the permanent or temporary diversion of the service to allow the construction of the development to safely and successfully proceed.

3.9.4 It should be noted that Statutory Undertakers' records normally exclude private services.

3.10 Enquiries with Environmental Health Officers

3.10.1 We have contacted the Local Authority Environmental Health Officer, who has confirmed that no gas monitoring is required on this site, due to the limited number of sources and pathways in the area (refer to Section 5 for further details). A copy of their correspondence is presented in Appendix E.

4 Chemical contamination

4.1 Contaminated land, regulation and liabilities

4.1.1 Statute

4.1.1.1 Part IIA of the Environment Protection Act 1990 became statute in April 2000. The principal feature of this legislation is that the hazards associated with contaminated land should be evaluated in the context of a site-specific risk based framework. More specifically contaminated land is defined as:

"any land which appears to the Local Authority in whose area it is situated to be in such a condition, by reasons of substances in, on or under the land, that:

a) Significant harm is being caused or there is a significant possibility of such harm being caused; or
b) Pollution of controlled waters is being or is likely to be caused".

4.1.1.2 Central to the investigation of contaminated land and the assessment of risks posed by this land is that:

i) There must be contaminant(s) at concentrations capable of causing health effects (*Sources).*
ii) There must be a human or environmental receptor present, or one which makes use of the site periodically *(Receptor)*; and
iii) There must be an exposure pathway by which the receptor comes into contact with the environmental contaminant *(Pathway).*

4.1.1.3 In most cases the Act is regulated by Borough or District Councils and their role is as follows:

i) Inspect their area to identify contaminated land
ii) Establish responsibilities for remediation of the land
iii) See that appropriate remediation takes place through agreement with those responsible, or if not possible:
   - by serving a remediation notice, or
   - in certain cases carrying out the works themselves, or
   - in certain cases by other powers
iv) keep a public register detailing the regulatory action which they have taken

4.1.1.4 For "special" sites the Environment Agency will take over from the Council as regulator. Special sites typically include:

- Contaminated land which affects controlled water and their quality
- Oil refineries
- Nuclear sites
- Waste management sites

4.1.2 Liabilities under the Act

4.1.2.1 Liability for remediation of contaminated land would be assigned to persons, organisations or businesses if they caused, or knowingly permitted contamination, or if they own or occupy contaminated land in a case where no polluter can be found.

4.1.3 Relevance to predevelopment conditions

4.1.3.1 For current use, Part IIA of the Environmental Protection Act 1990 provides the regulatory regime. The presence of harmful chemicals could provide a 'source' in a 'pollutant linkage' allowing the regulator (Local Authority or Environment Agency) to determine if there is a significant possibility of harm being caused to humans, buildings or the environment. Under such circumstances the regulator would determine the land as 'contaminated' under the provision of the Act requiring the remediation process to be implemented.

4.1.4 Relevance to planned development

4.1.4.1 The developer is responsible for determining whether land is suitable for a particular development or can be made so by remedial action. In particular, the developer should carry out an adequate investigation to inform a risk assessment to determine:

a) Whether the land in question is already affected by contamination through source – pathway – receptor pollutant linkages and how those linkages are represented in a conceptual model.
b) Whether the development proposed will create new linkages e.g. new pathways by which existing contaminants might reach existing or proposed receptors and whether it will introduce new vulnerable receptors, and

c) What action is needed to break those linkages and avoid new ones, deal with any unacceptable risks and enable safe development and future occupancy of the site and neighbouring land?

4.1.4.2 Building control bodies enforce compliance with the Building Regulations. Practical guidance is provided in Approved documents, one of which is Part C, *'Site preparation and resistance to contaminants and moisture'* which seeks to protect the health, safety and welfare of people in and around buildings, and includes requirements for protection against harm from chemical contaminants.

4.1.5 Pollution of controlled waters

4.1.5.1 Part IIA of the Environment Protection Act 1990, defines pollution of controlled waters as

'The entry into controlled waters of any poisonous, noxious or polluting matter or any solid waste matter'

4.1.5.2 Paragraphs A36 and A39 of statutory guidance (DETR 2000) further define the basis on which land may be determined to be contaminated land on the basis of pollution of controlled waters.

'Before determining that pollution of controlled waters is being, or likely to be, caused, the Local Authority should be satisfied that a substance is continuing to enter controlled waters, or is likely to enter controlled waters. For this purpose, the local authority should regard something as being likely when they judge it more likely than not to occur'

'Land should not be designated as contaminated land where:

a) A substance is already present in controlled waters:
b) Entry into controlled waters of that substance from the land has ceased, and
c) It is not likely that further entry will take place.

Substances should be regarded as having entered controlled waters where:

a) They are dissolved or suspended in those waters; or
b) If they are immiscible with water, they have direct contact with those waters, or beneath the surface of the waters'

4.1.5.3 Controlled waters are defined in statute to be:

'territorial waters which extend seawards for 3 miles, coastal waters, inland freshwaters, that is to say, the waters in any relevant lake or pond or of so much of any relevant river or watercourse as is above the freshwater limit, and groundwaters, that is to say, any waters contained in underground strata.'

4.1.6 Further information

4.1.6.1 The above provides a brief outline as regards current statute and planning controls. Further information can be obtained from the Department for the Environment, Food and Rural Affairs (DEFRA) and their website www.defra.gov.uk.

4.2 Objectives and procedures

4.2.1 Objectives

4.2.1.1 This report section discusses investigations carried out with respect to chemical contamination issues relating to the site. The investigations were carried out to determine if there are any liabilities with respect to Part IIA of the Environmental Protection Act. As stated in Section 2.4.2, the investigation process followed the principles of BS10175: 2011 *'Investigation of potentially contaminated sites – Code of Practice',* but limited to a desk study (preliminary investigation)

4.2.1.2 This section of the report produces *'Conceptual models'* based on investigatory data obtained to date. The conceptual model is constructed by identification of *contaminants* and establishment of feasible *pathways* and *receptors.* The conceptual model allows a *risk assessment* to be derived. Depending upon the outcome of the risk assessment it may be necessary to carry out remediation and/or further investigations with a view to eliminating, reducing or refining the risk of harm being caused to identified receptors. If appropriate, our report will provide recommendations in this respect.

4.2.1.3 Clearly we must consider the current pre-development condition, establishing risks which may require action to render the site safe to all relevant (current) receptors meeting the requirements of current legislation (Part IIA of the Environmental Protection Act 1990).

4.2.1.4 Definition of terms used in the preceding paragraph and subsequent parts of this section of the report are presented in Appendix A.

4.2.2 Procedure to assess risks of chemical contamination

4.2.2.1 For the purposes of presenting this section of this report, we have adopted the following sequence in assessing risks associated with chemical contamination.

Table outlining sequence to assess risk associated with chemical contamination

Conceptual model element	Contributory information	Outcome
Receptor	Development categorisation	Identification of receptors at risk of being harmed Method of analysing test data Criteria for risk assessment modelling
Pathways	Geology and ground conditions Development proposals	Identification of critical pathways from source to receptor
Source	Previous site history Desk study information Site reconnaissance Fieldwork observations	Testing regime Identification of a chemical source Analysis of test data and other evidence

Table 4.2.2

4.2.2.2 We have adopted, in general, the procedures described in CIRIA C552 *'Contaminated land risk assessment - a guide to good practice'* in deriving a risk assessment. Initially we have carried out a 'phase 1 assessment' based on desk study information and site reconnaissance, to produce an initial conceptual model and thus a preliminary risk assessment. This model / assessment is then used to target any future fieldwork activities and laboratory testing that is recommended, ultimately allowing the conceptual model to be updated and risk assessments to be refined.

4.3 Development characterisation and identified receptors

4.3.1 Site characterisation

4.3.1.1 The nature of the site has a significant influence the likely exposure pathways between potentially contaminated soils and potential receptors. The following table summarises elements which characterise the site based on site observations and desk study information.

Summary of site characteristics		
Element	**Source/criteria**	**Characteristic**
Current land use	Observations	Site currently in use as grazing land for livestock. Not accessible to the general public.
Future land use	Advice	Developed as POS and recreational grounds
Site history	Desk study	Recorded as fields from earliest maps.
Geology	Desk study	Alluvium overlying overlying >5m thickness of Devensian Till deposits with Bowland Shale Formation/Pendleside Sandstone Member at depth.
Ground water	Aquifer potential	Alluvium recorded as a Secondary A aquifer. Devensian Till deposits recorded as unproductive strata. Underlying Bowland Shale recorded as a Secondary A and secondary undifferentiated aquifers (r), with Pendleside Sandstone recorded as Secondary A.
	Abstractions	There are no potable water abstractions within 1000m of the site. There are two groundwater abstractions within 1000m of the site, the nearest associated with Mill Farm borehole located 900m south of the site.
	Source protection zone	Site not recorded in source protection zone (SPZ).
Surface waters	Location	The nearest surface water feature is a tertiary river (Higgin Brook) which flows in a north-westerly direction along the south-western boundary of the site.
	Abstractions	There is one surface water abstraction within 1000m of the site located 450m south-east associated with a field drain located in Lyndhurst, Longridge.
Table 4.3.1		

4.3.2 Identified receptors

4.3.2.1 The principal receptors subject to harm caused by any contamination of the proposed development site are as follows.

Principle Receptor	Detail
Humans	Users of the current site
	End user of the developed site
	Construction operatives and other site investigators
Vegetation	Plants and trees, both before and after development
Controlled waters	Surface waters (Rivers, streams, ponds and above ground reservoirs)
	Ground waters (used for abstraction or feeding rivers/streams etc.)
Table 4.3.2	

4.3.2.2 This section of the report assesses those receptors listed above.

4.3.3 Human receptors

4.3.3.1 The Contaminated Land Exposure Assessment (CLEA) model can be used to derive guideline values, against which land quality data can be compared to allow an assessment of the likely impacts of soil contamination on humans. The parameters used within the model can be chosen to allow guideline values to be derived for a variety of land uses and exposure pathways. For example, a construction worker is likely to be exposed in different ways and for different durations than an adult in a residential setting.

4.3.3.2 On the basis that the existing site is restricted to agricultural activities the adult is considered an appropriate current receptor. Following completion of the residential development the critical site user (receptor) is considered to be a child under the age of 6 years. These criteria have been used in the conceptual model for the current and future site use. Our assessment also considers construction operatives as adult receptors.

4.3.4 Vegetation receptors

4.3.4.1 Soil contaminants can have an adverse effect on plants if they are present at sufficient concentrations. The effects of phytotoxic contaminations include growth inhibition, interference with natural processes within the plant and nutrient deficiencies.

4.3.4.2 Vegetation is currently present at the site and will remain so following development, in addition to further vegetation proposed as part of the new development. We have therefore considered vegetation a viable receptor.

4.3.5 Water receptors

4.3.5.1 The near surface Alluvium deposits are recorded as a Secondary A aquifer. The underlying Devensian Till deposits are recorded as unproductive strata and are known to extend to depths beyond 3.2m within the Phase 1 and Phase 2 development areas. The underlying Bowland Shale Formation is recorded as a Secondary A aquifer. The site is not recorded in a source protection zone. Based on the above, given the relatively small and confined nature of the area of Alluvium recorded at the site and adjacent to the north, in addition to the thickness of Devensian Till, groundwater is not considered a viable receptor. The nearest watercourse to the site is Higgin Brook, which flows along the south-western site boundary. On this basis, surface water is considered to be a viable receptor.

4.3.6 Summary of identified receptors

4.3.6.1 Based on the above assessments, the following table summarises identified and critical receptors.

Table summarising identified (viable) receptors				
Principle Receptor	**Detail**	**Viable and critical receptors**		
		Viability and justification		**Critical receptor**
Humans	Users of the current site	Yes	Grazing land	Adult
	End user of the developed site	Yes	POS and recreational land	Child
	Construction operatives and other site investigators	Yes		Adult
Vegetation	Current site	Yes	Trees on site	Vegetation
	Developed site	Yes	Trees to remain	Vegetation
Controlled waters	Surface waters (Rivers, streams, ponds and above ground reservoirs)	Yes	Higgin Brook along site boundary	Surface waters
	Ground waters (used for abstraction or feeding rivers/ streams etc.)	No	Unlikely to be present (impermeable)	Groundwater

Table 4.3.6

4.4 Identification of pathways

4.4.1 Pathways to human receptors

4.4.1.1 Guidance published by the Environment Agency in Science Report SC050021/SR3 *'Updated technical background to the CLEA model'* provides a detailed assessment of pathways and assessment and human exposure rates to source contaminants. In summary, there are three principal pathway groups for a human receptor:

Table summarising likely pathways	
Principal pathways	**Detail**
Ingestion through the mouth	Ingestion of air-borne dusts
	Ingestion of soil
	Ingestion of soil attached to vegetables
	Ingestion of home grown vegetables
Inhalation through the nose and mouth.	Inhalation of air-borne dusts
	Inhalation of vapours
Absorption through the skin.	Dermal contact with dust
	Dermal contact with soil

Table 4.4.1

4.4.1.2 The site currently comprises open fields surfaced in grass and used for grazing livestock. It is understood that this has been the principal site use for much of the sites history, if not all. Based on such we have considered all the above pathways would be present for current users with the exception of those associated with the consumption of vegetables.

4.4.1.3 Following redevelopment the site will comprise areas of POS and recreational grounds. Based on such, again all of the above pathways with the exception of those associated with the consumption of vegetables will be considered. A summary of our pathway assessment is presented in Section 4.4.4.

4.4.2 Pathways to vegetation

4.4.2.1 Guidance published by the Environment Agency in Science Report SC050021/SR (Evaluation of models for predicting plant uptake of chemicals from soil) provides a detailed assessment of plant uptake pathways. In summary, plants are exposed to contaminants in soils by the following pathways:

- Passive and active uptake by roots.
- Gaseous and particulate deposition to above ground shoots.
- Direct contact between soils and plant tissue.

4.4.2.2 All of the above routes of exposure are considered to be present for vegetation.

4.4.3 Pathways to controlled waters

4.4.3.1 A number of pathways exist for the transport of soil contamination to controlled waters. A summary of these pathways is presented below:

- Percolation of water through contaminated soils
- Near-surface water run-off through contaminated soils
- Saturation of contaminated soils by flood waters

4.4.3.2 Near surface soils in the Phase 1 and Phase 2 development areas comprised cohesive Devensian Till deposits which are considered impermeable and extend to depths beyond 3.2m at the sites. Whilst deposits of Alluvium are recorded in the north-western part of the site, which may exhibit a degree of permeability, they are not considered to be laterally extensive and unlikely to provide a source of groundwater worthy of abstraction. The clay soils of the Till will also severely restrict the percolation of surface water into the underlying aquifer of the Bowland Shale Formation, therefore, pathways associated with percolation of surface water will not be considered further.

4.4.3.3 Based on the permeability of near surface Devensian Till deposits, in our opinion such soils are considered amenable to promoting significant amounts of near surface water run off through contaminated soils.

4.4.3.4 The site is not recorded within a fluvial flood plain and as such saturation of contaminated soils by flood waters is unlikely to occur.

4.4.4 Summary of identified likely pathways

4.4.4.1 Based on the above assessments, the following table summarises likely pathways of potential chemical contaminants at the site to identified receptors.

Table of likely pathways		
Receptor group	**Critical receptor**	**Pathway**
Proposed site users	Child	Ingestion of air-borne dusts
		Ingestion of soil
		Inhalation air-borne dusts
		Inhalation of vapours
		Dermal contact with dust
		Dermal contact with soil
Current site users and construction operatives	Adult	Ingestion of air-borne dusts
		Ingestion of soil
		Inhalation of air-borne dusts
		Inhalation of vapours
		Dermal contact with dust
		Dermal contact with soil
Vegetation		Root uptake, deposition to shoots and foliage contact
Groundwater	Surface water	Near-surface water run-off through contaminated soils
Table 4.4.4		

4.5 Assessment of sources of chemical contamination

4.5.1 Introduction

4.5.1.1 Initially, potential sources of contamination are assessed using the following elements of the investigation process.

- History of the site
- Desk study information
- Site reconnaissance
- Geology
- Fieldwork

4.5.1.2 These elements will dictate a relevant soil/water testing regime to quantify possible risks of any identified contaminative sources which may harm identified receptors.

4.5.2 Source assessment – History of the site

4.5.2.1 The history of the site and its immediate surroundings based on published Ordnance Survey maps is described in Section 3.

4.5.2.2 Based on published historical maps, there is no evidence to indicate the site has been subject to activities which could produce a source of chemical contamination. Records indicate that land uses in areas surrounding the site to the west, south and east consisted of mills, unclassified works, a garage, dairy and foundry. Due to the distance from the site and the relatively impermeable geology, in our opinion, there is unlikely to be a significant risk of contamination migrating from these potential sources to the subject site.

4.5.3 Source assessment – Desk study information

4.5.3.1 Envirocheck presents a detailed database of environmental information in relation to the site including;

- Pollution incidents
- Landfill sites
- Trading activities

4.5.3.2 Pollution incidents

4.5.3.2.1 Envirocheck report a number of pollution incidents to controlled waters within 2000m of the site, the closest of which are recorded some 200m to the north-west and 220m to the south-west. The incident to the north-west is dated 1994 and classified as a Category 3 minor incident, with silage liquor affecting Higgin Brook. The incident to the south-west is dated 1996 and associated with the release of inert materials and light oils and is classified as a Category 3 minor incident. Given the distances from the site and the type and severity of the incidents they are considered unlikely to have impacted the site.

4.5.3.3 Landfill sites

4.5.3.3.1 Envirocheck reports within 2km radius of the site, there are no BGS recorded or historical landfill sites; however, there are two registered landfill sites. Lords Delph (Forty Acre Lane, Longridge) is located approximately 500m to the east of the site and has been accepting non-biodegradable waste since at least 1982. Chapel Hill Quarry is located approximately 900m to the south of the site and accepted non-biodegradable waste; in 1992, the site was recorded as dormant.

4.5.3.3.2 In addition, we have reviewed old Ordnance Survey maps and there are a small number of quarries recorded between 250m and 700m from the subject site, predominantly to the east, exploiting the underlying clays and grits.

4.5.3.3.3 Based on the above, due to the distance, the risk of any chemical contamination associated with landfill sites and restored mineral sites in the area, migrating and impacting identified receptors at the site, is considered low.

4.5.4 Source assessment – Site reconnaissance

4.5.4.1 A full description of the site and observed adjacent land uses is provided in Section 3 of this report. A plan summarising observations made on site during our site reconnaissance visit is presented on Drawing 02.

4.5.4.2 We did not observe any obvious evidence of any current or recent activities on site which provide a potential source of chemical contamination.

4.5.5 Source assessment – Geology

4.5.5.1 The geological map of the area indicates the topography local to the site is formed in deposits of Alluvium, Devensian Till, Bowland Shale Formation and Pendleside Sandstone Formation. Typically, and in our experience, such deposits do not exhibit any abnormal concentrations of naturally occurring chemical contaminants.

4.5.7 Source assessment - summary

4.5.7.1 Based on the paragraphs above, we have identified the following potential sources of contamination:

Table summarising results of source assessment

Source	Origin of information	Possible contaminant	Probability of risk occurring	Likely extent of contamination
On site				
Historic land uses in local area	Desk study	Metals, PAHs, TPHs	Unlikely	N/A
Pollution incidents in local area	Desk study	Metals, PAHs, TPHs, organic pathogens/ bacteria	Unlikely	N/A
Landfills/ restored quarries	Desk study	Metals, PAHs, TPHs	Unlikely	N/A

Table reference 4.5.7

4.6 Initial Conceptual Model

4.6.1 Based on our assessment of potential contaminative sources, identified receptors and viable pathways to receptors described in preceding paragraphs, we have produced an initial conceptual model in the form of a table which is presented in Appendix F.

4.6.2 Based on the conceptual model the initial assessment of risk of chemical contamination causing harm to identified receptors does not exceed the low category, but this is solely based on desk study information. Clearly investigations are required to quantify and refine risks, but at this stage significant remediation is considered unlikely.

4.6.3 Based on laboratory testing of near surface soils within the areas of the Phase 1 and Phase 2 developments, concentrations of chemical contaminants tested were recorded below relevant guideline values for both current and proposed land uses. Typically Topsoil deposits were encountered, with very localised areas of Made Ground.

4.6.4 Near surface soils in the Phase 3 development area are highly likely to consist of Topsoil overlaying naturally deposited soils, and based on such, we consider it unlikely that such soils will be artificially contaminated in respect of human receptors.

4.6.5 Laboratory testing did, however, identify elevated concentrations of leachable copper in some samples of Topsoil tested, likely to be attributed to the use of copper based fertilisers in agriculture. The EQS values used in the assessment are largely dictated by the hardness of the receiving watercourse and fairly conservative values for hardness were adopted for the site based on readily available groundwater data. It is likely that if water was tested within Higgin Brook (receiving surface watercourse) that hardness values would be higher than those adopted (>200mg/l rather than <100mg/l) which would have the effect of increasing the EQS value of copper from 6µg/l to 28µg/l. If this were to be the case then the concentrations of leachable copper measured in Topsoil deposits in the development areas of Phase 1 and Phase 2 would fall below the guideline value for the site.

4.6.6 Based on the above, whilst there is the potential for leachable copper to also exist in Topsoil at the site, we are of the opinion that the concentrations are unlikely to have an adverse effect on surface waters in the area.

4.6.7 As a precaution, we recommended in the previous investigations that surface waters within Higgin Brook are tested to determine site specific values of hardness which will enable a more detailed risk assessment to be completed.

4.7 Actions

4.7.1 Based on the above our sole recommendations are as follows:-

- Hardness values within surface waters of Higgin Brook are determined, as recommended in our reports for the Phase 1 and Phase 2 redevelopment areas to the south, to enable a more detailed risk assessment to be completed in relation to water receptors
- Construction operatives adopt adequate hygiene precautions

4.7.2 We also recommend that ground workers/construction operatives are vigilant during excavations onsite, and any noticeable change in ground conditions should be assessed and investigated if necessary.

4.8 Risk assessment summary and recommendations

4.8.1 Based on our assessments described above, we can provide the following summary and recommendations for each identified receptor.

4.8.2 Current and proposed site users

4.8.2.1 As no source of significant chemical contamination has been identified on site, we are of the opinion that the site represents a very low risk of causing harm to the health of identified current users of the site.

4.8.3 Construction operatives and other site investigators

4.8.3.1 The risk of damage to health of construction operatives and other site investigators is, in our opinion, low. As a precautionary approach, however, we recommend adequate hygiene precautions are adopted on site. Such precautions would be:-

- Wearing protective clothing particularly gloves to minimise ingestion from soil contaminated hands.
- Avoiding dust by dampening the soils during the works.
- Wearing masks if processing produce dust.

4.8.3.2 Guidance on safe working practices can be obtained from the following documents

- The Health and Safety Executive Publication *"Protection of Workers and the General Public during the Development of Contaminated Land"* (HMSO) and
- *"A Guide to Safer Working on Contaminated Sites"* (CIRIA Report 132).

4.8.3.3 In addition, reference should be made to the Health and Safety Executive. In all cases work shall be undertaken following the requirements of the Health and Safety at Work Act 1974 and regulations made under the Act including the COSHH regulations.

4.8.4 Controlled waters

4.8.4.1 Based on the above, and on laboratory results for Phases 1 and 2, we are of the opinion that the site potentially represents a low-moderate risk of causing harm to water receptors. As a precaution we recommend that values of hardness are determined in surface waters of Higgin Brook to enable a more detailed risk assessment to be undertaken in relation to concentrations of leachable copper.

4.8.5 Vegetation

4.8.5.1 As no source of significant chemical contamination has been identified on site, we are of the opinion that the site represents a low risk of causing harm to vegetation.

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4.9 Statement with respect to National Planning Policy Framework

4.9.1 Based on investigations completed to date with respect to chemical contamination, providing the recommendations as outlined above are completed, we are of the opinion that the proposed development will be safe and suitable for use for the purpose for which it is intended, thus meeting the requirements of the National Planning Policy Framework section 121, and compliant with the Building Regulations Part C, '*Site preparation and resistance to contaminants and moisture*'.

5 Gaseous contamination

5.1 Legislative framework

5.1.1 There is currently a complex mix of documentation relating to legislative and regulatory procedures on the issue of contamination and it is not considered a purpose of this report to discuss the detail of these regulations. Essentially, Government Policy is based on *'suitable for use approach',* which is relevant to both the current and proposed future use of land. For current use Part IIA of the Environmental Protection Act 1990 provides the regulatory regime (see Section 8.1). The presence of harmful soil gases could provide a 'source' in a 'pollutant linkage' allowing the regulator (Local Authority) to determine if there is a significant possibility of harm being caused to humans, buildings or the environment. Under such circumstances the regulator would determine the land as 'contaminated' under the provision of the Act requiring the remediation process to be implemented with the Environment Agency responsible for enforcement.

5.1.2 The Town and Country Planning (General Development Procedure) Order 1995, requires the planning authority to consult with the Environment Agency before granting planning permission for development on land within 250 metres of land which is being used for deposit of waste, (or has been at any time in the last 30 years) or has been notified to the planning authority for the purposes of that provision.

5.1.3 Building control bodies enforce compliance with the Building Regulations. Practical guidance is provided in Approved documents, one of which is Part C, *'Site preparation and resistance to contaminants and moisture'* which seeks to protect the health, safety and welfare of people in and around buildings and includes requirements for protection against harm from soil gas.

5.2 General

5.2.1 The following assessment relates to the potential for, and the effects of, gases generated by biodegradable matter. The potential for the development to be affected by radon gas is considered in Section 3. The principal ground gases are carbon dioxide (CO_2) and methane (CH_4). The following table provides a summary of the effects of these gases when mixed with air.

Significant gas concentrations in air		
Gas	**Concentration by volume**	**Consequence**
Methane	0.25%	Ventilation required in confined spaces
	5 - 15%	Potentially explosive when mixed with air
	30%	Asphyxiation
	75%	Death after 10 minutes
Carbon Dioxide	0.5%	8 hour long term exposure limit (LTEL) (HSE workplace limit)
	1.5%	15 min short term exposure limit (STEL) (HSE workplace limit)
	>3%	Breathing difficulties
	6 – 11%	Visual distortion, headaches, loss of consciousness, possible death
	>22%	Death likely to occur

Table 5.2.1

5.2.2 Following the current Building Regulations Approved Document C1, Section 2 *'Resistance to Contaminants'* (2004 incorporating 2010 and 2013 amendments) a risk assessment approach is required in relation to gaseous contamination based on the source-pathway-receptor conceptual model procedure. We have adopted procedures described in the following reference documents for investigation and assessments of risk of the development being affected by landfill type gases (permanent gases) and if appropriate the identification of mitigation measures.

- BS10175:2011 *'Investigation of potentially contaminated sites- Code of Practice'*
- BS8576:2013 *'Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs)'*
- BS8485:2015 *'Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings'*
- CIRIA Report C665 *'Assessing risks posed by hazardous ground gases to buildings'* (2007)
- NHBC report No 10627-R01(04) *'Guidance on development proposals on sites where methane and carbon dioxide are present'* (January 2007)
- CL:AIRE Research Bulletin RB17 *'A pragmatic approach to ground gas risk assessment'* (November 2012)

5.2.3 Whilst we have followed the guidance and recommendations of BS8576, we have used BS8485:2015 to derive recommendations for protective works, and where considered necessary supplemented by NHBC report No 10627-R01(04).

5.2.4 An assessment of the risk of the site being affected by ground gases is based on the following aspects:

a) Source of the gas
b) Investigation information
c) Migration feasibility
d) Sensitivity of the development and its location relative to the source

5.3 Assessment of source of gases

5.3.1 General sources

5.3.1.1 The following table summarises the common sources of ground gases and parameters affecting the generation of ground gases:

Source and control of gases	
Type	**Parameters affecting the rate of gassing**
Landfills	Portion of biodegradable material, rate reduces with time
Mineworkings	Flooding reduces rate of gassing
Dock silt	Portion of organic matter
Carbonate deposits	Ground/rainwater (acidic) reacts with some carbonates to produce carbon dioxide.
Made Ground	Thickness of Made Ground and proportion of degradable organic matter.
Naturally deposited soils/rocks	Thickness of Made Ground and proportion of degradable organic matter.
Table 5.3.1	

5.3.1.2 The rate of decomposition in gas production is also related to atmospheric conditions, pH, temperature, and water content/infiltration.

5.3.1.3 As the site is not within a dockland environment or an area affected by mineworkings, and near surface soils do not exhibit high carbonate content, then potential gas sources are limited to landfills and/or soils with a high proportion of organic matter.

5.3.2 Landfill and infilled ground sources

5.3.2.1 Waste Management Paper 27 (1991) produced by the Department of the Environment '*Control of Landfill Gases*' contains the recommendation to avoid building within 50m of a landfill site actively producing large quantities of landfill type gases and to carry out site investigations within a zone 250m beyond the boundary of a landfill site. No distinction is made between sites of differing ground conditions, but the paper does not advocate the site is safe beyond the 250m zone, dependant, of course, upon the type of landfill and potential for migration of landfill gases.

5.3.2.2 Within a 2km radius of the site, there are no BGS recorded or historical landfill sites; however, there are two registered landfill sites. Lords Delph (Forty Acre Lane, Longridge) is located approximately 500m to the east of the site and has been accepting non-biodegradable waste since at least 1982. Chapel Hill Quarry is located approximately 900m to the south of the site and accepted non-biodegradable waste; in 1992, the site was recorded as dormant.

5.3.2.3 In addition, we have reviewed old Ordnance Survey maps there are a small number of quarries recorded between 500m and 1000m from the subject site, predominantly to the east. The geological map of the area indicates areas of infilled ground which approximately coincide with such areas.

5.3.2.4 Due to the distance of the sites from the subject site and the nature of the waste, in our opinion they are considered very unlikely to represent potential sources of ground gases which could affect the subject site. Furthermore, a series of small ponds are noted to have been recorded on adjacent sites and possibly filled in recent years. However, given the limited size of the water features it is considered unlikely that any gases associated with organic/putrescible material contained within would have the potential to affect identified receptors.

5.3.3 Soil conditions

5.3.3.1 None of the soils observed in exploratory excavations, in our opinion, exhibit significant concentrations of organic matter which are likely to produce elevated quantities of carbon dioxide and / or methane gas.

5.3.3.2 Based on an assessment of 'deep' geological conditions we are of the opinion that it is unlikely that the subject site would be affected by significant quantities of carbon dioxide and methane generated by soils/rocks at depth.

5.3.3.3 Based on the presence of extensive deposits of cohesive and impermeable Devensian Till in the local area, any potential migration of landfill type gases which may be generated at the sources outlined in Section 5.3.2 would also be severely restricted and unlikely to feasibly migrate to the subject site. We can confirm that we have consulted with Ribble Valley Borough Council with regards to this matter and they have agreed with such assessments. A copy of their correspondence is presented in Appendix E.

5.3.3.4 Deposits of Alluvium are also recorded at surface in the north-western part of the site. Such soils may have the potential to contain organic material which may have the potential to generate landfill type gases. Given that development of the Phase 3 area of the site will consist of POS and recreational areas, with no enclosed spaces, any gases generated are unlikely to pose a risk to human receptors.

5.3.4 Source assessment summary

5.3.4.1 The following table summarises the possibility of a source of landfill type gases.

Source assessment summary

Potential source origin	Viability of source	Evidence
Landfills	Unlikely	Desk study information
Mineworkings	Unlikely	Desk Study information Geological conditions not amenable
Dock silt	Unlikely	Site remote from dockland environment
Carbonate deposits	Unlikely	Recorded and observed soil conditions do not indicate high concentrations of carbonates
Made Ground	Unlikely	Based on Phase 1 and Phase 2 SI, unlikely to be present at thicknesses and compositions which would give cause for concern
Naturally deposited soils/rocks	Unlikely	Alluvium may generate some gasses if organic matter present, however, unlikely to harm human receptors in outdoor space.

Table 5.3.4

5.4 Conclusion

5.4.1 Based on the above there is no evidence to demonstrate that there is a potential source rendering the site at a significant risk of being affected by ground gases (carbon dioxide / methane) sufficient to cause significant harm to human end users of the site, construction operatives or indeed buildings. On this basis, it is not considered necessary to consider possible pathways for migration of ground gases, and indeed implementation of further investigations to measure concentrations of ground gases. Again on the basis of evidence provided above, mitigation measures against ingress of ground gases into the proposed development area are not considered necessary.

5.5 Statement with respect to National Planning Policy Framework

5.5.1 Based on investigations completed to date with respect to gaseous contamination, we are of the opinion the proposed development will be safe and suitable for use for the purpose for which it is intended (without the need for any remedial action) thus meeting the requirements of the National Planning Policy Framework section 121, and compliant with the Building Regulations Part C, '*Site preparation and resistance to contaminants and moisture*'.

6 Further investigations

6.1 Although we have endeavoured to provide a comprehensive investigation for the proposed development within budgetary constraints there are areas, which we recommend further investigations be carried out. These are as follows: -

- Hardness values within surface waters of Higgin Brook are determined, as recommended in our reports for the Phase 1 and Phase 2 redevelopment areas to the south, to enable a more detailed risk assessment to be completed in relation to water receptors

6.2 We would be pleased to carry out any of the supplementary investigations described above and provide proposals with costings on further instructions.

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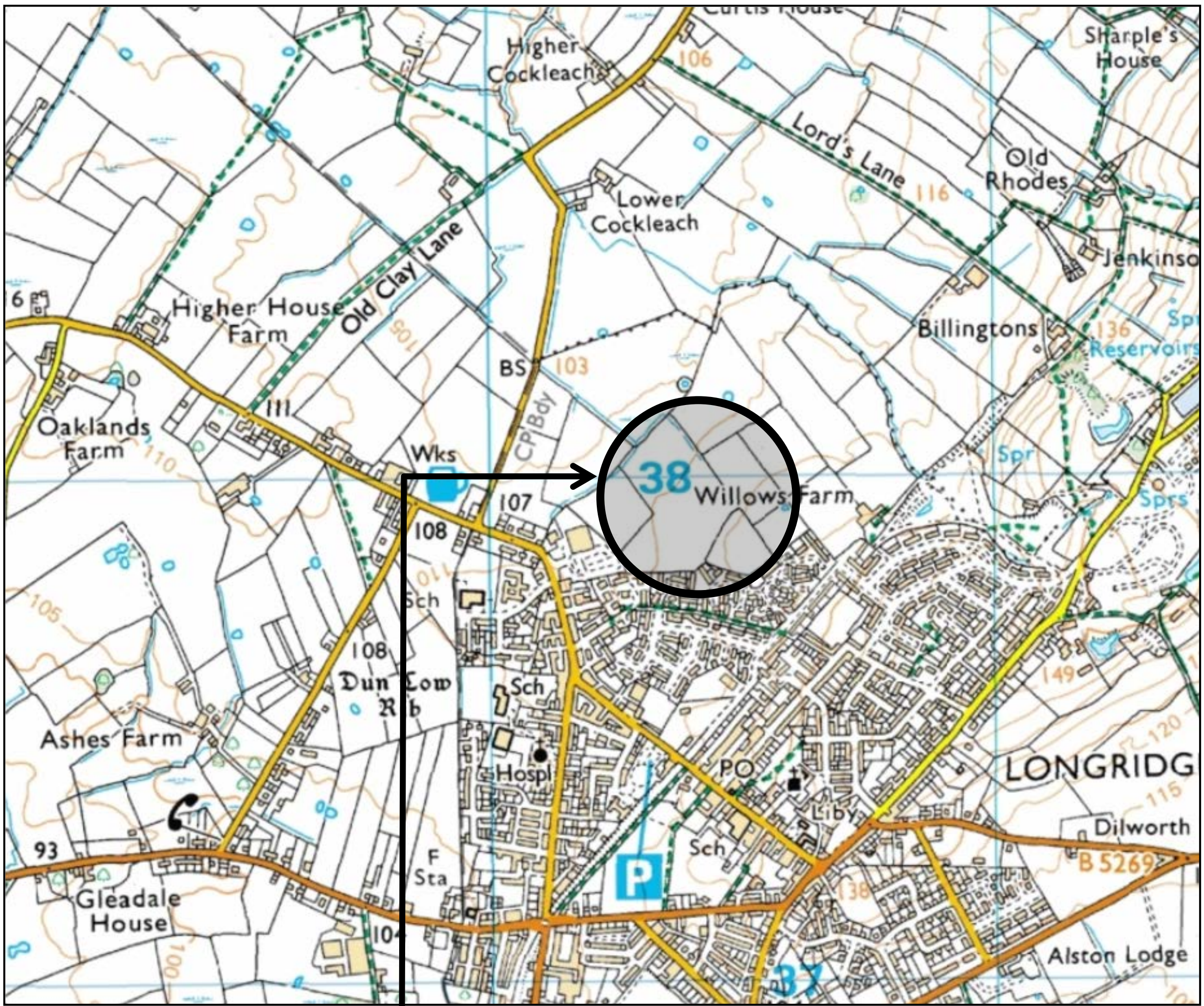

Approximate area of investigation

Title	Scale	Drawing number
Site location plan	Not to scale	01

Residential development
Phase 3, Chipping Lane, Longridge

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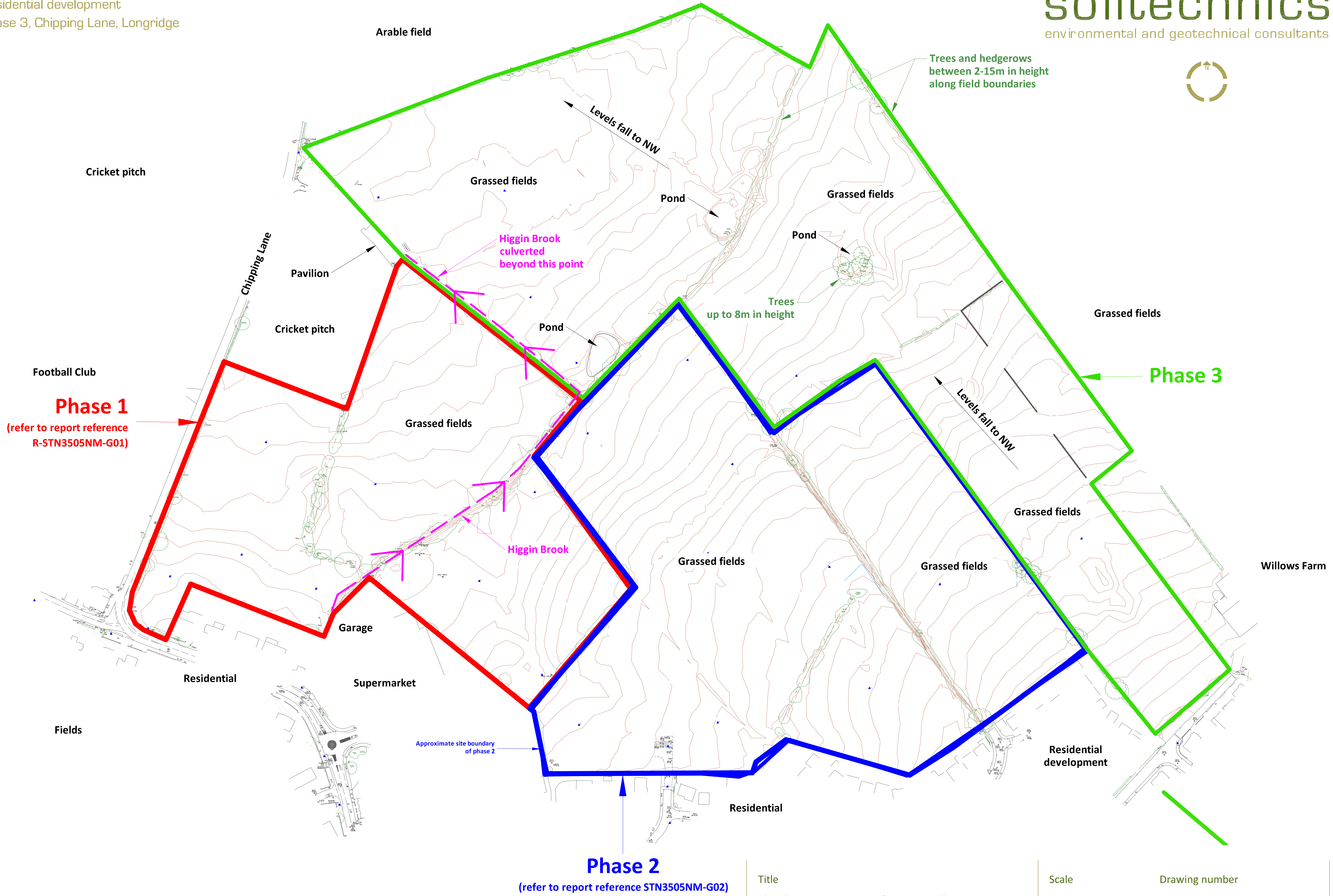

Title	Scale	Drawing number
Plan showing existing site features and location and extent of development phases	1:2500 at A3	02

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Definition of geo-environmental terms used in this report

Conceptual model
Textual and/or schematic hypothesis of the nature and sources of contamination, potential migration pathways (including description of the ground and groundwater) and potential receptors, developed on the basis of the information obtained from the investigatory process.

Contamination
Presence of a substance which is in, on or under land, and which has the potential to cause harm or to cause pollution of controlled water.

Controlled water
Inland freshwater (any lake, pond or watercourse above the freshwater limit), water contained in underground strata and any coastal water between the limit of highest tide or the freshwater line to the three mile limit of territorial waters.

Harm
Adverse effect on the health of living organisms, or other interference with ecological systems of which they form part, and, in the case of humans, including property.

Pathway
Mechanism or route by which a contaminant comes into contact with, or otherwise affects, a receptor.

Receptor
Persons, living organisms, ecological systems, controlled waters, atmosphere, structures and utilities that could be adversely affected by the contaminant(s).

Risk
Probability of the occurrence of, and magnitude of the consequences of, an unwanted adverse effect on a receptor.

Risk Assessment
Process of establishing, to the extent possible, the existence, nature and significance of risk.

Definition of environmental risk/hazard terms used in this report.

Based on CIRIA report C552 '*Contaminated land risk assessment – A guide to good practice*'.

Potential hazard severity definition

Category	Definition
Severe	Acute risks to human health, catastrophic damage to buildings/property, major pollution of controlled waters
Medium	Chronic risk to human health, pollution of sensitive controlled waters, significant effects on sensitive ecosystems or species, significant damage to buildings or structures.
Mild	Pollution of non sensitive waters, minor damage to buildings or structures.
Minor	Requirement for protective equipment during site works to mitigate health effects, damage to non sensitive ecosystems or species.

Probability of risk definition

Category	Definition
High likelihood	Pollutant linkage may be present, and risk is almost certain to occur in long term, or there is evidence of harm to the receptor.
Likely	Pollutant linkage may be present, and it is probable that the risk will occur over the long term
Low likelihood	Pollutant linkage may be present, and there is a possibility of the risk occurring, although there is no certainty that it will do so.
Unlikely	Pollutant linkage may be present, but the circumstances under which harm would occur are improbable.

Level of risk for potential hazard definition

Probability of risk	Potential severity			
	Severe	Medium	Mild	Minor
High Likelihood	Very high	High	Moderate	Low/Moderate
Likely	High	Moderate	Low/Moderate	Low
Low Likelihood	Moderate	Low/Moderate	Low	Very low
Unlikely	Low/Moderate	Low	Very low	Very low

Refer sheet 2 for definitions of 'very high' to 'low'

Definition of environmental risk/hazard terms used in this report.

Based on CIRIA report C552 '*Contaminated land risk assessment – A guide to good practice'.*

Risk classifications and likely action required:

Very high risk
High probability that severe harm could arise to a designated receptor from an identified hazard OR there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised is likely to result in substantial liability. Urgent investigation and remediation are likely to be required.

High risk
Harm is likely to arise to a designated receptor from an identified hazard. This risk, if realised, is likely to result in substantial liability. Urgent investigation is required and remedial works may be necessary in the short term and are likely over the long term.

Moderate risk
It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is likely that the harm would be relatively mild. Investigation is normally required to clarify risks and to determine potential liability. Some remedial works may be required in the long term.

Low risk
It is possible that harm could arise to a designated receptor from an identified hazard but it is likely that this harm, if realised, would at worst normally be mild.

Very low risk
It is a low possibility that harm could arise to a designated receptor. On the event of such harm being realised it is not likely to be severe.

List of documents used in assessment of chemical contamination

No.	Title	Publication reference / publisher
1	Human health toxicological assessment of contaminants in soil	EA Science Report – SC050021/SR2
2	Updated technical background to the CLEA model	EA Science Report – SC050021/SR3
3	CLEA Software (Version 1.03 beta) Handbook	EA Science Report - SC050021/SR4
4	Guidance on comparing Soil Contamination Data with a Critical Concentration	CIEH
5	The LQM/CIEH S4ULs for Human Health Risk Assessment (2015)	LQM/CIEH
6	Assessment of Risks to Human Health from Land Contamination: An overview of the development of soil guideline values and related research	R&D Publication, Contaminated Land Report CLR 7
7	Contaminants of Soil: Collation of Toxicological Data and Intake Values for Humans	R&D Publication, Contaminated Land Report CLR 9
8	The Contaminated Land Exposure Assessment Model (CLEA): Technical Basis and Algorithms	R&D Publication, Contaminated Land Report CLR 10
9	Model Procedures for the Management of Land Contamination	R&D Publication, Contaminated Land Report CLR 11
10	Contaminants in Soil: Collection of Toxicological Data and Intake Values for Human Values	R&D Publications, Tox. 6
11	Soil Guideline Values for Contamination (2002)	R&D Publications, SGV 10
12	Soil Guideline Values (2009)	EA Science Reports – SC050021
13	Atkins ATRISK^{SOIL} (2011)	http://www.atrisksoil.co.uk
14	Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination (September 2014)	CL:AIRE

CIEH	Chartered institute of Environmental Health
LQM	Land Quality Management
EA	Environment Agency
CL:AIRE	Contaminated Land: Applications in Real Environments

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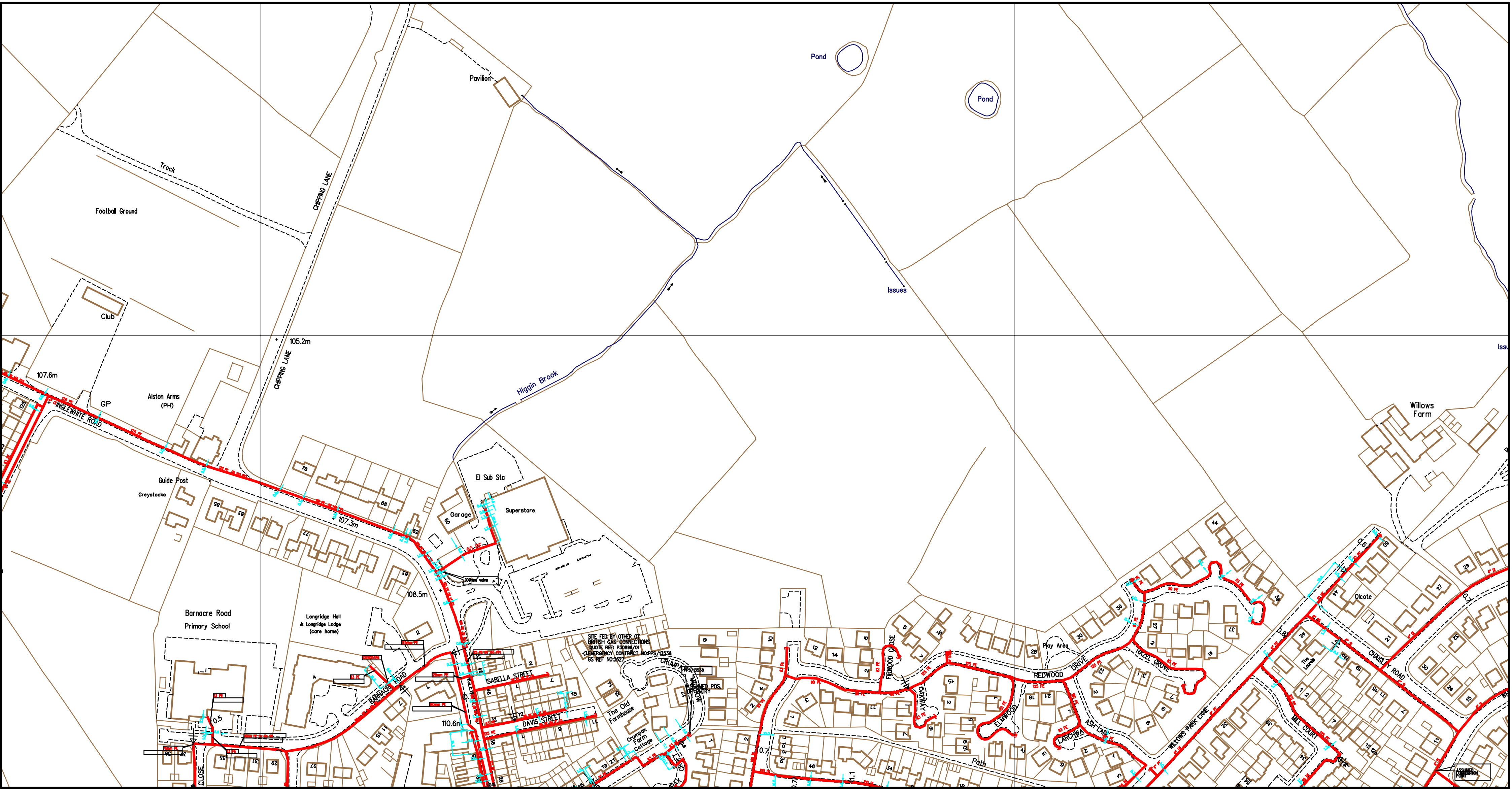
Testing suite summary

Table summarising testing suites		
Suite	**Parameters**	**Medium**
Suite 1	Arsenic, beryllium, boron, cadmium, chromium (total and VI), copper, lead, mercury, nickel, selenium, vanadium zinc, cyanide (free, total and complex), organic matter content, PAH (16 speciated), pH, phenol (total), TOC	Soil
Suite 2	Arsenic, boron (water soluble), beryllium, cadmium, chromium (total), copper, lead, mercury, nickel, selenium, vanadium, zinc, cyanide (free, total and complex, PAH (16 speciated), pH, phenol (total), sulfate (water soluble), sulfide, nitrate	Leachate
Suite 3	Arsenic, boron (water soluble), beryllium, cadmium, chromium (total), copper, lead, mercury, nickel, selenium, vanadium, zinc, cyanide (free, total and complex, PAH (16 speciated), pH, phenol (total), sulfate (water soluble), sulfide, nitrate	Water
Suite 4	TPH Texas Banding Aliphatic/Aromatic Split, PAH (16 speciated), TOC	Soil
Suite 5	TPH Texas Banding Aliphatic/Aromatic Split, PAH (16 speciated)	Leachate
Suite 6	TPH Texas Banding Aliphatic/Aromatic Split, PAH (16 speciated)	Water
Suite 7	TPH Texas Banding Aliphatic/Aromatic Split, TOC, organic matter	Soil
Suite 8	Sulphur (total), sulphate (water and acid soluble), pH	Soil
Suite 9	Sulphate, ammoniacal nitrogen, dissolved magnesium, pH	Water
Suite 10	VOC, SVOC, TOC, organic matter	Soil
Suite 11	VOC, SVOC	Leachate
Suite 12	VOC, SVOC	Water
Suite 13	Organotins dibutyltin/ tributyl-tin/tetrabutyltin/triphenyl-tin, Tetraethyl-lead/tetramethyl-lead	Soil
Suite 14	Organotin	Leachate
Suite 15	Organotin	Water
Suite 16	TPH Texas Banding Aliphatic/Aromatic Split, BTEX, VOC, SVOC	Soil, water, leachate
Suite 17	TPH Texas Banding Aliphatic/Aromatic Split, BTEX, SVOC, VOC, arsenic, boron (water soluble), beryllium, cadmium, chromium (total), copper, lead, mercury, nickel, selenium, vanadium, zinc, cyanide (free, total and complex, pH, phenol (total), sulfate (water soluble), sulfide, nitrate	Soil, water, leachate
Concrete BRE suite	pH, sulphate (water and acid soluble), magnesium (water soluble), ammonia (water soluble), chloride, nitrate	Soil



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DATE: 06/11/2015	IP MAINS
EXTRACT DATE: 15/06/2015	LHP MAINS
MAP REF: SD6037	NHP MAINS
CENTRE: 360328, 437960	

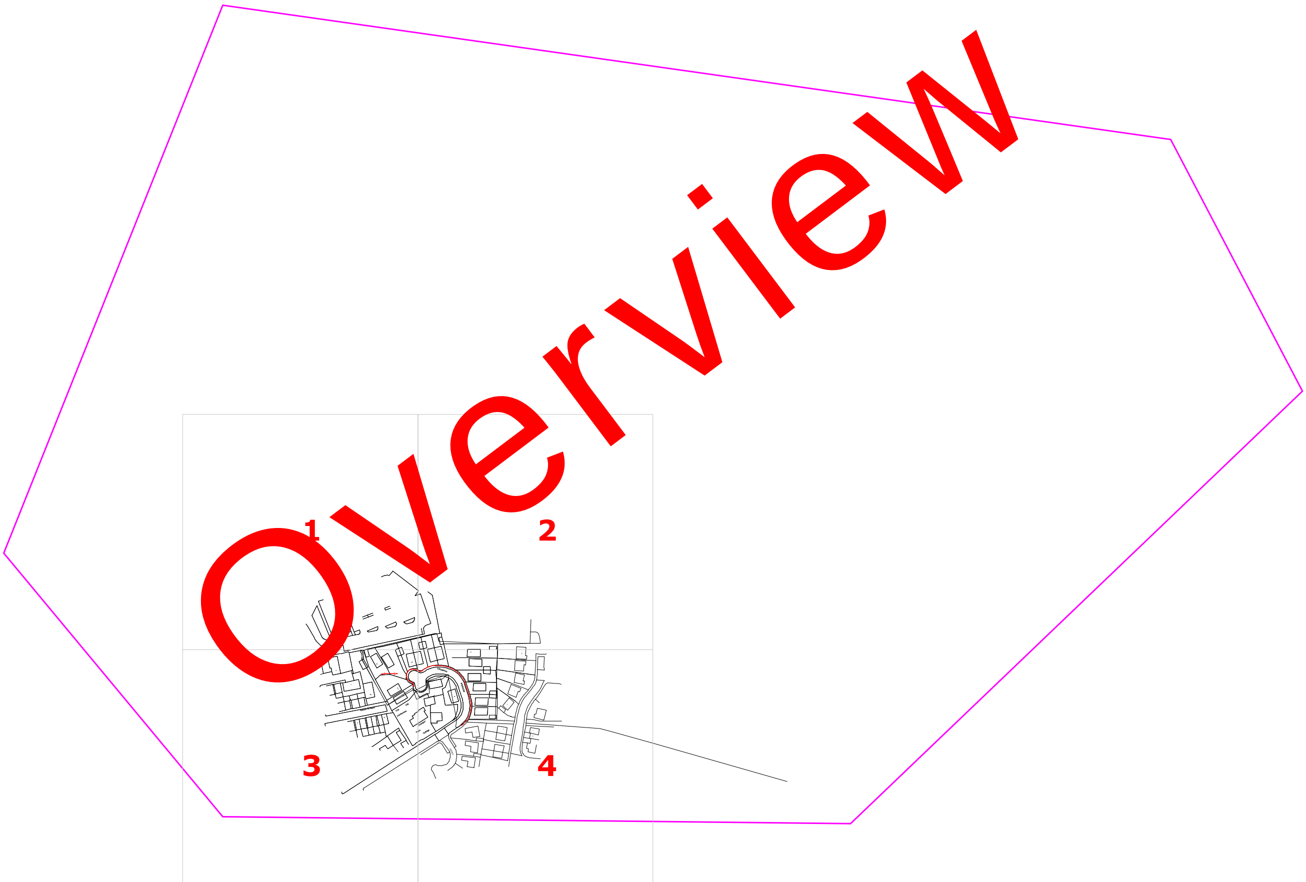
Some examples of Plant Items:

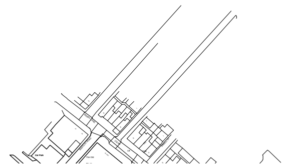
Valve Depth of Cover Syphon Diameter Change Material Change

This plan shows those pipes owned by National Grid Gas plc in their role as a Licensed Gas Transporter (GT). Gas pipes owned by other GTs, or otherwise privately owned, may be present in this area. Information with regard to such pipes should be obtained from the relevant owners. The information shown on this plan is given without warranty, the accuracy thereof cannot be guaranteed. Service pipes, valves, syphons, stub connections, etc. are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by National Grid Gas plc or their agents, servants or contractors for any error or omission. Safe digging practices, in accordance with HS(G)47, must be used to verify and establish the actual position of mains, pipes, services and other apparatus on site before any mechanical plant is used. It is your responsibility to ensure that this information is provided to all persons (either direct labour or contractors) working for you on or near gas apparatus. The information included on this plan should not be referred to beyond a period of 28 days from the date of issue. Further information on all DR4s can be determined by calling the DR4 hotline on 01455 892426 (9am-5pm) A DR4 is where a potential error has been identified within the asset record and a process is currently underway to investigate and resolve the error as appropriate.

MAPS Viewer Version 5.6.7.0

Local Machine





Date Requested: 09/11/2015
Requested by: Paul Wignall
Job Reference: 7631462

Company: Barratt Homes Manchester
Your Scheme/Reference: Chippings Lane

Key for Mains & Service Pipework

Existing LP mains or services operating up to 75 millibar gauge

Existing MP mains or services operating between 75 millibar and 2 bar gauge

Existing IP mains or services operating between 2 bar and 7 bar gauge

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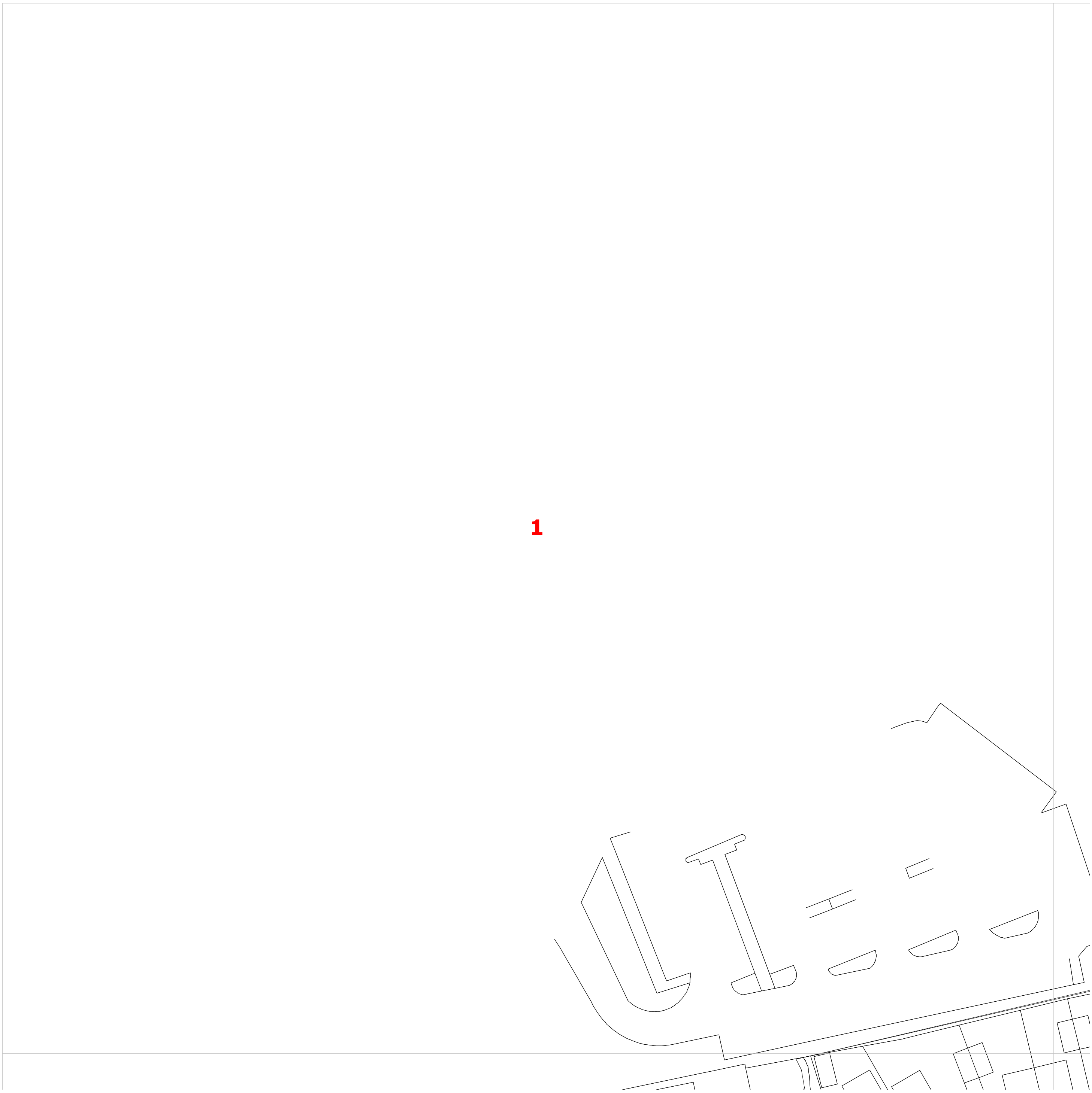
Leatherhead,
Surrey, KT22 7AA
Phone: 01372 227560
Email: info@espipelines .com

Dig Sites:
Area Line
Approx scale on A4 paper: 1:1000
(excluding Overview map)



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Key for Mains & Service Pipework

Red line	Existing LP mains or services operating up to 75 millibar gauge
Blue line	Existing MP mains or services operating between 75 millibar and 2 bar gauge
Green line	Existing IP mains or services operating between 2 bar and 7 bar gauge

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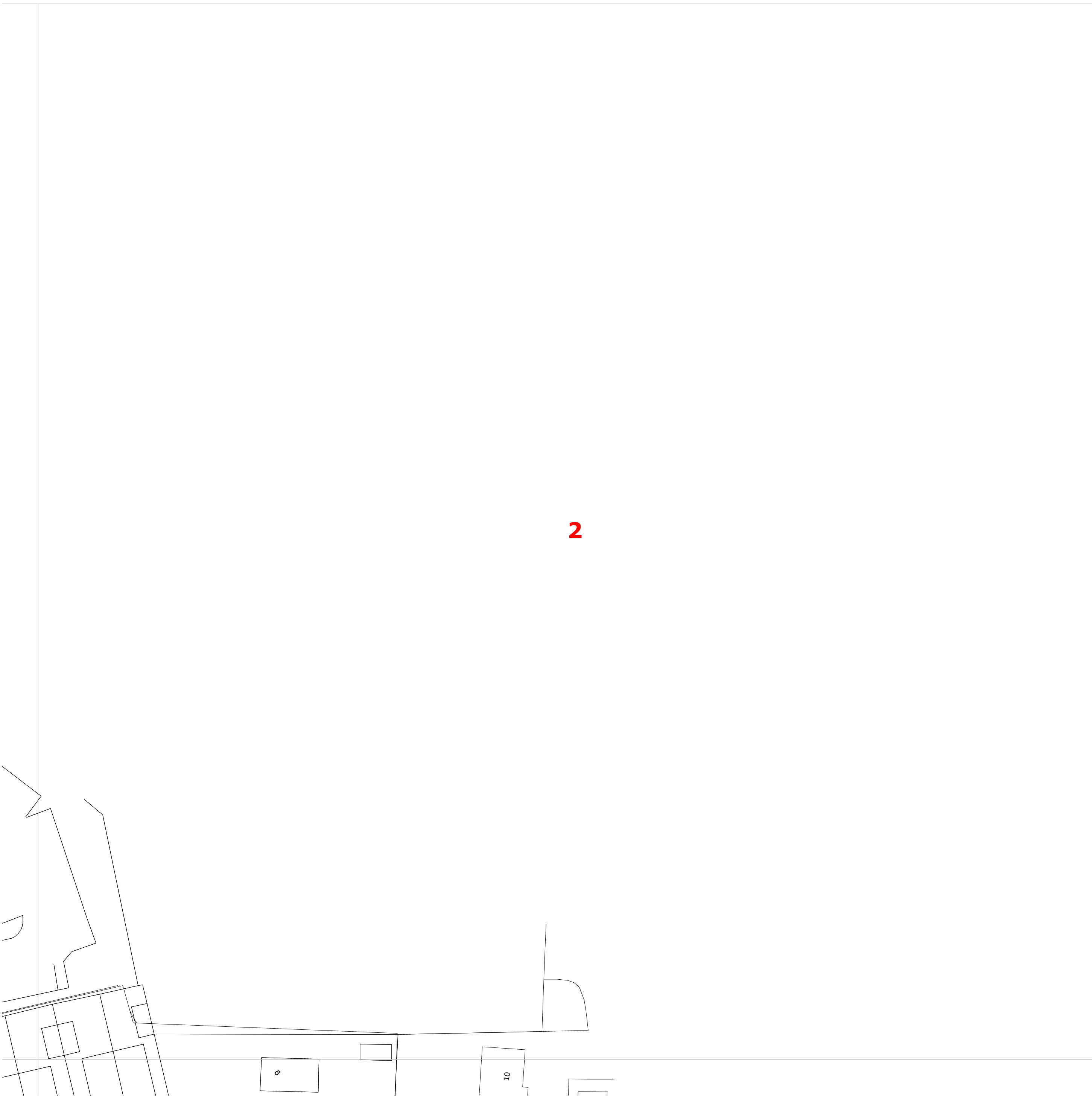

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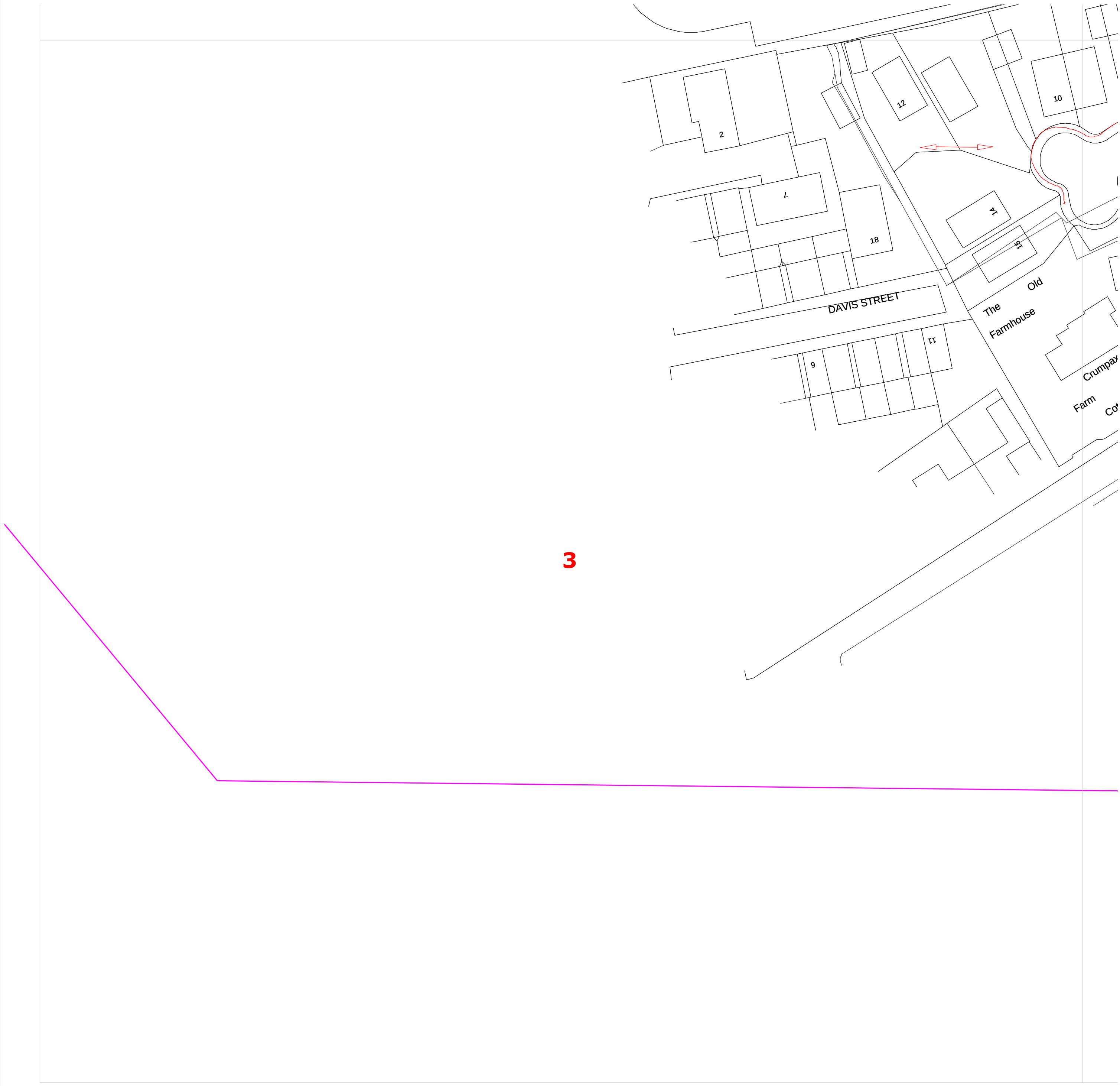

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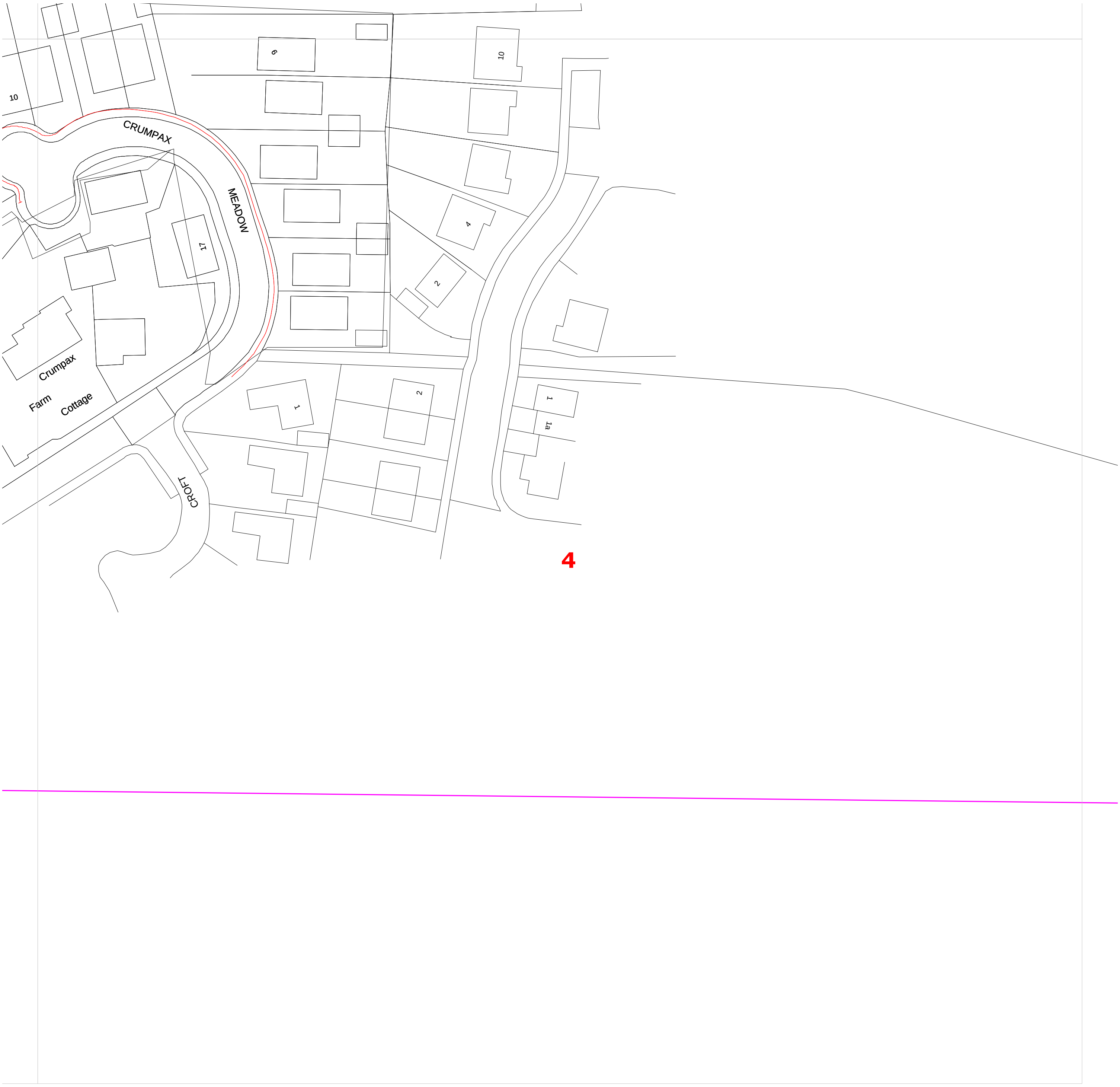

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Key for Mains & Service Pipework

Red line	Existing LP mains or services operating up to 75 millibar gauge
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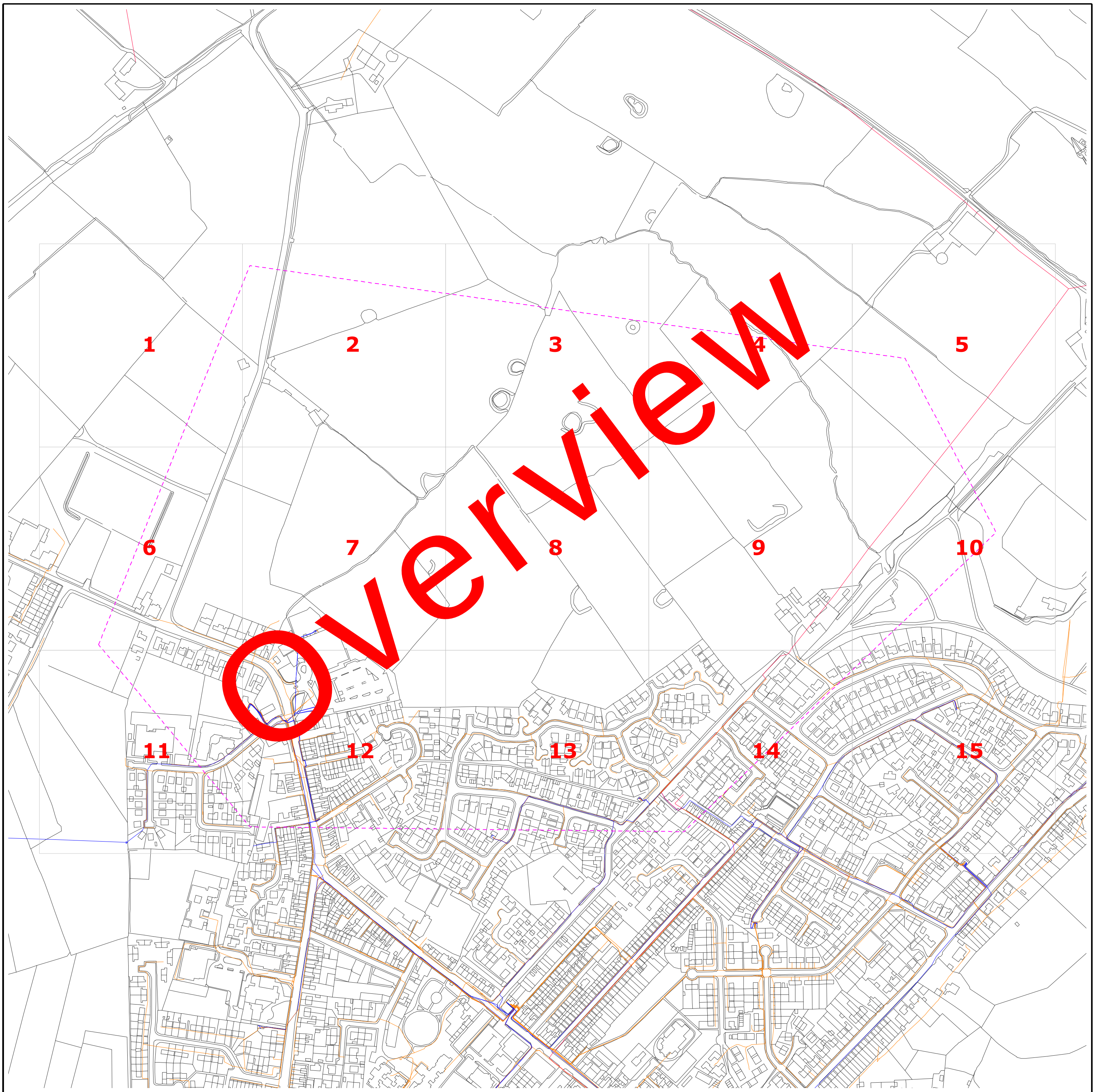

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Date Requested: 09/11/2015

Job Reference: 7631462

Your Scheme/Reference: Chippings Lane

Dig Sites:

Area Line

Operating Voltage	Colour Code	Line Colour
132kV	Black	
33kV	Green	
22kV-25kV	Yellow	
11kV	Red	
6kV-6.6kV	Blue	
1kV-6kV	Violet	
LV	Orange	
Unknown Voltage	Brown	

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Dickinson Street
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Email: planrequest@enwl.co.uk

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1:250 Line dig site

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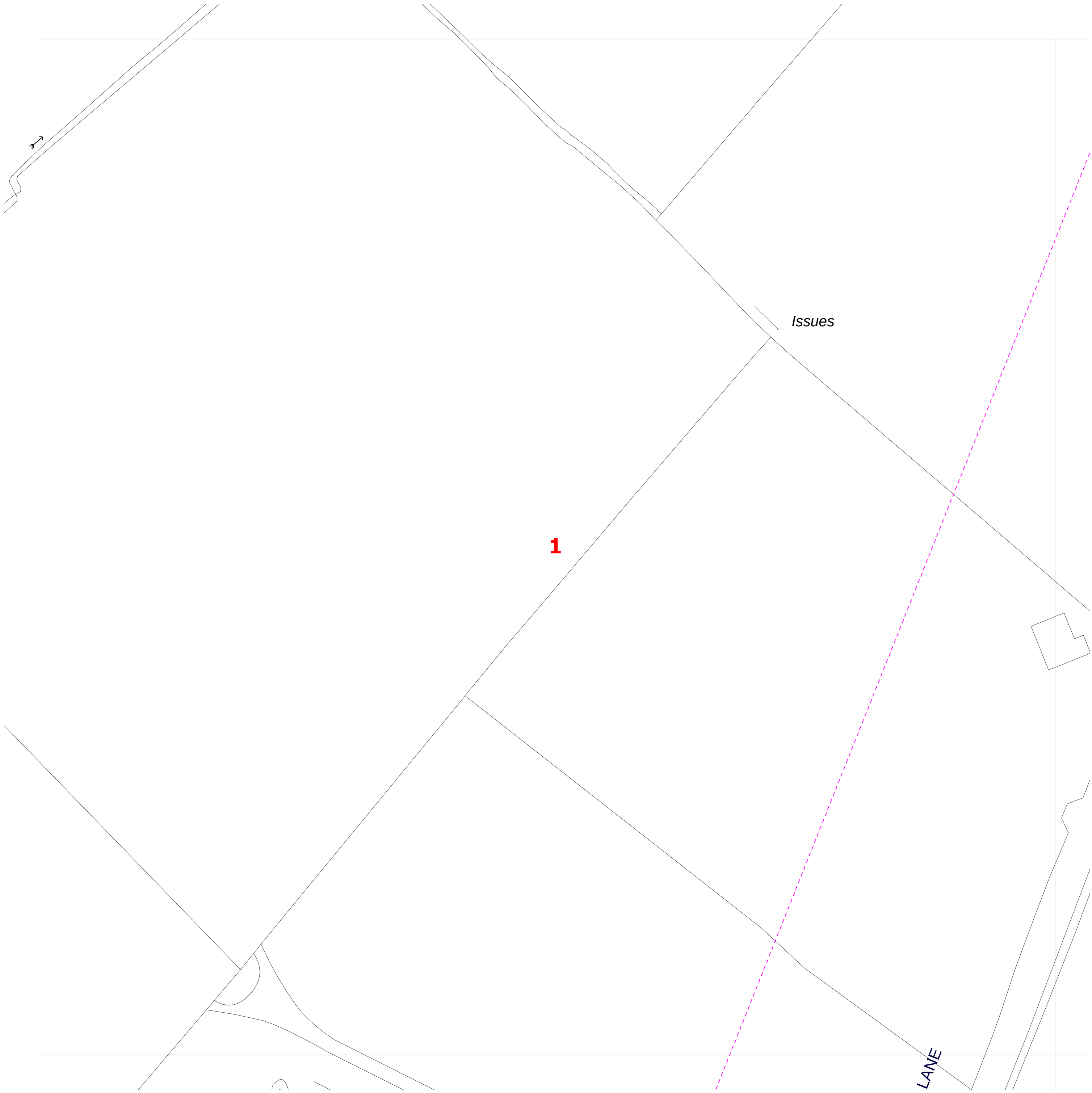

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Date Requested: 09/11/2015
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Your Scheme/Reference: Chippings Lane

Dig Sites:

Area Line

Operating Voltage	Colour Code	Line Colour
132kV	Black	
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22kV-25kV	Yellow	
11kV	Red	
6kV-6.6kV	Blue	
1kV-6kV	Violet	
LV	Orange	
Unknown Voltage	Brown	

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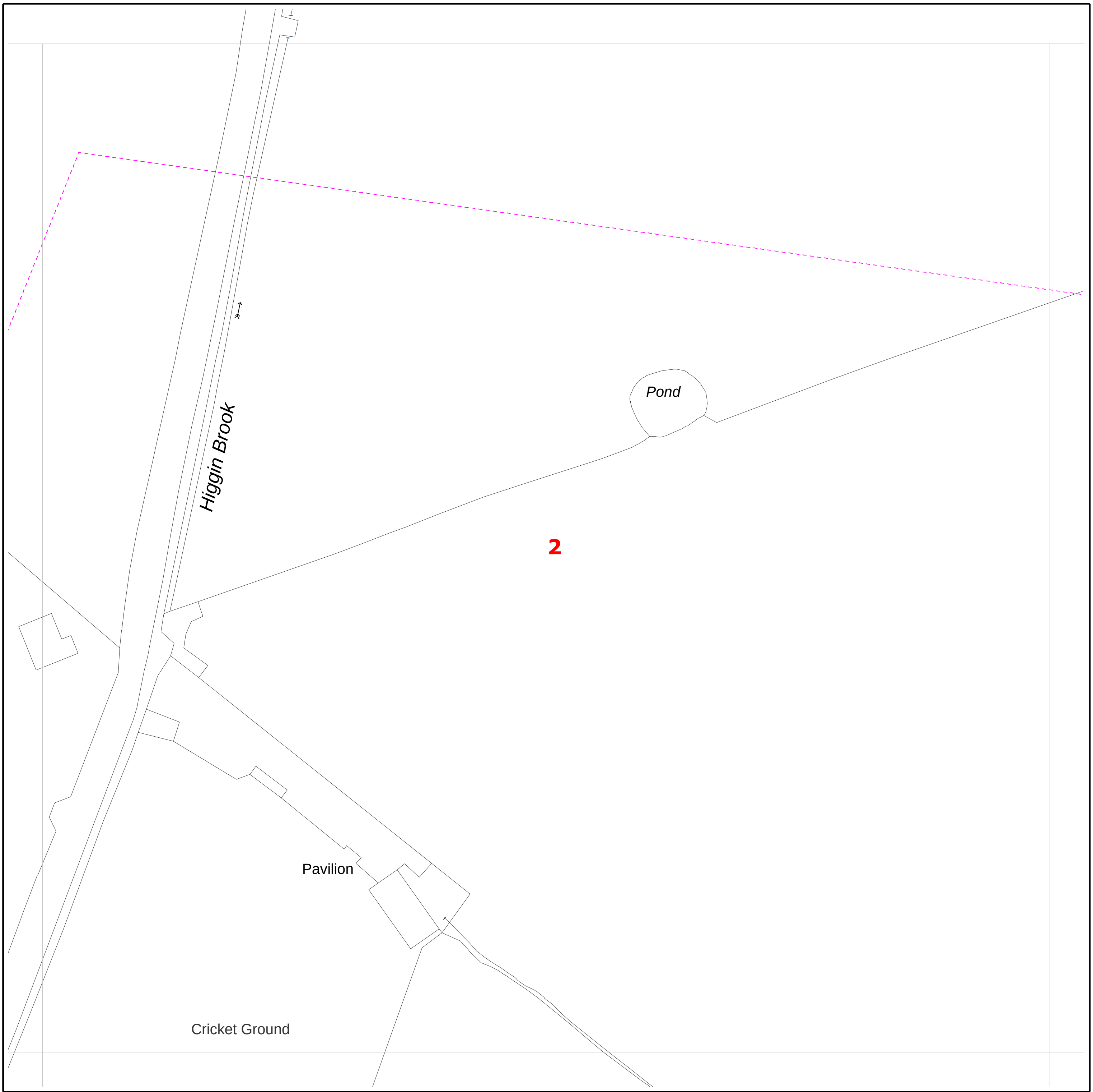
1:250 Line dig site



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Dig Sites:

Area | Line

Operating Voltage	Colour Code	Line Colour
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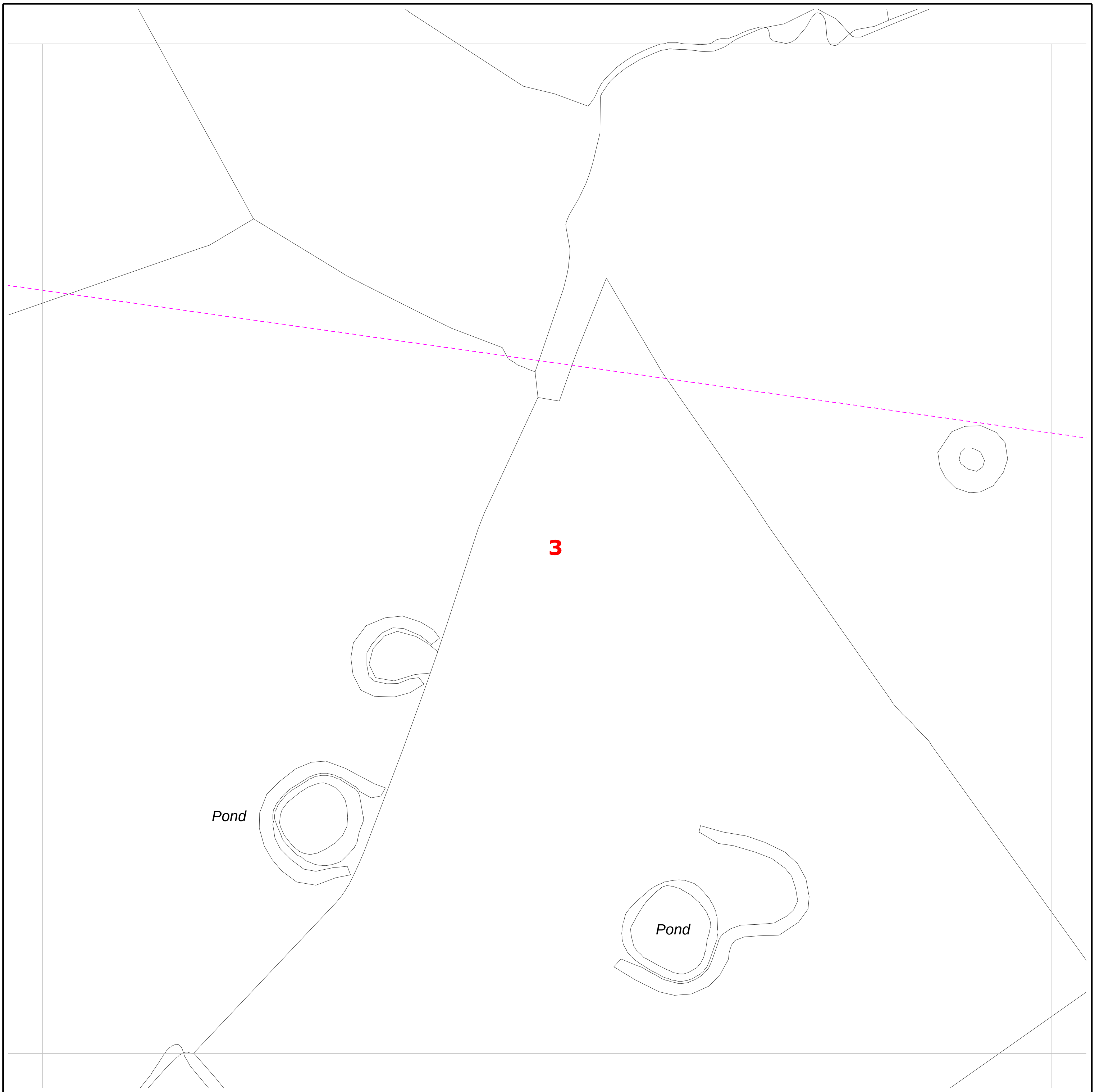

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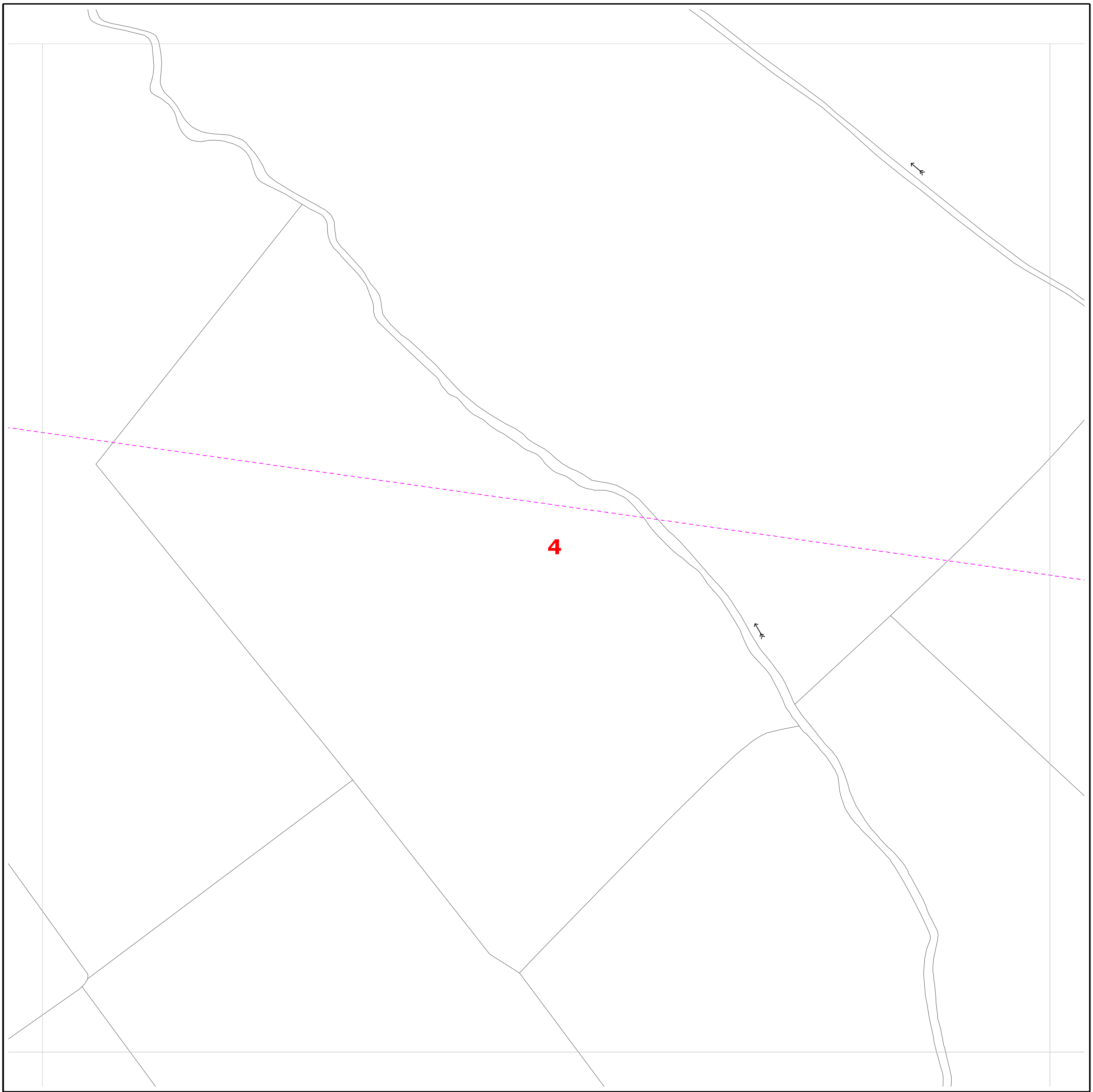

Requested by: Paul Wignall

Company: Barratt Homes Manchester

Date Requested: 09/11/2015

Job Reference: 7631462

Your Scheme/Reference: Chippings Lane

Dig Sites:

Area Line

Operating Voltage	Colour Code	Line Colour
132kV	Black	
33kV	Green	
22kV-25kV	Yellow	
11kV	Red	
6kV-6.6kV	Blue	
1kV-6kV	Violet	
LV	Orange	
Unknown Voltage	Brown	

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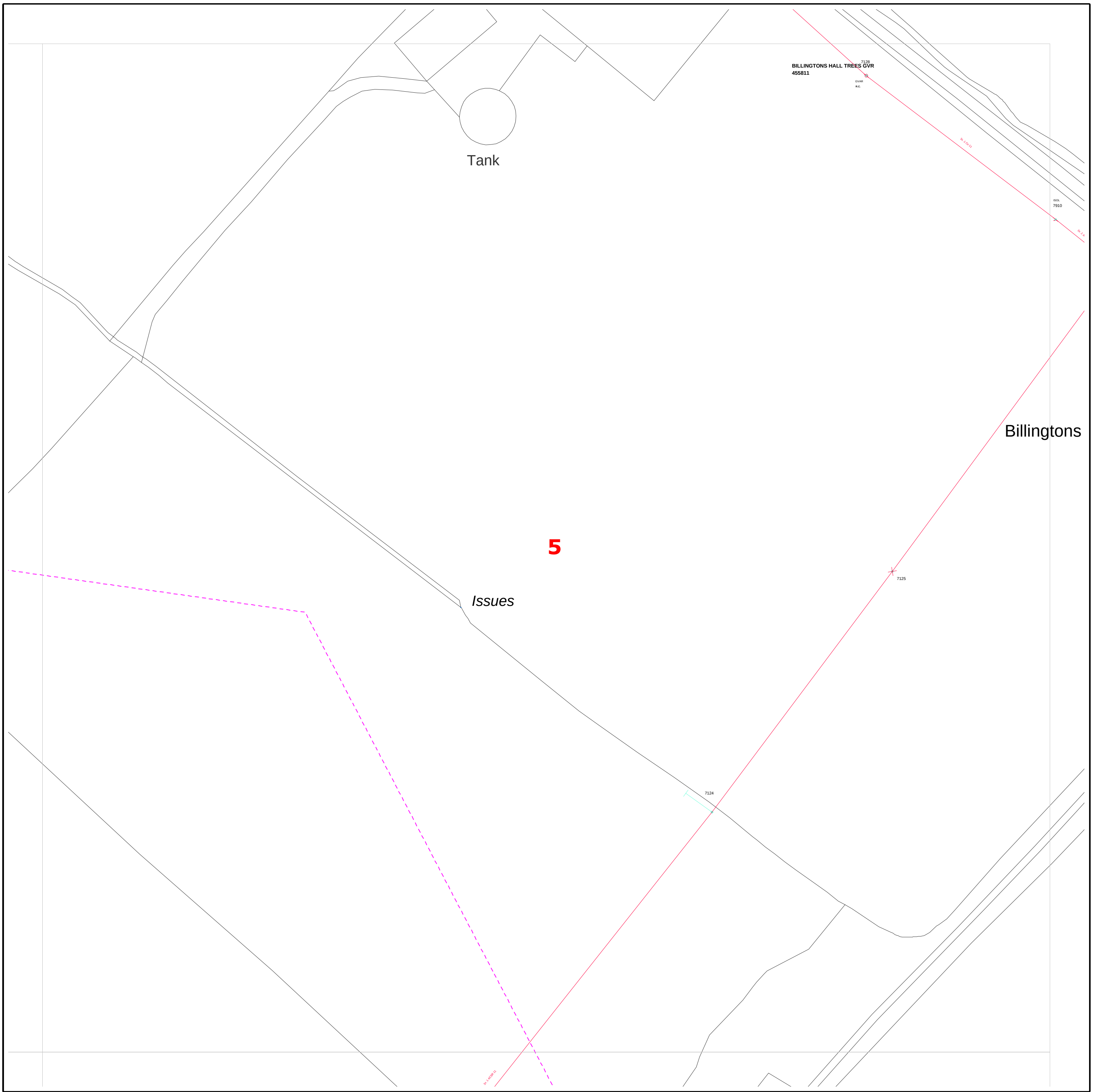
Phone: 0800 195 4141
Email: planrequest@enwl.co.uk

Scales on A4 paper:
1:1250 Area dig site
1:250 Line dig site



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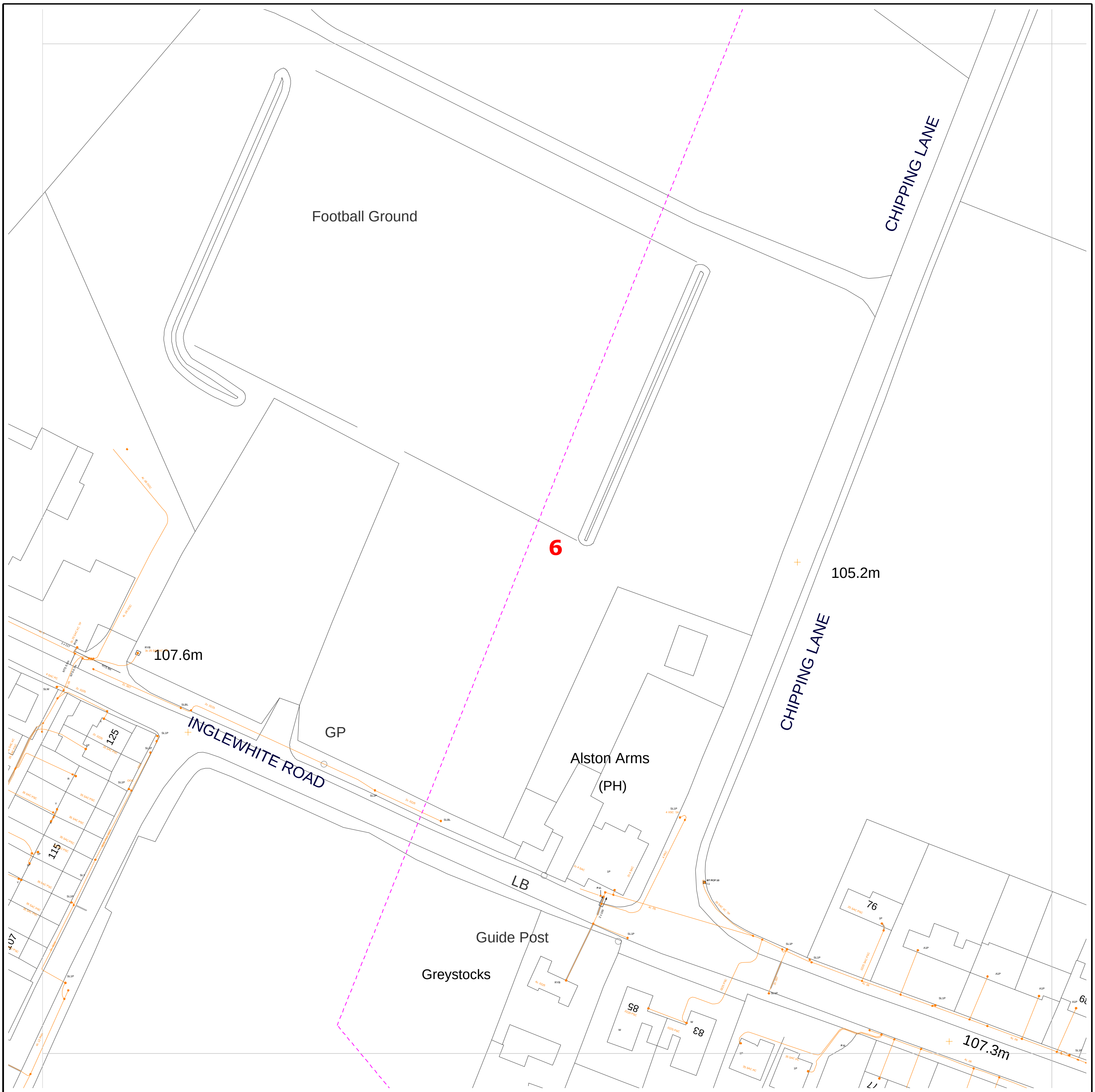

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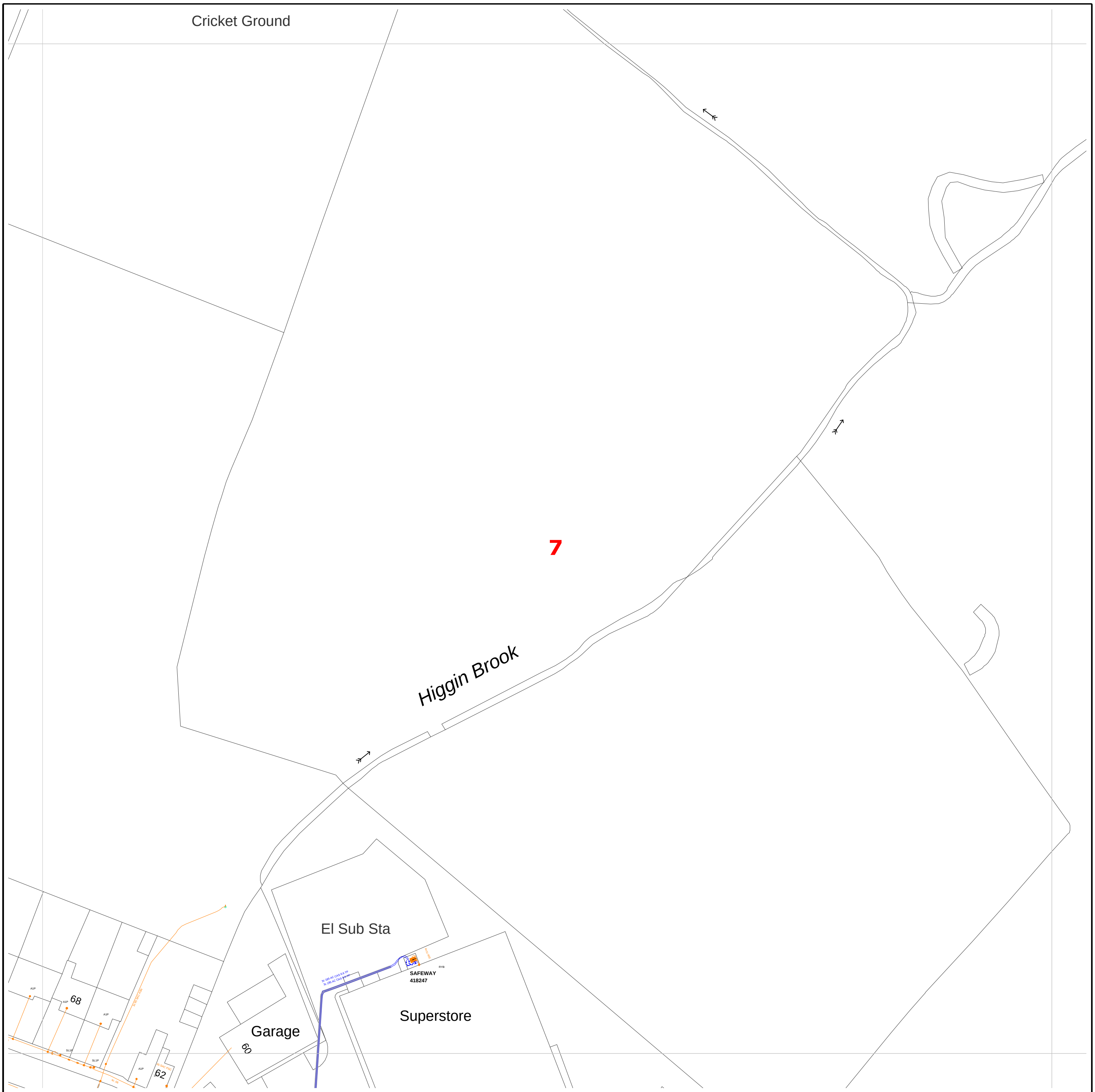

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electricity north west

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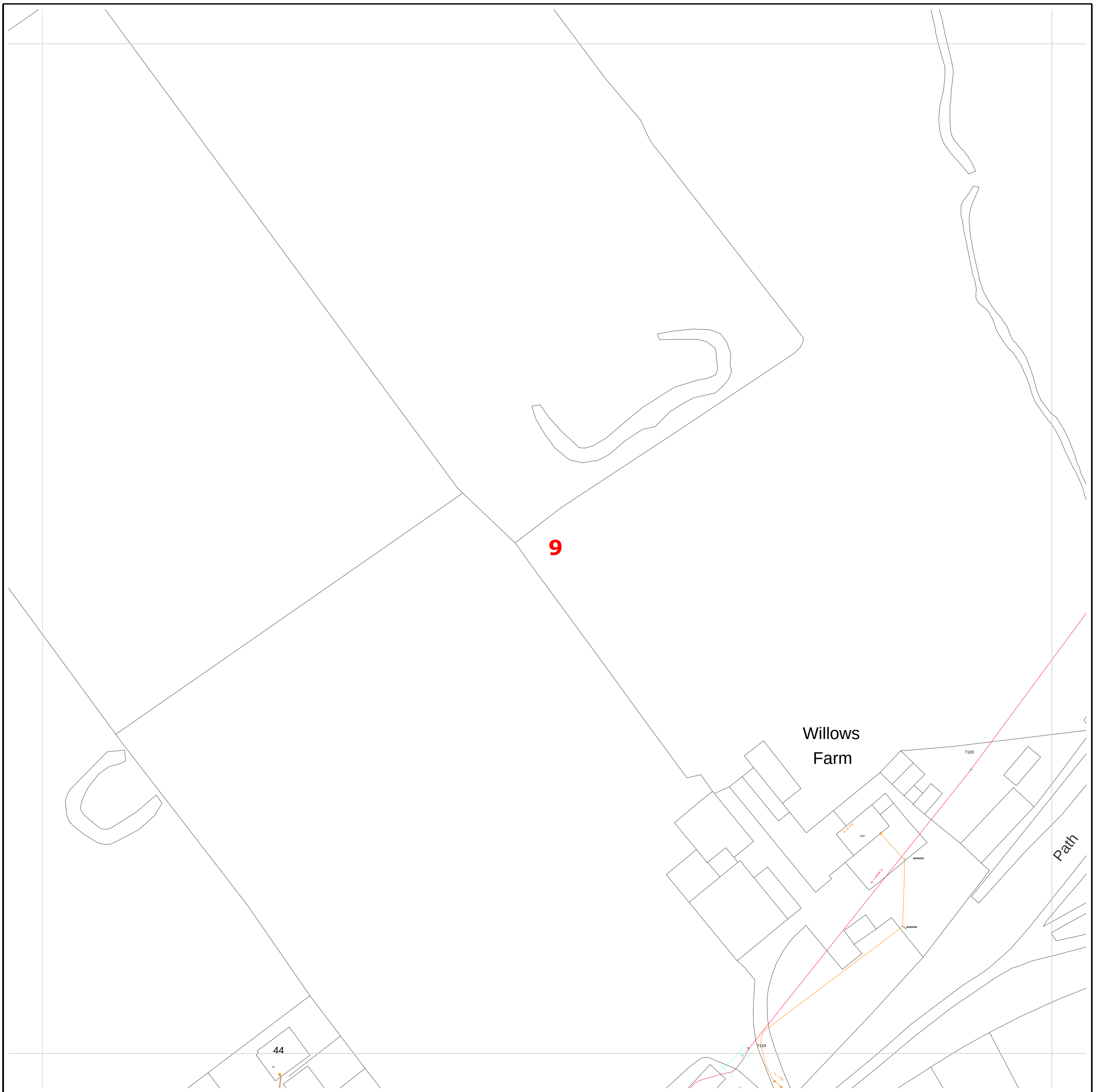

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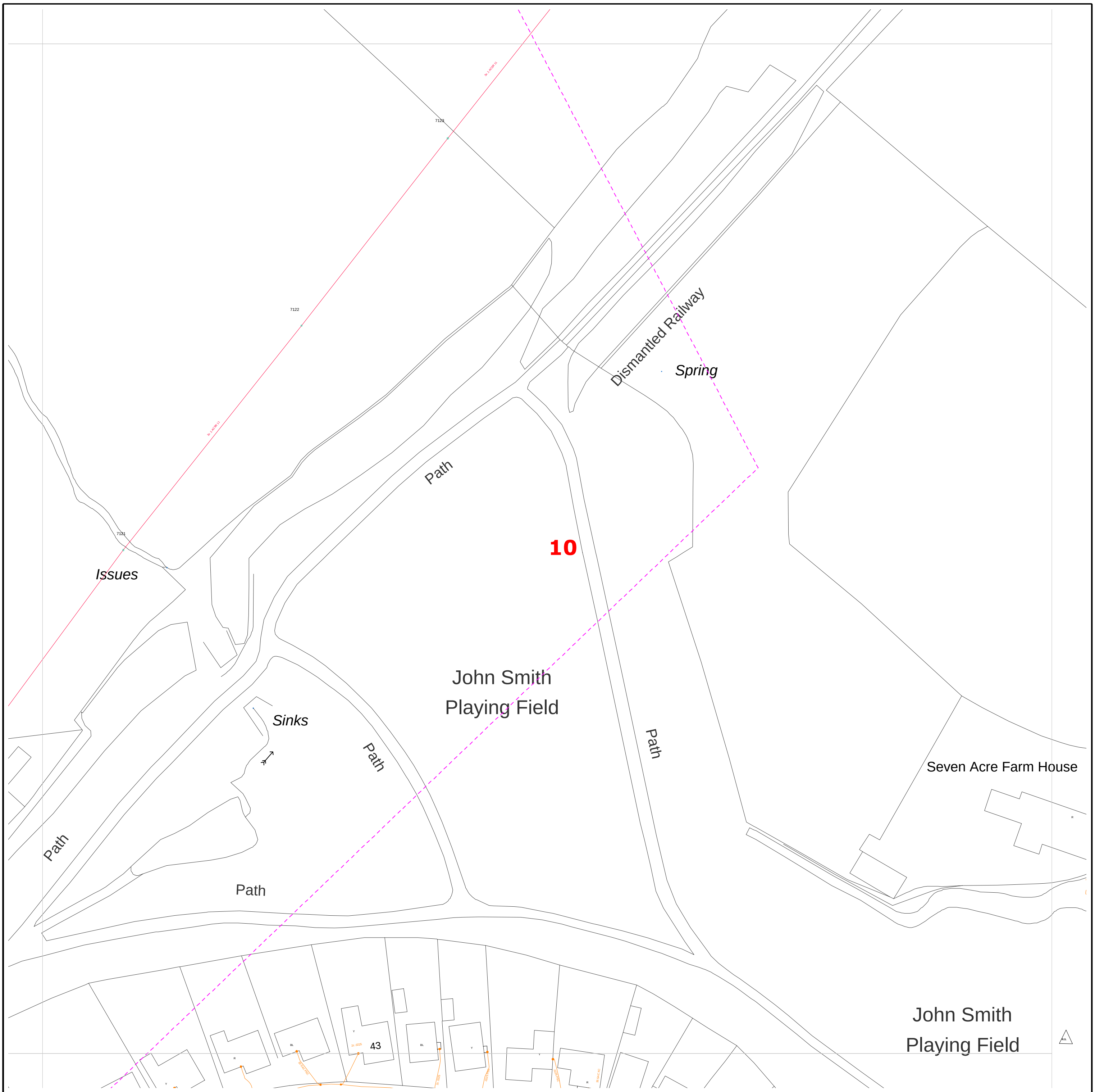

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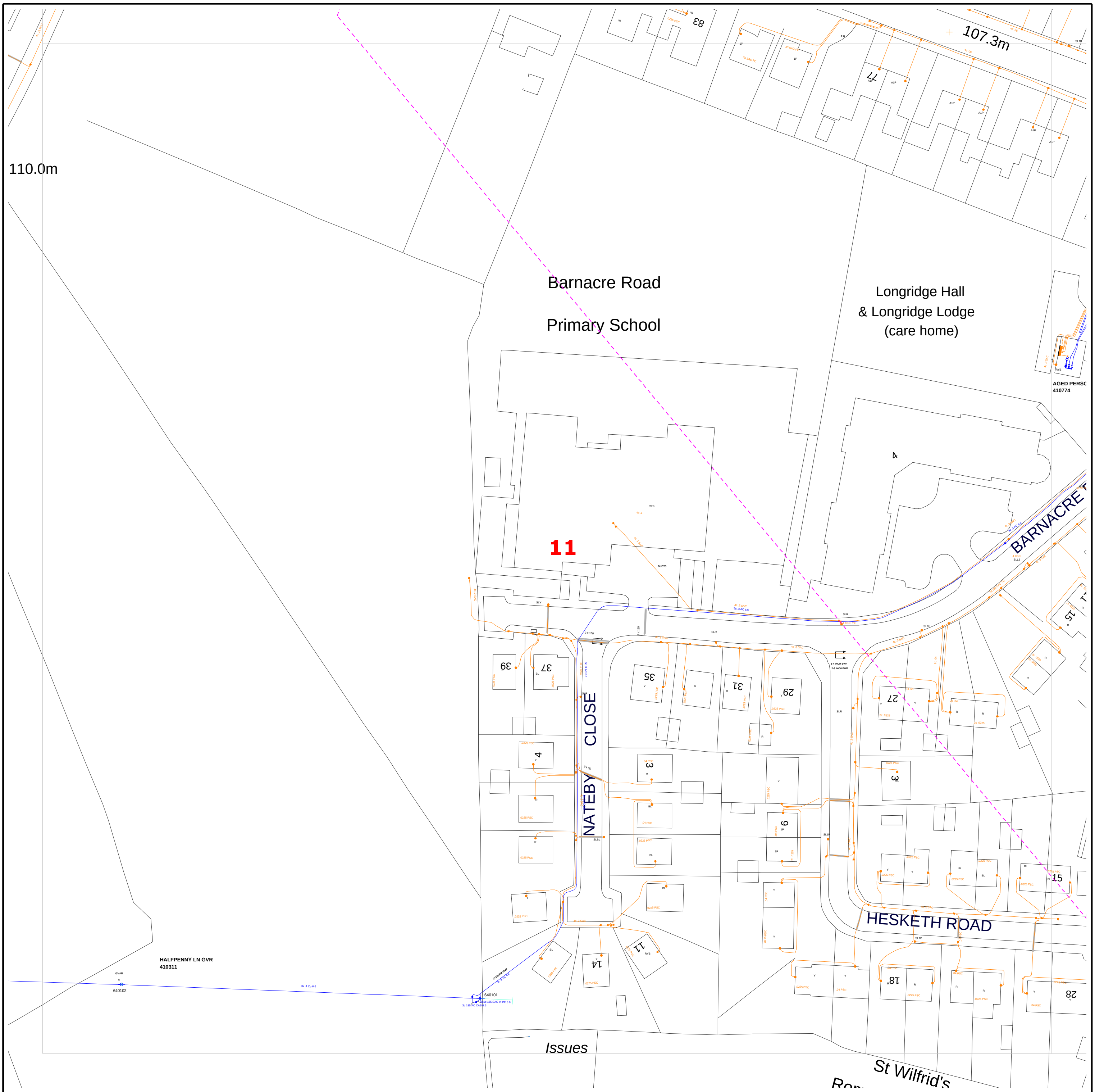

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electricity north west

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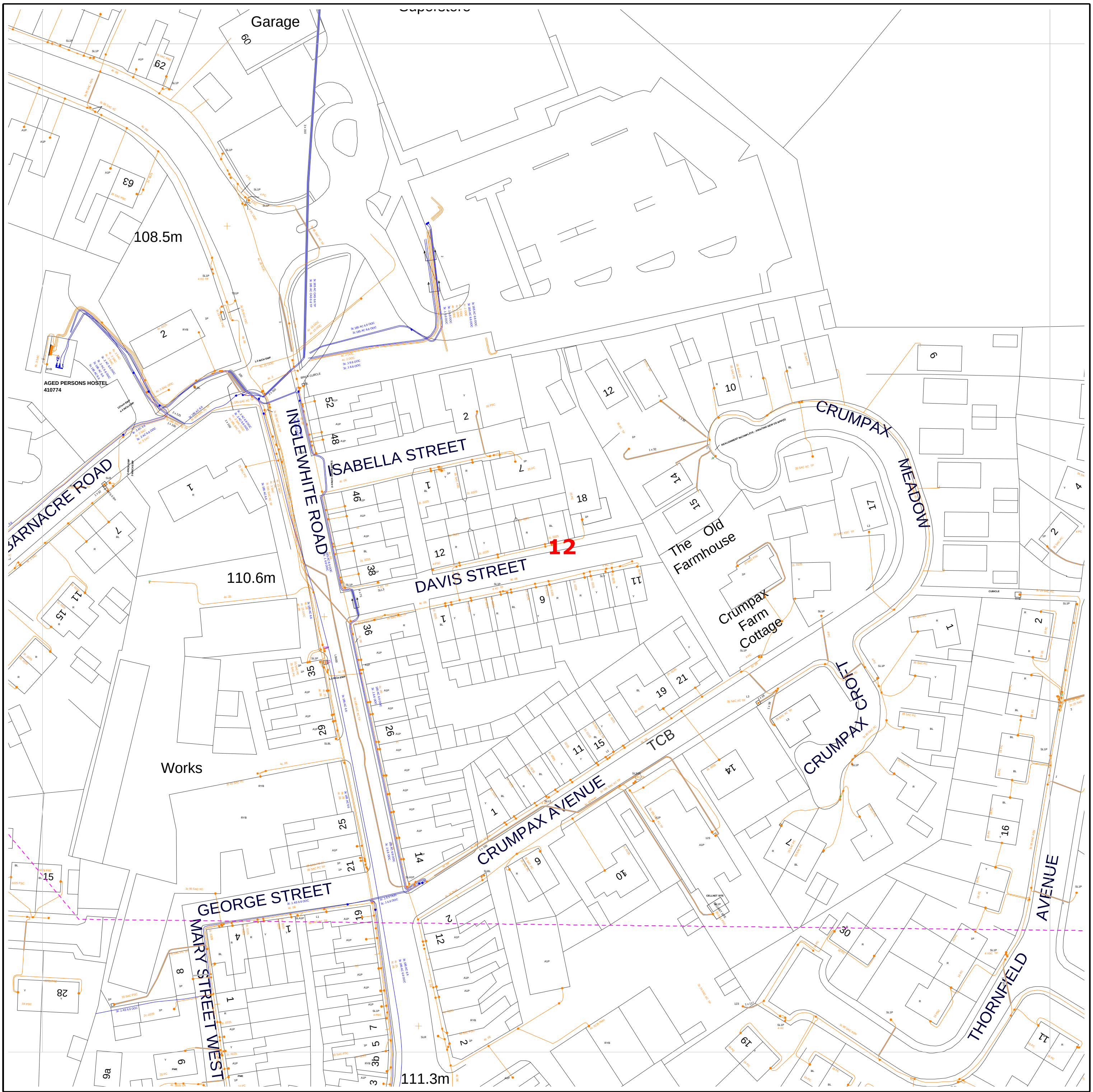

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electricity north west

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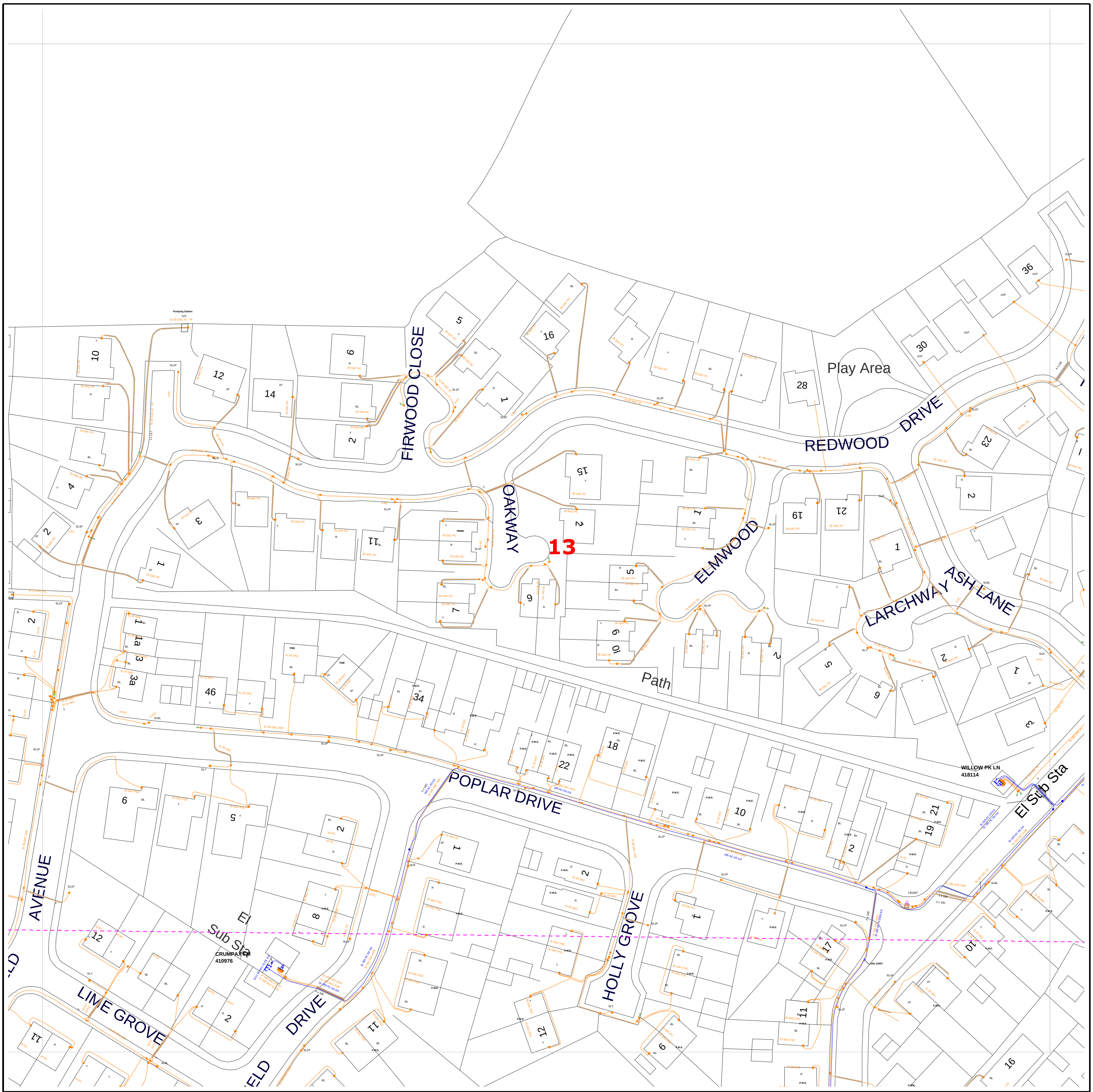

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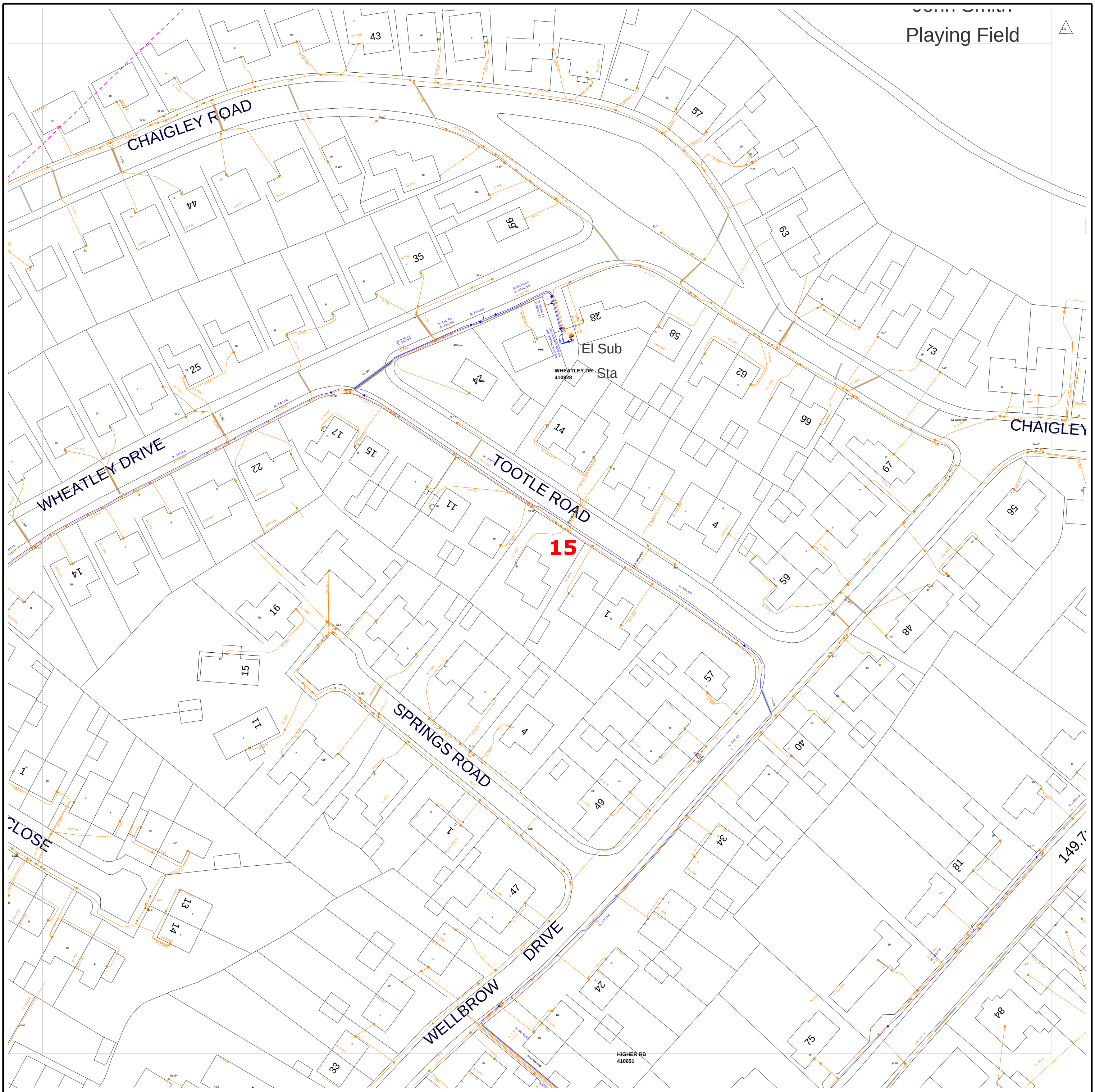

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United Utilities

United Utilites Water Limited
Property Searches
Ground Floor Grasmere House
Lingley Mere Business Park
Great Sankey
Warrington
WA5 3LP
DX 715568 Warrington
Telephone 0370 751 0101
Property.searches@uuplc.co.uk

Barratt Manchester

4 Brindley Road, City Park
Manchester

M16 9HQ

Your Ref: LONGRIDGE - FREDDIE
Our Ref: 14/ 1154561
Date: 10/11/2015

FAO:

Dear Sirs

Location: LONGRIDGE CRICKET CLUB CHIPPING LANE LONGRIDGE PRESTON PR3 2NA

I acknowledge with thanks your request dated 09/11/15 for information on the location of our services.

Please find enclosed plans showing the approximate position of our apparatus known to be in the vicinity of this site. The enclosed plans are being provided to you subject to the United Utilities Terms and Conditions - Wastewater & Water Distribution Plans which are shown overleaf.

I also attach United Utilities' General Condition and Information sheets regarding United Utilities wastewater network and water distribution apparatus, which details contact numbers for additional services (i.e. new supplies, connections, diversions) which we are unable to deal with at this office. You should ensure that the Condition and Information sheets are made available to anyone carrying out any works which may affect our apparatus.

I trust the above meets with you requirements and look forward to hearing from you should you need anything further.

If you have any queries regarding this matter please telephone us on 0370 7510101.

Yours Faithfully,

S McManus.

Sue McManus
Operations Manager
Property Searches

United Utilities Water Limited
Registered in England & Wales No. 2366678
Registered Office: Haweswater House,
Lingley Mere Business Park, Lingley Green Avenue,
Great Sankey, Warrington, WA5 3LP

TERMS AND CONDITIONS - WASTERWATER & WATER DISTRIBUTION PLANS

These provisions apply to the public sewerage, water distribution and telemetry systems (including sewers which are the subject of an agreement under Section 104 of the Water Industry Act 1991 and mains installed in accordance with the agreement for the self construction of water mains) (UUWL apparatus) of United Utilities Water Limited "(UUWL)".

TERMS AND CONDITIONS:

1. This Map and any information supplied with it is issued subject to the provisions contained below, to the exclusion of all others and no party relies upon any representation, warranty, collateral contract or other assurance of any person (whether party to this agreement or not) that is not set out in this agreement or the documents referred to in it.

2. This Map and any information supplied with it is provided for general guidance only and no representation, undertaking or warranty as to its accuracy, completeness or being up to date is given or implied.

3. In particular, the position and depth of any UUWL apparatus shown on the Map are approximate only. UUWL strongly recommends that a comprehensive survey is undertaken in addition to reviewing this Map to determine and ensure the precise location of any UUWL apparatus. The exact location, positions and depths should be obtained by excavation trial holes.

4. The location and position of private drains, private sewers and service pipes to properties are not normally shown on this Map but their presence must be anticipated and accounted for and you are strongly advised to carry out your own further enquiries and investigations in order to locate the same.

5. The position and depth of UUWL apparatus is subject to change and therefore this Map is issued subject to any removal or change in location of the same. The onus is entirely upon you to confirm whether any changes to the Map have been made subsequent to issue and prior to any works being carried out.

6. This Map and any information shown on it or provided with it must not be relied upon in the event of any development, construction or other works (including but not limited to any excavations) in the vicinity of UUWL apparatus or for the purpose of determining the suitability of a point of connection to the sewerage or other distribution systems.

7. No person or legal entity, including any company shall be relieved from any liability howsoever and whensoever arising for any damage caused to UUWL apparatus by reason of the actual position and/or depths of UUWL apparatus being different from those shown on the Map and any information supplied with it.

8. If any provision contained herein is or becomes legally invalid or unenforceable, it will be taken to be severed from the remaining provisions which shall be unaffected and continue in full force and affect.

9. This agreement shall be governed by English law and all parties submit to the exclusive jurisdiction of the English courts, save that nothing will prevent UUWL from bringing proceedings in any other competent jurisdiction, whether concurrently or otherwise.

OS Sheet No: SD6037NE

Scale: 1: 1250 Date: 10/11/2015

Printed By: Property Searches

Refno	Cover	Func	Invert	Size.x	Size.y	Shape	Matl	Length	Grad
5501	120.43	FO							
5502	118.76	FO							
5503		FO	0	225		CI	VC	9.67	
5504	122.91	FO	120.74	375		CI	CO	55.93	27
5505	118.6	FO	116.56	525		CI	CO	49.67	
5506	118.8	FO							
5508		FO							
5510		FO							
5601	119.97	FO	117.63	225		CI	VC	12.29	45
5602	119.58	FO							
5603	118.53	FO							
5604	118.55	SW	115.75	225		CI	VC	69.35	96
5605		FO							
5606		FO	0	225		CI	VC	86.94	
5607		FO							
5608		FO		0		CI	VC	9.93	
5702	119.53	SW	117.86	150		CI	VC	13	162
5703	118.4	SW							
5704	118.41	SW							
5705	117.49	FO							
5706	117.44	SW							
5707	118.91	FO							
5708	118.9	SW							
5709	118.4	FO	116.6	150		CI	VC	18.55	84
5710	118.39	SW	117.03	150		CI	VC	17.9	45
5711		FO							
5712	116.8	FO							
5713	116.8	SW							
5714	116.9	SW							
5715	118.88	SW							
5716	118.9	SW							
5718		FO							
5802	118.8	SW							
5803	118.13	SW							
5804	118.2	SW							
5805	118.19	FO							
5806	118.49	SW							
5807	118.5	FO							
5808	118.5	SW							
5809	118.39	FO							
6501	127.76	FO	0	150		CI	VC	36.12	
6502	125.21	FO							
6601	127.45	FO							
6602	127.43	FO							
6603	123.67	FO							
6604	123.46	FO							
6605	123.56	FO							
6606		SW							
6607		SW	0	375		CI	CO	44.6	
6608	127.48	FO	124.38	375		CI	CO	63.4	29
6609		CO							
6701	120.98	FO	118.58	225		CI	VC	37.66	144
6702	120.69	FO							
6703	121.3	FO							
6704	120.86	SW							
6705		FO	0	939		CI	CO	22.97	
6706	123.31	SW	0	225		CI	CO	55.26	
6707		SW							
6708		SW							
6709		SW	0	375		CI	CO	4.35	
6710	123.15	FO	0	225		CI	VC	54.25	
6711		FO	0	225		CI	VC	22.36	
6712		FO							
6713		SW							
6714		SW							
6715		FO							
6716		FO							
6717	119.53	SW							
6718	120.02	SW							
6719		SW							
6720		FO							
6721		FO							
6722		FO							
6801	121.77	FO	120.33	225		CI	VC	83.39	49
6802	121.77	SW							
6803	121.77	SW							
6805	120.52	FO	118.67	150		CI	VC	18.04	52
6806	120.51	SW	118.79	150		CI	VC	14.81	106
6807	120.21	FO							
6808	120.2	SW							
6809	119.83	FO							
6810	119.79	SW							
6811	119.29	FO							
6812	119.31	SW							
6813	118.83	FO							
7501	134.23	FO	133.25	150		CI	VC	25.04	
7502	134.23	FO	132.78	150		CI	VC	27.21	
7503		CO							
7504		CO							
7601	135.27	FO							
7602	128.42	SW	0	225		CI	VC	6.78	
7604	128.8	FO	127.33	225		CI	VC	18.73	13
7605	131.2	FO	127.99	225		CI	VC	10.05	29
7606	131.2	FO	127.64	225		CI	CO	33.58	26
7608		SW	0	150		CI	VC	10.87	
7701		FO							
7702		SW	0	939		CI	CO	34.37	
7703	131.71	FO	128.44	600		CI	CO	64.34	143
7704		SW	0	939		CI	CO	63.34	
7705		SW	0	939		CI	CO	36.04	
7707		FO		100		CI	VC	16.65	
7708		FO							
7709		SW							
7710		FO							
7711		SW							
7712		FO							
7713		FO							
7801	123.67	FO	121.64	225		CI	VC	33.1	26
7803	123.76	SW	122.78	225		CI	VC	13.59	10
8501	137.78	FO	136.63	150		CI	VC	24.29	78
8502	137.4	FO							
8503	137.24	FO							
8504	137.48	FO	136.81	100		CI	VC	24.07	57
8505	136.58	FO							
8506	137.25	FO							
8507		FO							
8508	136.43	SW	0	150		CI	VC	92.67	
8601	136.16	FO	134.4	225		CI	VC	28.59	34
8602		FO							
8603		FO							
9501	140.88	FO	140.08	150		CI	VC	94.57	27
9601	136.1	FO							
9602	136.6	FO							
9603	137.05	FO							
9604	136.85	FO	134.36	750		CI	CO	27.67	461
9606		FO							
9607	136.8	SW	0	225		CI	VC	29.8	
9608	137.05	SW	135.37	225		CI	VC	14.74	14
9609	136.78	SW							
9611		FO							
9615		FO							
5609		FO		0		CI	VC	27.45	
5719		SW							
6504		CO							
6610		CO							
6611		CO							
6804		SW	120.24	225		CI	VC	5.34	
7603		SW							
7609		FO							
7716		FO							
7718		FO							
7802		SW	121.46	150		CI	VC	13.34	11
8605		FO							
9613		FO							
9614		FO							
9616		FO							
9701		FO							
6503		FO							
7607		SW	0	225		CI	VC	31.82	
7611		CO							

Refno	Cover	Func	Invert	Size.x	Size.y	Shape	Matl	Length	Grad
7719		FO							
9503		FO							
9605		FO							
9617		FO							
9618		FO							
5507		FO							
5701	119.18	SW							
6720		SW							

WASTE WATER SYMBOLOGY

Foul Surface Combined Overflow

Manhole
Manhole, Side Entry
MainSewer, Public
MainSewer, Private
MainSewer, S104
Rising Main, Public
Rising Main, Private
Rising Main, S104
Highway Drain, Private

Foul Surface Combined

WW Site Termination
Air Valve
Cascade
Non Return Valve
Extent of Survey
Flow Meter
Gulley
Hatch Box
Head of System
Hydrobrake / Vortex
Inlet
Inspection Chamber
Bifurcation
Catchpit
Contaminated Surface Water
WW Pumping Station
Sludge Pumping Station
Sewer Overflow
T Junction/Saddle
LampHole
OilInterceptor
PenStock
Pump
RoddingEye
Soakaway
Summit
Valve
Valve Chamber
Washout Chamber
DropShaft
WW Treatment Works
Septic Tank
Vent Column
Network Storage Tank
Orifice Plate
Vortex Chamber
Penstock Chamber
Blind Manhole

Sludge Main, Public
Sludge Main, Private
Sludge Main, S104

ABANDONED PIPE

MainSewer
Rising Main
Highway Drain
Sludge Main

Foul Surface Combined Overflow

Screen Chamber
Discharge Point
Outfall

Control Kiosk
Unspecified

LEGEND

MANHOLE FUNCTION

FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

SEWER SHAPE

CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	HorseShoe
RE	Rectangular	UN	Unspecified
SQ	Square		

SEWER MATERIAL

AC	Asbestos Cement	DI	Ductile Iron
BR	Brick	PVC	Polyvinyl Chloride
PE	Polyethylene	CI	Cast Iron
RP	Reinforced Plastic Matrix	SI	Spun Iron
CO	Concrete	ST	Steel
CSB	Concrete Segment Bolted	VC	Vitrified Clay
CSU	Concrete Segment Unbolted	PP	Polypropylene
CC	Concrete Box Culverted	PF	Pitch Fibre
PSC	Plastic/Steel Composite	MAC	Masonry, Coursed
GRC	Glass Reinforced Concrete	MAR	Masonry, Random
GRP	Glass Reinforced Plastic	U	Unspecified

The position of underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available.
The actual positions may be different from those shown on the plan and private pipes, sewers or drains may not be recorded.
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158 Nodes
Sheet 1 of 1

United Utilities
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SEWER RECORDS

Refno	Cover	Func	Invert	Size.x	Size.y	Shape	Matl	Length	Grad
0501	111.4	FO	110.17	150		CI	VC	25.01	
0603		FO							
0604		FO							
0605		FO							
0702		CO							
0703		CO							
0704		CO							
0801	107.71	FO	106.08	150		CI	VC	26.95	168
0802	108.15	FO							
0803	108.05	FO							
1501	111.49	FO	104.73	525		CI	CO	67.09	216
1502	111.33	FO							
1503	111.48	FO							
1504	111.4	FO	107.97	225		CI	VC	16.75	38
1505	111.36	FO							
1506	111.94	FO							
1507		FO							
1508		FO	0	225		CI	VC	16.15	
1509		FO							
1519		FO							
1601	111.21	FO							
1602	111.32	FO							
1603	111.09	FO							
1604	110.82	FO							
1605	111.06	FO							
1606	111.12	FO							
1607	111.12	FO							
1608	111.47	SW							
1609	111.49	FO							
1610	111.39	FO							
1612		FO	0	225		CI	VC	45.49	
1613		FO	0	225		CI	VC	6.1	
1614		FO	0	225		CI	VC	12.94	
1701	109.24	FO							
1702	110.01	FO							
1703	110.86	FO							
1704	110.63	FO	105.3	300		CI	VC	72.9	
1705	110.15	FO	106.16	225		CI	VC	25.02	35
1706	110.96	FO							
1801	108.2	FO	105.72	300		CI	VC	27.73	1386
1802	108.57	FO							
1804		FO	0	300		CI	VC	15.55	
1901	106.66	SW							
2501	112.35	FO							
2503	113.24	FO	110.21	375		CI	VC	69.64	94
2504	112.57	FO							
2505	112.64	FO	111.01	150		CI	VC	6.42	24
2506	112.67	FO							
2507	113.01	FO	111.51	150		CI	VC	23.42	23
2601	111.86	FO	110.2	225		CI	VC	34.31	191
2602	111.73	FO							
2603	112.22	FO	0	225		CI	VC	21.1	
2604	111.78	SW	110.65	150		CI	VC	41.54	81
2605	111.89	SW							
2701	108.98	FO	0	225		CI	VC	23.26	
2703	109.57	FO							
2704	110.25	FO							
2705	110.19	FO							
2706	109.98	FO							
2708	108.63	SW	0	150		CI	VC	23.03	
2709	108.4	SW							
2710	108.16	SW							
2711	108	SW							
2713	108.73	FO	0	150		CI	VC	19.59	
2714	108.41	FO							
2715	108.09	FO							
2716	107.79	FO							
2717	109.01	FO							
2718	107.3	FO							
2719	106.86	FO	0	225		CI	VC	6.64	
2721	110.59	FO	106.97	375		CI	CO	30.09	501
2722	109.95	FO	107.04	375		CI	CO	15.04	501
2723	109.1	FO	106.86	375		CI	CO	16.17	
2724	109.44	FO							
2725	109.04	FO							
2801	108.56	SW							
2802	110.19	FO	106.87	375		CI	CO	81.37	160
2901	106.75	SW							
3501	112.75	FO	111.87	150		CI	VC	19.99	
3503		FO							
3601	111.25	FO							
3603		FO	0	225		CI	VC	68.36	
3604		FO							
3605	111.34	SW	109.57	375		CI	CO	6.86	86
3606	111.19	SW							
3607	111.62	SW	109.91	375		CI	CO	19.45	61
3608	111.86	SW	110.15	375		CI	CO	15.13	72
3609	112.25	SW	110.55	375		CI	CO	25.68	68
3701	111.32	FO							
3702	111.34	FO							
3703	113.14	FO	111.3	225		CI	VC	67.52	98
3704	111.38	SW	109.9	300		CI	CO	18.72	267
3705	111.43	SW							
3706	111.43	SW							
3707	112.61	FO							
3708	112.53	SW							
3709	111.83	FO	109.29	150		CI	VC	14.61	26
3710	111.72	SW	109.88	375		CI	CO	14	20
3711	111.37	FO							
3712	111.43	SW							
3713	111.24	SW	109.69	150		CI	VC	29.99	60
3714	111.23	FO							
3716		FO							
3718	111.29	FO							
3719	111.32	FO							
3720	111.3	FO							
3721	111.41	FO							
3722	111.88	FO							
3801	110.1	SW							
3802	111.35	FO							
3805	111.11	FO							
4501		FO							
4502		FO							
4503		FO							
4504		FO							
4505		FO							
4601	116.2	FO							
4602	114.13	FO	0	150		CI	VC	39.79	
4603	112.85	SW	111.19	150		CI	VC	49.13	78
4604	113.29	SW	110.55	225		CI	VC	69.42	90
4605	115.79	SW							
4606	112.74	FO	111.41	150		CI	VC	38.19	
4611		FO							
4612		SW							
4619		FO							
4620		FO							
4621		FO							
4701	116.9	FO							
4702	116.65	FO	114.85	150		CI	VC	15.86	17
4703	116.58	SW	115.21	150		CI	VC	19.83	25
4704	115.14	FO							
4705	115.12	SW							
4706		FO							
4707	114.67	SW							
4708	114.11	FO							
4709	114.1	SW							
4710	114.23	FO	112.36	150		CI	VC	13	29
4711	114.25	SW	112.7	225		CI	VC	12.68	32
4712	113.3	FO	111.5	150		CI	VC	16.19	34
4713	113.33	SW	111.83	150		CI	VC	19.75	46
4714	113.44	FO							
4715	113.48	SW							
1512		FO	0	225		CI	VC	54.22	
1513		FO	108.61	375		CI	PE	22.09	69
1516		FO							
1517		FO							
1518		FO							
1615		FO							
1616		FO	0	225		CI	VC	39.96	
1617		FO	108.5	225		CI	PE	13.56	32

Refno	Cover	Func	Invert	Size.x	Size.y	Shape	Matl	Length	Grad
2502		FO	0	150		CI	CI	50.56	
2508		FO	0	225		CI	VC	36.87	
2509		FO	110.74	225		CI	VC	5.62	35
2510		FO	110.51	225		CI	VC	22.73	27
2512		FO							
2707		FO	0	225		CI	VC	32.2	
3504		FO							
3505		FO							
3506		CO							
3508		FO							
3804		FO	0	375		CI	CO	6.62	
4613		SW							
4614		SW							
4616		FO							
4623		FO							
1510		FO	0	150		CI	CI	25.94	
1511		FO							
1514		FO							
1515		FO							
1520		FO							
2511		FO							
3507		FO							
3809		FO							
4615		SW							
4617		FO							
4622		FO							
1803	108.09	FO							
2702	109.25	FO							
2720		FO							
3807		FO	0			CI	DI	6.11	
3808		FO	0			CI	DI	5.77	
1805		FO	0			CI	DI	16.9	
3715		FO	0			CI	PVC	1.88	
3803	111.11	FO							

WASTE WATER SYMBOLOGY

Foul Surface Combined Overflow

- Manhole
- Manhole, Side Entry
- MainSewer, Public
- MainSewer, Private
- MainSewer, S104
- Rising Main, Public
- Rising Main, Private
- Rising Main, S104
- Highway Drain, Private

Foul Surface Combined

- WW Site Termination
- Air Valve
- Cascade
- Non Return Valve
- Extent of Survey
- Flow Meter
- Gulley
- Hatch Box
- Head of System
- Hydrobrake / Vortex
- Inlet
- Inspection Chamber
- Bifurcation
- Catchpit
- Contaminated Surface Water
- WW Pumping Station
- Sludge Pumping Station
- Sewer Overflow
- T Junction/Saddle
- LampHole
- OilInterceptor
- PenStock
- Pump
- RoddingEye
- Soakaway
- Summit
- Valve
- Valve Chamber
- Washout Chamber
- DropShaft
- WW Treatment Works
- Septic Tank
- Vent Column
- Network Storage Tank
- Orifice Plate
- Vortex Chamber
- Penstock Chamber
- Blind Manhole

- Sludge Main, Public
- Sludge Main, Private
- Sludge Main, S104

ABANDONED PIPE

- MainSewer
- Rising Main
- Highway Drain
- Sludge Main

Foul Surface Combined Overflow

- Screen Chamber
- Discharge Point
- Outfall

- Control Kiosk
- Unspecified

LEGEND

MANHOLE FUNCTION

FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

SEWER SHAPE

CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	HorseShoe
RE	Rectangular	UN	Unspecified
SQ	Square		

SEWER MATERIAL

AC	Asbestos Cement	DI	Ductile Iron
BR	Brick	PVC	Polyvinyl Chloride
PE	Polyethylene	CI	Cast Iron
RP	Reinforced Plastic Matrix	SI	Spun Iron
CO	Concrete	ST	Steel
CSB	Concrete Segment Bolted	VC	Vitrified Clay
CSU	Concrete Segment Unbolted	PP	Polypropylene
CC	Concrete Box Culverted	PF	Pitch Fibre
PSC	Plastic/Steel Composite	MAC	Masonry, Coursed
GRC	Glass Reinforced Concrete	MAR	Masonry, Random
GRP	Glass Reinforced Plastic	U	Unspecified

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Scale: 1: 1250 Date: 10/11/2015

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Sheet 1 of 1

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SEWER RECORDS

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OS Sheet No: SD6037NW

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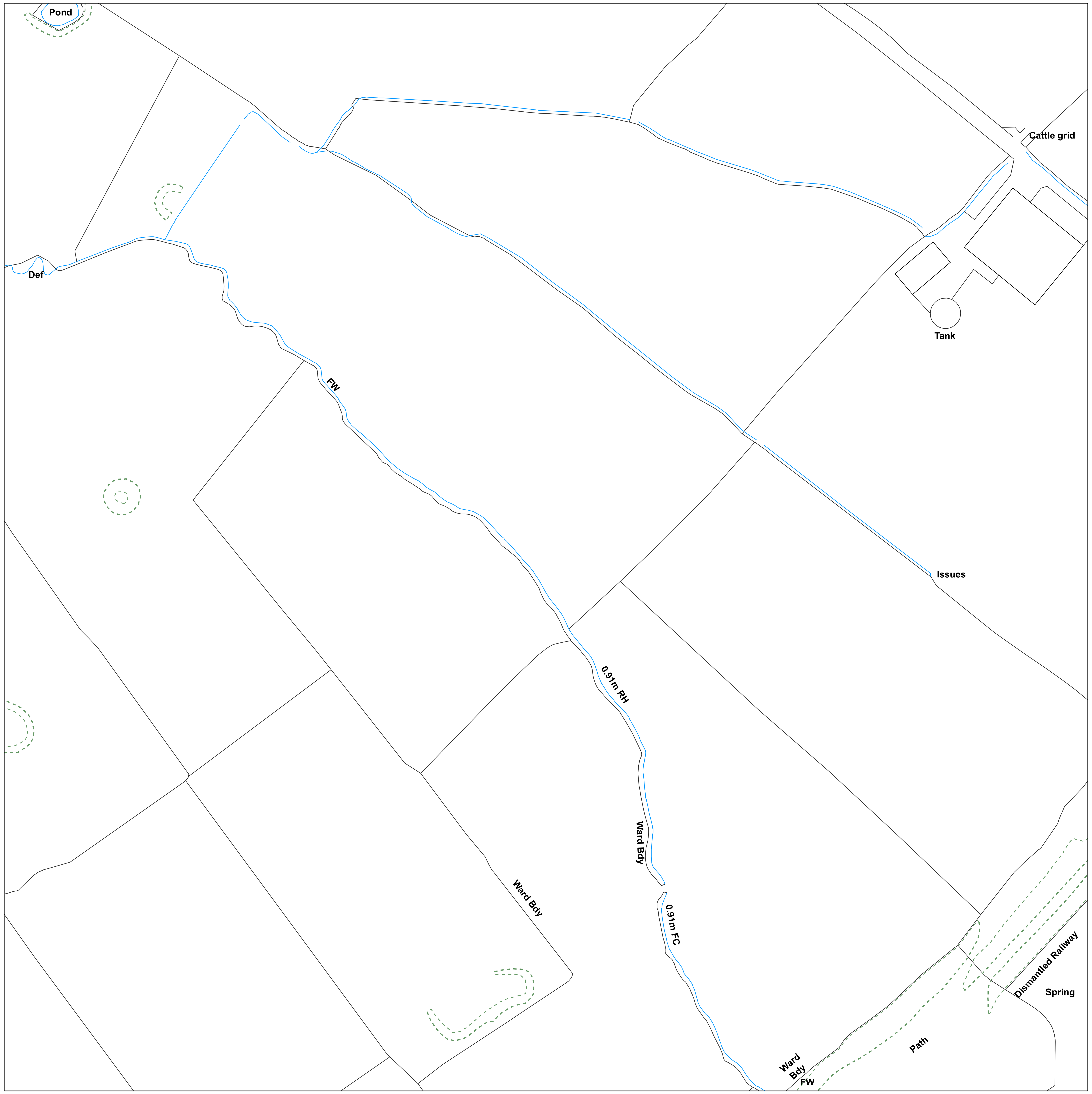

Refno Cover Func Invert Size x Size y Shape Matl Length Grad

Refno Cover Func Invert Size x Size y Shape Matl Length Grad

WASTE WATER SYMBOLOGY

Foul Surface Combined Overflow

Manhole
Manhole, Side Entry
MainSewer, Public
MainSewer, Private
MainSewer, S104
Rising Main, Public
Rising Main, Private
Rising Main, S104
Highway Drain, Private

Foul Surface Combined

WW Site Termination
Air Valve
Cascade
Non Return Valve
Extent of Survey
Flow Meter
Gulley
Hatch Box
Head of System
Hydrobrake / Vortex
Inlet
Inspection Chamber
Bifurcation
Catchpit
Contaminated Surface Water
WW Pumping Station
Sludge Pumping Station
Sewer Overflow
T Junction/Saddle
LampHole
OilInterceptor
PenStock
Pump
RoddingEye
Soakaway
Summit
Valve
Valve Chamber
Washout Chamber
DropShaft
WW Treatment Works
Septic Tank
Vent Column
Network Storage Tank
Orifice Plate
Vortex Chamber
Penstock Chamber
Blind Manhole

Foul Surface Combined Overflow

Screen Chamber
Discharge Point
Outfall

Sludge Main, Public
Sludge Main, Private
Sludge Main, S104

ABANDONED PIPE

MainSewer
Rising Main
Highway Drain
Sludge Main

Control Kiosk
Unspecified

LEGEND

MANHOLE FUNCTION

FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

SEWER SHAPE

CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	HorseShoe
RE	Rectangular	UN	Unspecified
SQ	Square		

SEWER MATERIAL

AC	Asbestos Cement	DI	Ductile Iron
BR	Brick	PVC	Polyvinyl Chloride
PE	Polyethylene	CI	Cast Iron
RP	Reinforced Plastic Matrix	SI	Spun Iron
CO	Concrete	ST	Steel
CSB	Concrete Segment Bolted	VC	Vitrified Clay
CSU	Concrete Segment Unbolted	PP	Polypropylene
CC	Concrete Box Culverted	PF	Pitch Fibre
PSC	Plastic/Steel Composite	MAC	Masonry, Coursed
GRC	Glass Reinforced Concrete	MAR	Masonry, Random
GRP	Glass Reinforced Plastic	U	Unspecified

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OS Sheet No: SD6038SE
Scale: 1: 1250 Date: 10/11/2015
0 Nodes
Sheet 1 of 1

United Utilities
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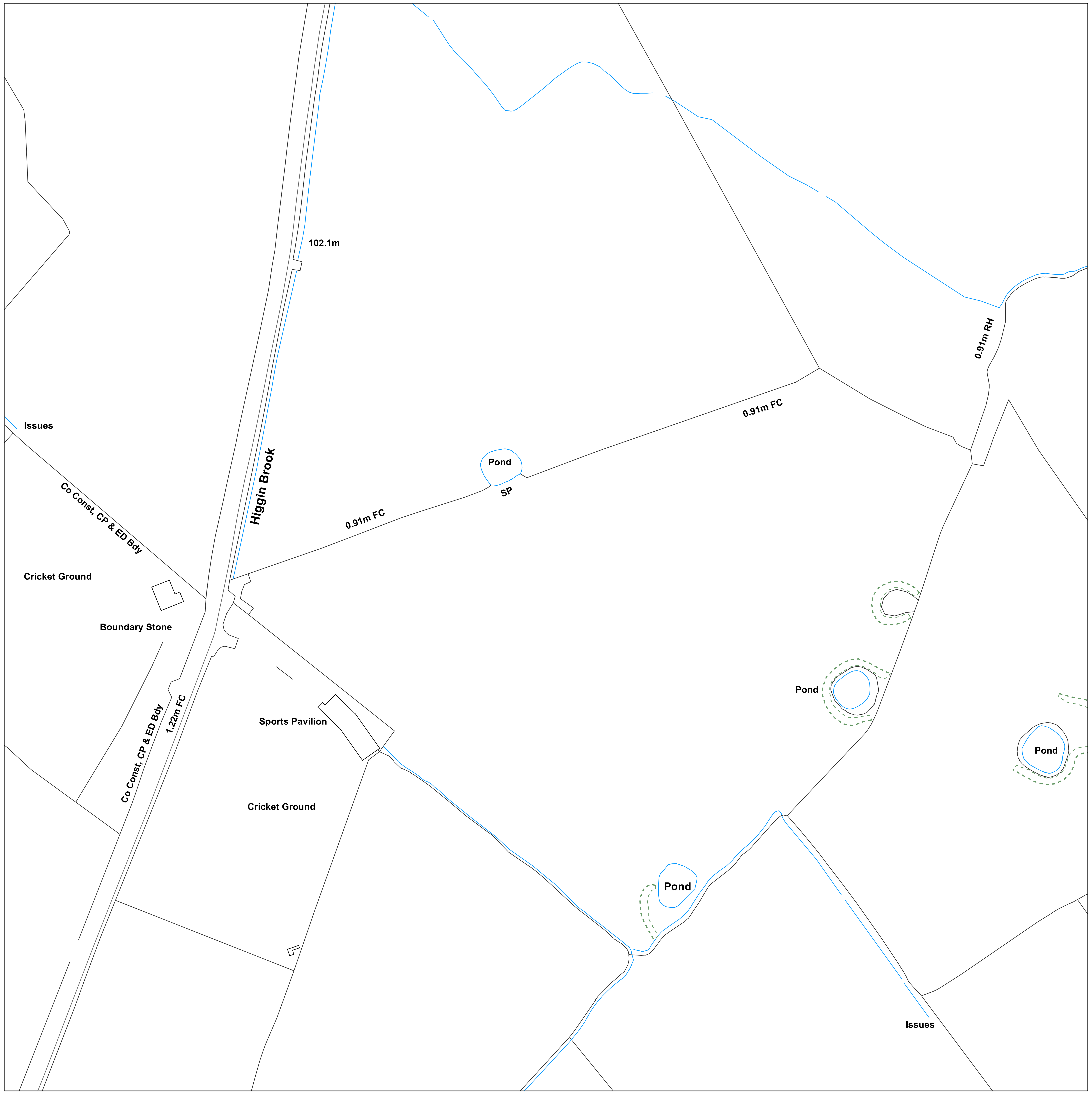
SEWER RECORDS

Printed By: Property Searches

OS Sheet No: SD6038SE

Scale: 1: 1250 Date: 10/11/2015



Refno	Cover	Func	Invert	Size.x	Size.y	Shape	Matl	Length	Grad	Refno	Cover	Func	Invert	Size.x	Size.y	Shape	Matl	Length	Grad

WASTE WATER SYMBOLOGY

Foul Surface Combined Overflow

Manhole
Manhole, Side Entry
MainSewer, Public
MainSewer, Private
MainSewer, S104
Rising Main, Public
Rising Main, Private
Rising Main, S104
Highway Drain, Private

Foul Surface Combined

WW Site Termination
Air Valve
Cascade
Non Return Valve
Extent of Survey
Flow Meter
Gulley
Hatch Box
Head of System
Hydrobrake / Vortex
Inlet
Inspection Chamber
Bifurcation
Catchpit
Contaminated Surface Water
WW Pumping Station
Sludge Pumping Station
Sewer Overflow
T Junction/Saddle
LampHole
OilInterceptor
PenStock
Pump
RoddingEye
Soakaway
Summit
Valve
Valve Chamber
Washout Chamber
DropShaft
WW Treatment Works
Septic Tank
Vent Column
Network Storage Tank
Orifice Plate
Vortex Chamber
Penstock Chamber
Blind Manhole

Sludge Main, Public
Sludge Main, Private
Sludge Main, S104

ABANDONED PIPE

MainSewer
Rising Main
Highway Drain
Sludge Main

Foul Surface Combined Overflow

Screen Chamber
Discharge Point
Outfall

Control Kiosk
Unspecified

LEGEND

MANHOLE FUNCTION

FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

SEWER SHAPE

CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	HorseShoe
RE	Rectangular	UN	Unspecified
SQ	Square		

SEWER MATERIAL

AC	Asbestos Cement	DI	Ductile Iron
BR	Brick	PVC	Polyvinyl Chloride
PE	Polyethylene	CI	Cast Iron
RP	Reinforced Plastic Matrix	SI	Spun Iron
CO	Concrete	ST	Steel
CSB	Concrete Segment Bolted	VC	Vitrified Clay
CSU	Concrete Segment Unbolted	PP	Polypropylene
CC	Concrete Box Culverted	PF	Pitch Fibre
PSC	Plastic/Steel Composite	MAC	Masonry, Coursed
GRC	Glass Reinforced Concrete	MAR	Masonry, Random
GRP	Glass Reinforced Plastic	U	Unspecified

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OS Sheet No: SD6038SW

Scale: 1: 1250 Date: 10/11/2015

0 Nodes

Sheet 1 of 1

United Utilities
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SEWER RECORDS

OS Sheet No: SD6038SW

Scale: 1: 1250 Date: 10/11/2015

Printed By: Property Searches

Legend

PIPE WORK

Live	Proposed	
		Trunk Main - PressurisedMain
		Raw Water Aqueduct - PressurisedMain
		Raw Water Aqueduct - GravityMain
		LDTM Raw Water Distribution - PressurisedMain
		LDTM Raw Water Distribution - GravityMain
		LDTM Treated Water Distribution - PressurisedMain
		LDTM Treated Water Distribution - GravityMain
		Private Pipe - LateralLine
		Distribution Main - PressurisedMain
		Comms Pipe - LateralLine
		Concessionary Service - LateralLine

ABANDONED PIPE

- Trunk Main
- Raw Water Aqueduct
- LDTM Raw Water Distribution
- LDTM Treated Water Distribution
- Private Pipe
- Distribution Main
- Comms Pipe
- Concessionary Service

NODES/ FURNITURE

Live	Proposed	
		End Cap
		CC Valve
		AC Valve
		Air Valve
		Sluice Valve
		Non Return Valve
		Pressure Management Valve
		Change of Char
		Anode
		Chlorination Point
		De Chlorination Point
		Bore Hole
		Inlet Point
		Bulk Supply Point
FH	FH	Fire Hydrant
H	H	Hydrant
PFH	PFH	Private Fire Hydrant
		Pump
		Site Termination
		Service Start
		Service End
PM	PM	Process Meter
		Stop Tap
		Monitor Location
SP	SP	Strainer Point
AP	AP	Access Point
HB	HB	Hatch Box
IP	IP	IP Point
RM		Route Marker
SPT	SPT	Sampling Station
LB	LB	Logger Box

Property Types

Live	Proposed	
		Condition Report
PB	PB	Pipe Bridges
NT	NT	Tunnels (non carrier)
		Pumping Station
		Water Treatment Works
		Private Treatment Works
VH	VH	Valve House
		Water Tower
SR	SR	Service Reservoir
SUP RES	SUP RES	Supply Reservoir
Inlet AP	Inlet AP	Abstraction Point
M	M	Domestic meter
CM	CM	Commercial meter
T	T	Telemetry Outstation

Material Types

AC ASBESTOS CEMENT	OT OTHERS
CI CAST IRON	PB LEAD
CU COPPER	PV uPVC
CO CONCRETE	SI SPUN IRON
DI DUCTILE IRON	ST STEEL
GI GALVANISED IRON	UN UNKNOWN
GR GREY IRON	PE POLYETHYLENE

Lining Types

CL CEMENT LINING	ERL EPOXY RESIN
TB TAR OR BITUMEN	

Insertion Types

DD DIE DRAWN	MO MOLING
DR DIRECTIONAL DRILLING	PI PIPELINE
	SL SLIP LINED

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OS Sheet No: SD6037NE

Scale: 1: 1250

Date: 10/11/2015

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WATER MAIN RECORDS

OS Sheet No: SD6037NE

Scale: 1: 1250 Date: 10/11/2015

Printed By: Property Searches

Printed By: Property Searches

OS Sheet No: SD6037NW

Scale: 1: 1250 Date: 10/11/2015

Legend

PIPE WORK

Live / Proposed

- Trunk Main - PressurisedMain
- Raw Water Aqueduct - PressurisedMain
- Raw Water Aqueduct - GravityMain
- LDTM Raw Water Distribution - PressurisedMain
- LDTM Raw Water Distribution - GravityMain
- LDTM Treated Water Distribution - PressurisedMain
- LDTM Treated Water Distribution - GravityMain
- Private Pipe - LateralLine
- Distribution Main - PressurisedMain
- Comms Pipe - LateralLine
- Concessionary Service - LateralLine

ABANDONED PIPE

- Trunk Main
- Raw Water Aqueduct
- LDTM Raw Water Distribution
- LDTM Treated Water Distribution
- Private Pipe
- Distribution Main
- Comms Pipe
- Concessionary Service

NODES/ FURNITURE

Live / Proposed

- End Cap
- CC Valve
- AC Valve
- Air Valve
- Sluice Valve
- Non Return Valve
- Pressure Management Valve
- Change of Char
- Anode
- Chlorination Point
- De Chlorination Point
- Bore Hole
- Inlet Point
- Bulk Supply Point
- Fire Hydrant
- Hydrant
- Private Fire Hydrant
- Pump
- Site Termination
- Service Start
- Service End
- Process Meter
- Stop Tap
- Monitor Location
- Strainer Point
- Access Point
- Hatch Box
- IP Point
- Route Marker
- Sampling Station
- Logger Box

Property Types

Live / Proposed

- Condition Report
- Pipe Bridges
- Tunnels (non carrier)
- Pumping Station
- Water Treatment Works
- Private Treatment Works
- Valve House
- Water Tower
- Service Reservoir
- Supply Reservoir
- Abstraction Point
- Domestic meter
- Commercial meter
- Telemetry Outstation

Material Types

AC	ASBESTOS CEMENT	OT	OTHERS
CI	CAST IRON	PB	LEAD
CU	COPPER	PV	uPVC
CO	CONCRETE	SI	SPUN IRON
DI	DUCTILE IRON	ST	STEEL
GI	GALVANISED IRON	UN	UNKNOWN
GR	GREY IRON	PE	POLYETHYLENE

Lining Types

CL	CEMENT LINING	ERL	EPOXY RESIN
TB	TAR OR BITUMEN		

Insertion Types

DD	DIE DRAWN	MO	MOLING
DR	DIRECTIONAL DRILLING	PI	PIPELINE
		SL	SLIP LINED

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OS Sheet No: SD6037NW

Scale: 1: 1250 Date: 10/11/2015

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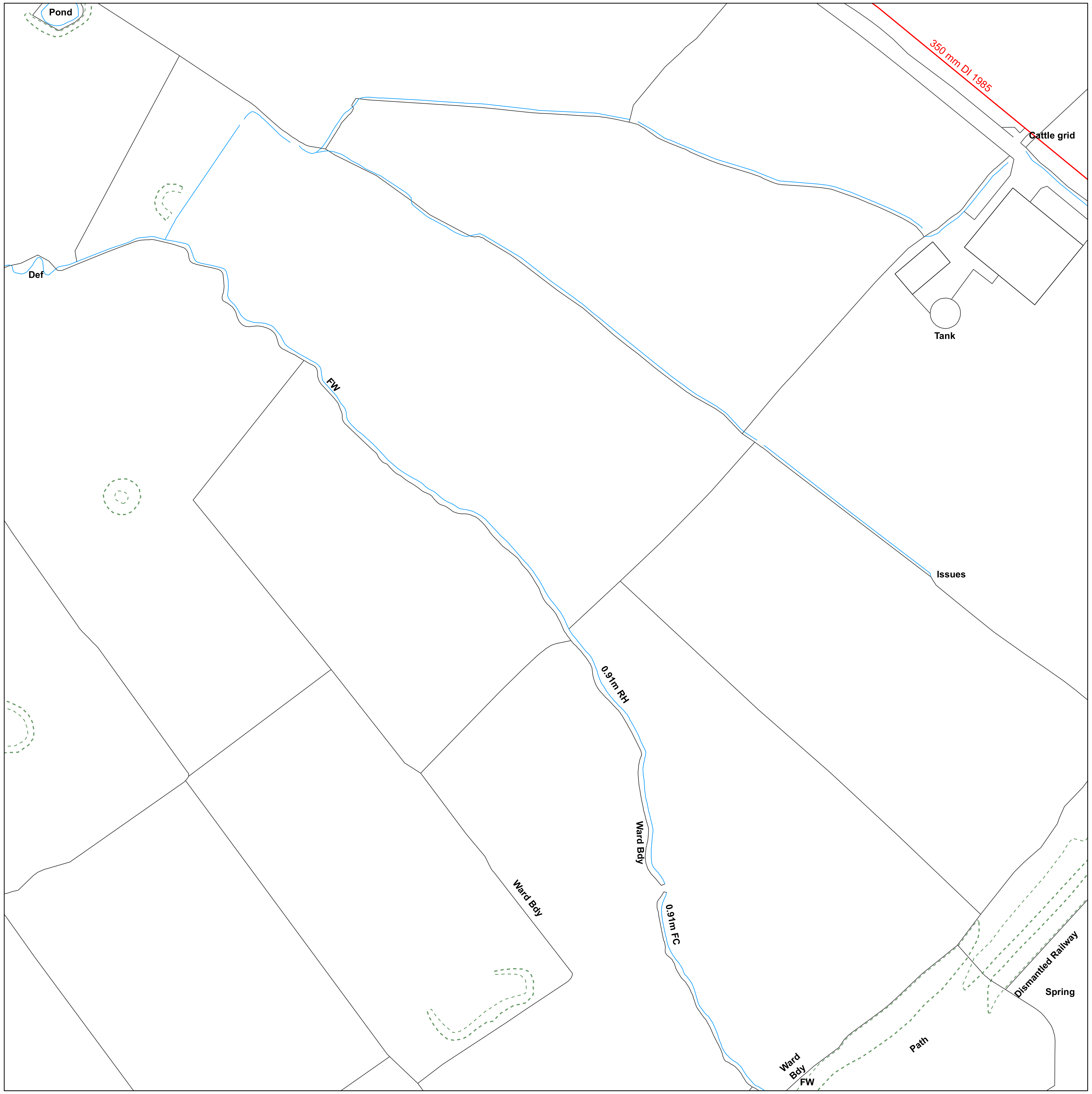
WATER MAIN RECORDS



Legend

PIPE WORK

Live | Proposed

- Trunk Main - PressurisedMain
- Raw Water Aqueduct - PressurisedMain
- Raw Water Aqueduct - GravityMain
- LDTM Raw Water Distribution - PressurisedMain
- LDTM Raw Water Distribution - GravityMain
- LDTM Treated Water Distribution - PressurisedMain
- LDTM Treated Water Distribution - GravityMain
- Private Pipe - LateralLine
- Distribution Main - PressurisedMain
- Comms Pipe - LateralLine
- Concessionary Service - LateralLine

ABANDONED PIPE

- Trunk Main
- Raw Water Aqueduct
- LDTM Raw Water Distribution
- LDTM Treated Water Distribution
- Private Pipe
- Distribution Main
- Comms Pipe
- Concessionary Service

NODES/ FURNITURE

Live | Proposed

- End Cap
- CC Valve
- AC Valve
- Air Valve
- Sluice Valve
- Non Return Valve
- Pressure Management Valve
- Change of Char
- Anode
- Chlorination Point
- De Chlorination Point
- Bore Hole
- Inlet Point
- Bulk Supply Point
- Fire Hydrant
- Hydrant
- Private Fire Hydrant
- Pump
- Site Termination
- Service Start
- Service End
- Process Meter
- Stop Tap
- Monitor Location
- Strainer Point
- Access Point
- Hatch Box
- IP Point
- Route Marker
- Sampling Station
- Logger Box

Property Types

Live | Proposed

- Condition Report
- Pipe Bridges
- Tunnels (non carrier)
- Pumping Station
- Water Treatment Works
- Private Treatment Works
- Valve House
- Water Tower
- Service Reservoir
- Supply Reservoir
- Abstraction Point
- Domestic meter
- Commercial meter
- Telemetry Outstation

Material Types

AC	ASBESTOS CEMENT	OT	OTHERS
CI	CAST IRON	PB	LEAD
CU	COPPER	PV	uPVC
CO	CONCRETE	SI	SPUN IRON
DI	DUCTILE IRON	ST	STEEL
GI	GALVANISED IRON	UN	UNKNOWN
GR	GREY IRON	PE	POLYETHYLENE

Lining Types

CL	CEMENT LINING	ERL	EPOXY RESIN
TB	TAR OR BITUMEN		

Insertion Types

DD	DIE DRAWN	MO	MOLING
DR	DIRECTIONAL DRILLING	PI	PIPELINE
		SL	SLIP LINED

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OS Sheet No: SD6038SE

Scale: 1: 1250 Date: 10/11/2015

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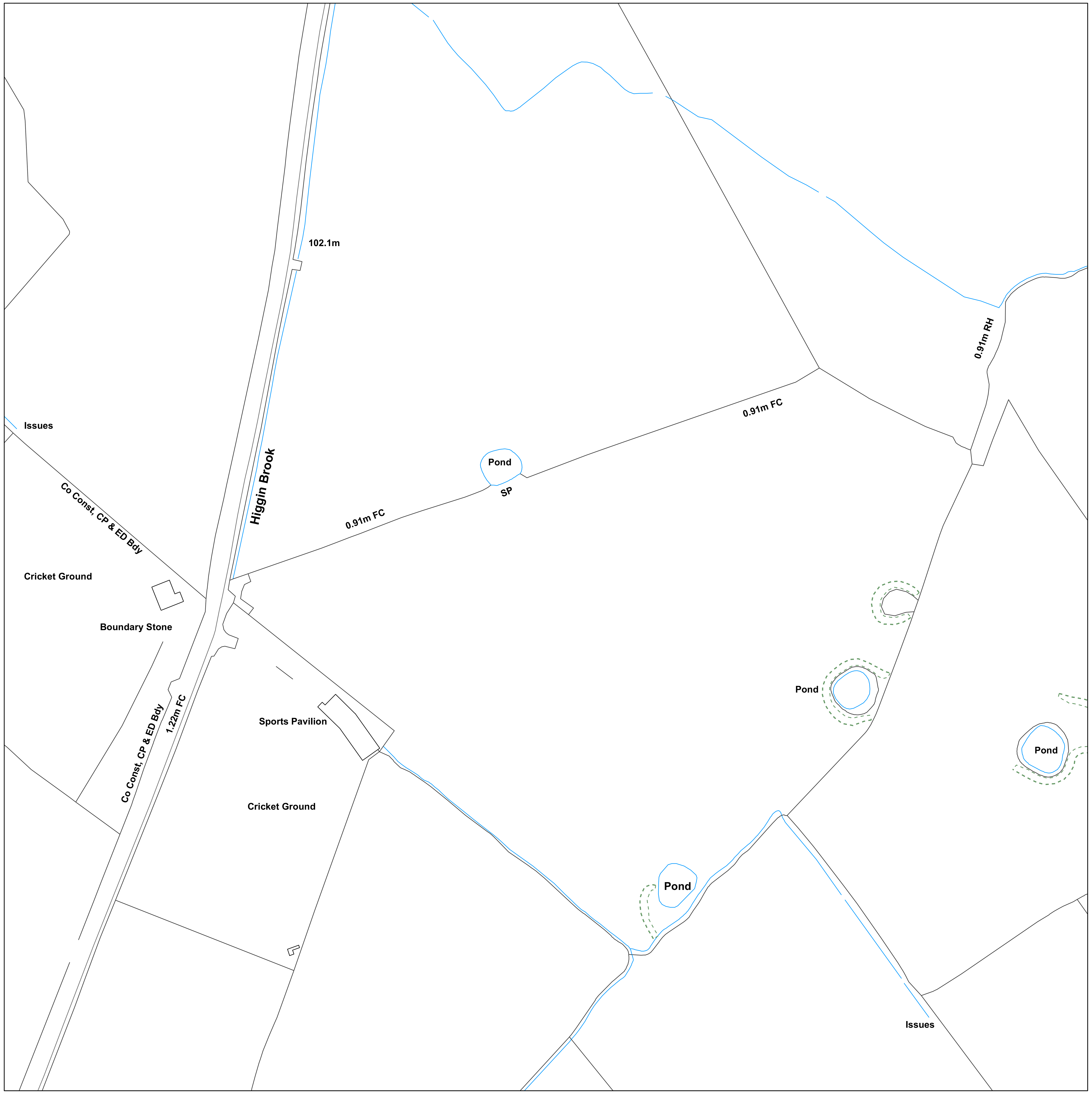
WATER MAIN RECORDS

Printed By: Property Searches

OS Sheet No: SD6038SE

Scale: 1: 1250 Date: 10/11/2015



Legend

PIPE WORK

Live | Proposed

- Trunk Main - PressurisedMain
- Raw Water Aqueduct - PressurisedMain
- Raw Water Aqueduct - GravityMain
- LDTM Raw Water Distribution - PressurisedMain
- LDTM Raw Water Distribution - GravityMain
- LDTM Treated Water Distribution - PressurisedMain
- LDTM Treated Water Distribution - GravityMain
- Private Pipe - LateralLine
- Distribution Main - PressurisedMain
- Comms Pipe - LateralLine
- Concessionary Service - LateralLine

ABANDONED PIPE

- Trunk Main
- Raw Water Aqueduct
- LDTM Raw Water Distribution
- LDTM Treated Water Distribution
- Private Pipe
- Distribution Main
- Comms Pipe
- Concessionary Service

NODES/ FURNITURE

Live | Proposed

- End Cap
- CC Valve
- AC Valve
- Air Valve
- Sluice Valve
- Non Return Valve
- Pressure Management Valve
- Change of Char
- Anode
- Chlorination Point
- De Chlorination Point
- Bore Hole
- Inlet Point
- Bulk Supply Point
- Fire Hydrant
- Hydrant
- Private Fire Hydrant
- Pump
- Site Termination
- Service Start
- Service End
- Process Meter
- Stop Tap
- Monitor Location
- Strainer Point
- Access Point
- Hatch Box
- IP Point
- Route Marker
- Sampling Station
- Logger Box

Property Types

Live | Proposed

- Condition Report
- Pipe Bridges
- Tunnels (non carrier)
- Pumping Station
- Water Treatment Works
- Private Treatment Works
- Valve House
- Water Tower
- Service Reservoir
- Supply Reservoir
- Abstraction Point
- Domestic meter
- Commercial meter
- Telemetry Outstation

Material Types

AC ASBESTOS CEMENT	OT OTHERS
CI CAST IRON	PB LEAD
CU COPPER	PV uPVC
CO CONCRETE	SI SPUN IRON
DI DUCTILE IRON	ST STEEL
GI GALVANISED IRON	UN UNKNOWN
GR GREY IRON	PE POLYETHYLENE

Lining Types

CL CEMENT LINING	ERL EPOXY RESIN
TB TAR OR BITUMEN	

Insertion Types

DD DIE DRAWN	MO MOLING
DR DIRECTIONAL DRILLING	PI PIPELINE
	SL SLIP LINED

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OS Sheet No: SD6038SW

Scale: 1: 1250

Date: 10/11/2015

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WATER MAIN RECORDS

Printed By: Property Searches

OS Sheet No: SD6038SW

Scale: 1: 1250 Date: 10/11/2015

United Utilities

WASTE WATER SYMBOLOGY

Foul | Surface | Combined | Overflow

- Manhole
- Manhole, Side Entry
- MainSewer, Public
- MainSewer, Private
- MainSewer, S104
- Rising Main, Public
- Rising Main, Private
- Rising Main, S104
- Highway Drain, Private

Overflow

- Sludge Main, Public
- Sludge Main, Private
- Sludge Main, S104

Abandoned Pipe

- MainSewer
- Rising Main
- Highway Drain
- Sludge Main

Foul | Surface | Combined

- Septic Tank
- Vent Column
- Network Storage Tank
- Orifice Plate
- Vortex Chamber
- Penstock Chamber
- Blind Manhole

Foul | Surface | Combined

- WW Site Termination
- Air Valve
- Cascade
- Non Return Valve
- Extent of Survey
- Flow Meter
- Gulley
- Hatch Box
- Head of System
- Hydrobrake / Vortex
- Inlet
- Inspection Chamber
- Bifurcation
- Catchpit
- WW Pumping Station

Foul | Surface | Combined

- Sludge Pumping Station
- Sewer Overflow
- T Junction/Saddle
- LampHole
- OilInterceptor
- PenStock
- Pump
- RoddingEye
- Soakaway
- Summit
- Valve
- Valve Chamber
- Washout Chamber
- DropShaft
- WW Treatment Works

Foul | Surface | Combined | Overflow

- Screen Chamber
- Discharge Point
- Outfall
- Control Kiosk
- Unspecified

Legend

MANHOLE FUNCTION

FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

SEWER SHAPE

CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	HorseShoe
RE	Rectangular	UN	Unspecified
SQ	Square		

SEWER MATERIAL

AC	Asbestos Cement	DI	Ductile Iron
BR	Brick	VC	Vitrified Clay
CO	Concrete	PP	Polypropylene
CSB	Concrete Segment	PF	Pitched Fibre
CSU	Concrete Segment	MA	Masonry, Coursed
CC	Concrete Box Culverted	MA	Masonry, Random
PSC	Plastic / Steel	RP	Reinforced Plastic
GR	Glass Reinforced	CI	Cast Iron
GRP	Glass Reinforced	SI	Spun Iron
PVC	Polyvinyl Chloride	ST	Steel
PE	Polyethylene	U	Unspecified

CLEAN WATER SYMBOLOGY

PIPE WORK

Live | Proposed

- Trunk Main - PressurisedMain
- Raw Water Aqueduct - PressurisedMain
- Raw Water Aqueduct - GravityMain
- LDTM Raw Water Distribution - PressurisedMain
- LDTM Raw Water Distribution - GravityMain
- LDTM Treated Water Distribution - PressurisedMain
- LDTM Treated Water Distribution - GravityMain
- Private Pipe - LateralLine
- Distribution Main - PressurisedMain
- Comms Pipe - LateralLine
- Concessionary Service - LateralLine

ABANDONED PIPE

- Trunk Main
- Raw Water Aqueduct
- LDTM Raw Water Distribution
- LDTM Treated Water Distribution
- Private Pipe
- Distribution Main
- Comms Pipe
- Concessionary Service

NODES/FURNITURES

Live | Proposed

- End Cap
- CC Valve
- AC Valve
- Air Valve
- Sluice Valve
- Non Return Valve
- Pressure Management Valve
- Change of Characterstic
- Anode
- Chlorination Point
- De Chlorination Point
- Bore Hole
- Inlet Point
- Bulk Supply Point
- Fire Hydrant
- Hydrant

Live | Proposed

- Private Fire Hydrant
- Pump
- Site Termination
- Service Start
- Service End
- Process Meter
- Stop Tap
- Monitor Location
- Strainer Point
- Access Point
- Hatch Box
- IP Point
- Route Marker
- Sampling Station
- Logger Box

PROPERTY TYPES

Live | Proposed

- Condition Report
- Pipe Bridges
- Tunnels (non carrier)
- Pumping Station
- Water Treatment Works
- Private Treatment Works

Live | Proposed

- Valve House
- Water Tower
- Service Reservoir
- Supply Reservoir
- Abstraction Point
- Domestic meter
- Commercial meter
- Telemetry Outstation

Legend

MATERIAL TYPES

AC	ASBESTOS CEMENT
CI	CAST IRON
CU	COPPER
CO	CONCRETE
DI	DUCTILE IRON
GI	GALVANISED IRON
GR	GREY IRON
OT	OTHERS
PB	LEAD
PV	uPVC
SI	SPUN IRON
ST	STEEL
UN	UNKONWN
PE	POLYETHYLENE

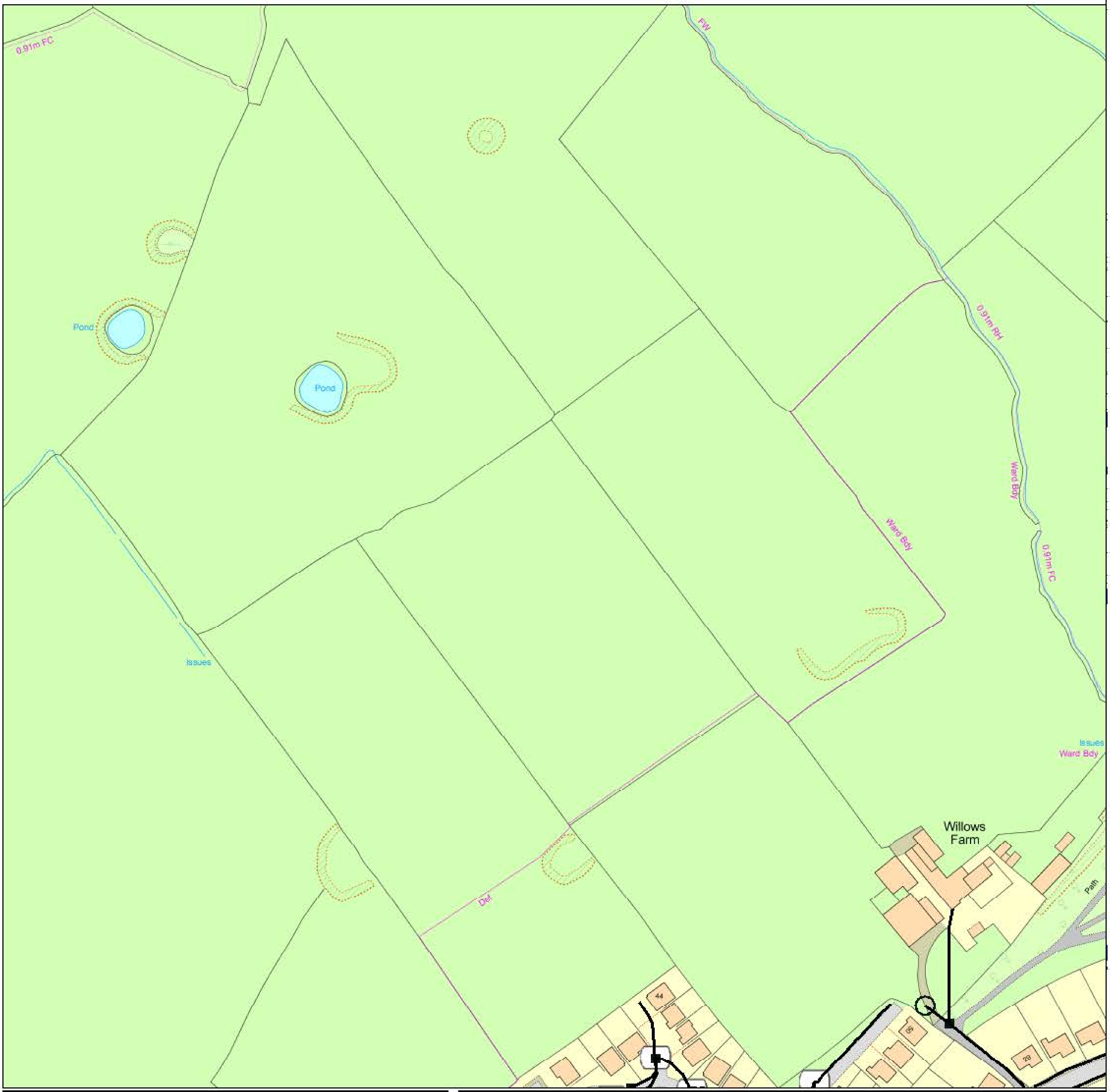
LINING TYPES

CL	CEMENT LINING
TB	TAR OR BITUMEN
ERL	EPOXY RESIN

INSERTION TYPES

DD	DIE DRAWN
DR	DIRECTIONAL DRILLING
MO	MOLING
PI	PIPELINE
SL	SLIP LINED

Maps by email Plant Information Reply



IMPORTANT WARNING

Information regarding the location of BT apparatus is given for your assistance and is intended for general guidance only. No guarantee is given of its accuracy.
It should not be relied upon in the event of excavations or other works being made near to BT apparatus which may exist at various depths and may deviate from the marked route.

DIAL BEFORE YOU DIG

FOR PROFESSIONAL ON SITE ASSISTANCE PRIOR TO COMMENCEMENT OF EXCAVATION WORKS

ADVANCE NOTICE REQUIRED
(Office hours: Monday-Friday 08.00 to 17.00)

Tel: 0800 9173993
E-mail: dbyd@openreach.co.uk
Website: www.dialbeforeyoudig.com

KEY TO BT SYMBOLS

	UNDERGROUND PLANT		POLE
A/C, D/W or W	OVERHEAD PLANT		CABINET
	JOINT BOX		BURIED JOINT
456 OR 456	DISTRIBUTION POINT	J	JOINTING POST
OR 72	MANHOLE		PROPOSED U/G
	DP BOUNDARY	A/C, D/W or W	PROPOSED O/H
OR	OTHER BT BOUNDARY		PROPOSED BOX

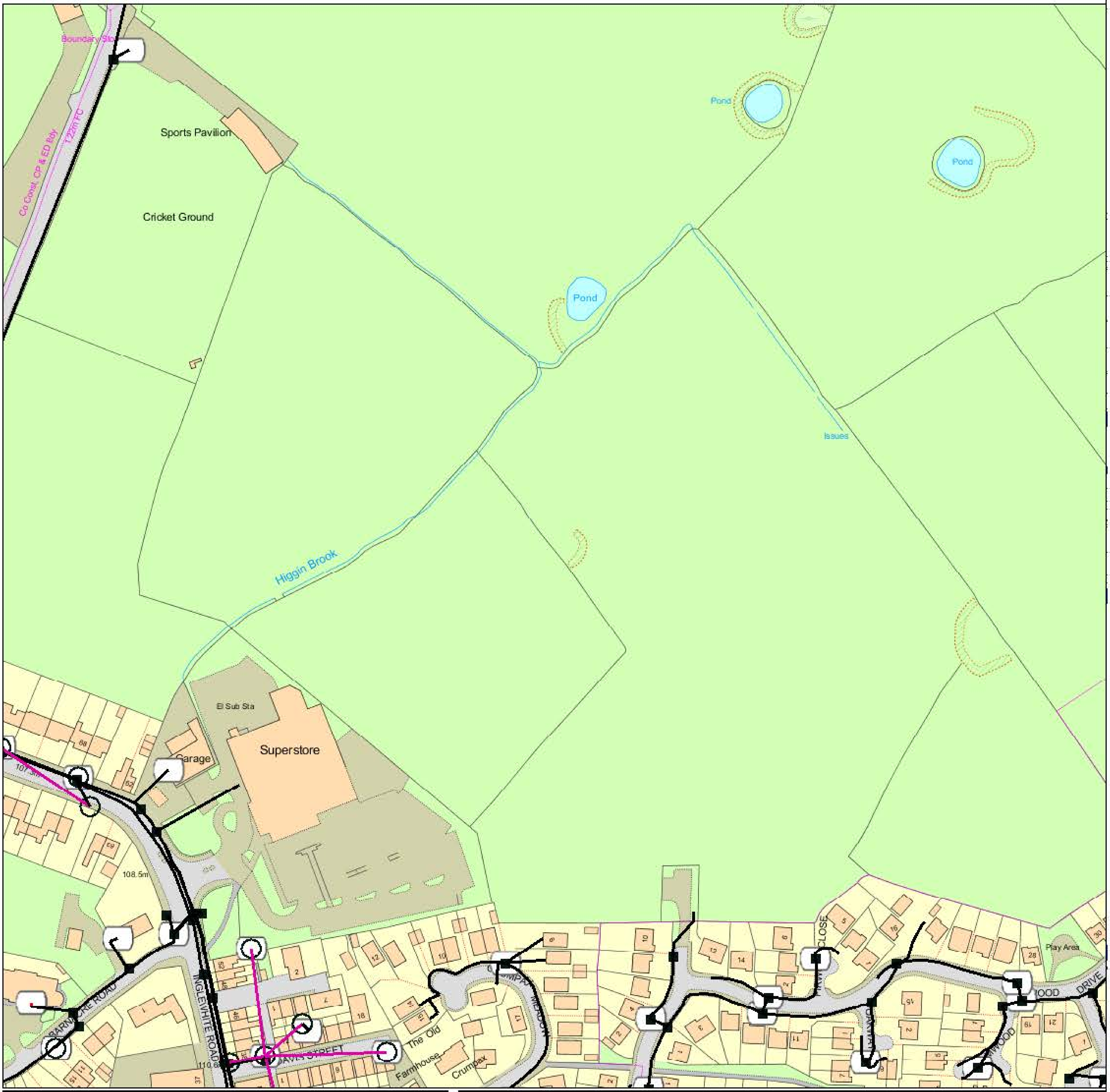
Other proposed plant is shown using dashed lines. BT symbols not listed above may be disregarded. Existing BT plant may not be recorded. Information valid at the time of preparation.

openreach
a BT Group business
BT

BT Ref : SFE10281D
Map Reference : (centre) SD6058538084
Easting/Northing : (centre) 360585,438084
Issued : 09/11/2015 10:29:12

FOOTNOTE: WARNING IT IS ESSENTIAL THAT YOU CONTACT NATIONAL NETWORK HANDLING CENTRE BY EMAIL nnhc@openreach.co.uk BEFORE PROCEEDING WITH ANY WORK IN THE HATCHED AREA

Maps by email Plant Information Reply



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DIAL BEFORE YOU DIG

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ADVANCE NOTICE REQUIRED
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Tel: 0800 9173993
E-mail: dbyd@openreach.co.uk
Website: www.dialbeforeyoudig.com

KEY TO BT SYMBOLS

	UNDERGROUND PLANT		POLE
A/C, D/W or W	OVERHEAD PLANT		CABINET
	JOINT BOX		BURIED JOINT
456 OR 456	DISTRIBUTION POINT	J	JOINTING POST
OR 72	MANHOLE		PROPOSED U/G
	DP BOUNDARY	A/C, D/W or W	PROPOSED O/H
OR	OTHER BT BOUNDARY		PROPOSED BOX

Other proposed plant is shown using dashed lines. BT symbols not listed above may be disregarded. Existing BT plant may not be recorded. Information valid at the time of preparation.

openreach
a BT Group business
BT

BT Ref : WEU10283I
Map Reference : (centre) SD6029637980
Easting/Northing : (centre) 360296,437980
Issued : 09/11/2015 10:28:47

FOOTNOTE: WARNING IT IS ESSENTIAL THAT YOU CONTACT NATIONAL NETWORK HANDLING CENTRE BY EMAIL nnhc@openreach.co.uk BEFORE PROCEEDING WITH ANY WORK IN THE HATCHED AREA

Maps by email Plant Information Reply

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DIAL BEFORE YOU DIG

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(Office hours: Monday-Friday 08.00 to 17.00)

Tel: 0800 9173993
E-mail: dbyd@openreach.co.uk
Website: www.dialbeforeyoudig.com

KEY TO BT SYMBOLS

	UNDERGROUND PLANT		POLE
A/C, D/W or W	OVERHEAD PLANT		CABINET
	JOINT BOX		BURIED JOINT
456 OR 456	DISTRIBUTION POINT	J	JOINTING POST
OR 72	MANHOLE		PROPOSED U/G
	DP BOUNDARY	A/C, D/W or W	PROPOSED O/H
OR	OTHER BT BOUNDARY		PROPOSED BOX

Other proposed plant is shown using dashed lines. BT symbols not listed above may be disregarded. Existing BT plant may not be recorded. Information valid at the time of preparation.

openreach
a BT Group business
BT

BT Ref : WRN10294F
Map Reference : (centre) SD6018638227
Easting/Northing : (centre) 360186,438227
Issued : 09/11/2015 10:29:32

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Bowland Meadows, Land East of Chipping Lane, Longridge

Phase 1 Detailed Desk Top Study

Curtin's Ref: EB1355/GL/3692

Revision: A

Issue Date: 14 April 2014

Client Name: Barratt Homes

Client Address: 4 Brindley Road, City Park, Manchester, M16 9HQ

Site Address: Bowland Meadow, Land East of Chipping Lane, Longridge

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For and on behalf of **Curtins**

Planning Guidance: Contamination Statement
Does the site described herein involve any of the following: a. Land which is known to be contaminated? **No** b. Land where contamination is suspected for all or part of the site? **Yes** c. A proposed use that would be particularly vulnerable to the presence of contamination? **Yes**

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1.0 Introduction

In April 2014 Curtins were instructed by Barratt Homes to undertake a Phase 1 Geo-Environmental Detailed Desk Top Study, of a site located on Bowland Meadow, Land East of Chipping Lane, Longridge.

The site is centred on national grid reference 360130, 438020 with an area of 7.22ha. A location plan can be found in Appendix A1.

It is understood that proposals are for new residential development. The site is currently occupied open fields and farmland.

Scope of Phase 1 Investigation – Detailed Desk Top Study

The desk top study is to be undertaken, principally, to provide an overview of the geo-environmental setting of the site of interest with a brief assessment of any risks that could be presented to site users and the wider environment.

Additionally the desk top study should provide information that could be used to ascertain the extent of any in-situ geo-environmental investigation required to confirm the site conceptual model developed in the desk top study. The desk top study provides an initial view in respect of the status of the site with regard to:

- The potential impact on the site of interest from surrounding land uses and other environmental factors.
- Potential contamination of the site strata by historical and or current use.
- The potential impact on the wider environment by historical and or current use of the site of interest.
- Potential problems associated with geological features such as faulting, mineral extraction, mining and land instability.
- The location of apparent sub-surface structures that may affect the proposed redevelopment.
- The location of above-surface features that may affect the proposed redevelopment.

2.0 Phase 1 – Detailed Desk Top Study

In accordance with the scope identified in Section 1.1, this desk top study has been undertaken using the following data sources and involves no intrusive investigations or testing.

- Envirocheck Report.
- British Geological Society 1:50,000 map.
- British Geological Society website.
- Environment Agency website.
- Local Authority records.
- Radon Atlas for England and Wales.

2.1 Previous Site Use

Since the earliest historical map dated 1893 the site has been occupied by open fields and farmland. To the north and north east of the site boundary approximately 50-100m are a number of small ponds bounded by embankments. The historical maps illustrate no existing buildings or developments and have remained unchanged up until the most recent historical map dated 2013.

2.2 Surrounding Land Use

Since 1893 the surrounding area adjacent to the site is bound by Chipping Lane to the east and Higher Lane to the south. Pit street mill is illustrated to the south east of the site approximately 20m away and a cluster of residential housing and farm houses including Berry Farm and Crumpax Farm are located approximately 50-60m from the site. Additionally illustrated on the map is a drinking fountain/trough suspected to be associated with the surrounding farms. Adjacent south west of the site are several buildings labelled Alston Arms and west of the site boundary approximately 50m is an iron and brass foundry.

During 1895 the surrounding area illustrates the development of a number of works, mills and factories, including a gas works and a foundry circa 50m south west of the site. South Longridge is continuing to be developed. Another significant development to the area was a railway line running approximately 500m from site, and several mills and a quarry to the east.

From 1913 onwards steady urban expansion continued, and by 1932 this had slowed. A brook is now shown running adjacent to the western boundary.

From 1961 to 1967 the surrounding area expanded significantly, with the closest developments occurring approximately 10-30m from the site (Frey Stocks) and a garage south east of the site.

By 1970 the railway running adjacent to the mills and factories towards the south east was dismantled

The pattern of redevelopment to the surrounding area continues, however not within close proximity of the site.

The site remains predominantly unchanged up to the most recent historical map dated 2013.

2.3 Mapping Data Recorded in the Envirocheck Report

The Envirocheck report contains historical ordnance survey maps (Lancashire and Furness) as identified below.

- 1:2,500 scale maps provided for the survey publication of 1893, 1912, 1932, 1967, 1975, 1975-1992, 1978-1987, 1981-1982, 1992, 1994, 1995, 1996,
- 1:10,000 scale maps for the survey publication of 1956, 1968, 1970, 1976, 1994, 2001, 2006 and 2013.
- 1:10,560 scale maps for the survey publication of 1847, 1895, 1913-1914 and 1932,

A summary of the map records is provided on the following pages; a copy of all maps obtained can be referred to in Appendix A2.

Date	Scale	Description
1:1,250 and 1:2,500 Scale Mapping		
1893	1:2,500	The site is occupied by open fields with occasional woodland. The far north eastern corner illustrates a small pond surrounded by sparse woodland. The sites surrounding area adjacent bounding the site is Chipping Lane to the east and Higher Lane to the south. Pit street mill is illustrated to the south east of the site approximately 20m and a cluster of residential housing and farm houses including Berry Farm and Crumpax Farm approximately 50-60m from the site, also illustrated is a drinking fountain/trough suspected to be associated with the surrounding farms. To the south west of the site approximately 50m is Iron and Brass Foundry. Adjacent south west of the site are a few buildings labelled Alston Arms. West of the site boundary approximately 50m in iron and brass foundry. Surrounding the site towards the east and north east are a number of small ponds between 50-100m from the site boundary.
1912	1:2,500	The site and surrounding are remains the same as the previous historical map.
1932	1:2,500	The site remains the same as the previous historical map with a small potential spring towards the south eastern boundary of the site. The surrounding area remains predominantly unchanged apart from Bobbin Works which is now illustrated. Higgin Brook runs adjacent to site on the western boundary.

1961-1967	1:2,500	The site remains undeveloped. Higgin Brook is now labelled on the eastern site if the site. The surrounding area illustrates significant residential housing developments south and south east adjacent to and approximately 50-100m from the site boundary. Further south (100m) of the residential buildings is a large building labelled Fell View. There is a large building illustrated and labelled as Ashley Dairy, which is likely to be associated with the surrounding farm land. To the south western corner of the site boundary approximately 10-30m are a few small buildings labelled as Frey Stocks. To the south east of the site adjacent is a number of small buildings labelled as a garage. To the north and north east of the site boundary approximately 50-100m are a number of small ponds bounded by embankments.
1975	1:2,500	South east tiles illustrated only. No significant changes to the site or surrounding area, apart from Ashley Dairy building appears to have been demolished and rebuilt and to the south approximately 50-100m from the site are a number of residential homes with associated gardens.
1975-1992	1:2,500	South and Western tiles illustrated only. No significant changes made to the site. Surrounding area remains predominantly the same apart from a newly established Longridge County Primary School.
1978-1987	1:2,500	Southern tiles illustrated only. No significant changes have been made. The surrounding area illustrates no significant changes, apart from residential developments 100m from the site boundary in the south east.
1981-1992	1:2,500	The site and surrounding area remains predominantly the same with no significant changes made.
1992	1:2,500	South east tiles not illustrated, no significant changes the site or surrounding area.
1994	1:2,500	The site remains the same as the previous historical map. The surrounding area remains unchanged from the previous historical map.
1995	1:2,500	South east tiles illustrated only. There are no significant changes made to the site or surrounding area.
1996	1:1,250	South east tiles illustrated only. There are no significant changes made to the site or surrounding area.
1:10,560 & 1:10,000 Scale Mapping		
1847	1:10,560	The site is open fields and occasional woodland. The surrounding are illustrates no infrastructure only occasional small ponds and farmland with woodland.

1895	1:10,560	The site remains the same as the previous historical map. The surrounding area illustrates a number of works, mills and factories approximately 100-150m south east including a gas works and a foundry approximately 50m south west of the site boundary. South east 250-500m illustrates the small town of Longridge being developed. There are a number of schools and churches. There is a police station south west, bobbin works and stone bridge mill adjacent to a railway line running south east approximately 500m from site. Towards the east approximately 500m is Victoria Mill and 700-800m is Lords Quarry.
1913-1914	1:10,560	The site remains the same as the previous historical map. The surrounding are towards the west of the site boundary approximately 100m is Poplar Foundry (Iron and Brass) and Belmont Foundry approximately 500m. Towards the southern edge of the site 100m is Pitt Street Mill. The surrounding area illustrates minor changes showing slight development of residential dwellings in the nearby town of Longridge. 500m South east illustrates two small reservoir adjacent to Victoria Cotton Mill.
1932	1:10,560	The site remains the same as the previous historical map. The surrounding area remains predominantly unchanged illustrating increasing density of Longridge town and residential dwelling towards the south of the site.
1956	1:10,000	The site and surrounding area remain predominantly unchanged.
1968	1:10,000	Western tiles illustrated only. No significant changes to the site or surrounding are.
1970	1:10,000	Eastern tiles illustrated only. No significant changes made to site. The surrounding area illustrates increase in residential buildings and Longridge town is now expanding. The railway running adjacent to the mills and factories towards the south east has now been dismantled.
1976	1:10,000	No tiles illustrated on map.
1994	1:10,000	The site remains the same as the previous historical map. The brass and iron foundries towards the west of the site boundary approximately 500m have now been demolished and there are now a number of farmhouses, cottages and a home for the aged. Towards the south west approximately 500m is a large pond with a number of small buildings bounding the southern side adjacent to Halfpenny Lane labelled as a substation. The gas works and mills to the south of the site approximately 500m appear to have been demolished. There are now a number of schools around the area and residential housing. However there are still a number of works surround the site approximately 800m south and 500m towards the east side of the site boundary.

2001	1:10,000	The site remains the same as the previous historical map. The surrounding area illustrates little changes. Adjacent to the site on the eastern boundary is a large superstore. Adjacent to the north east corner of the site is a cricket ground and associated Pavilion building.
2006	1:10,000	The site and surrounding area remain predominantly unchanged from the previous historical map.
2013	1:10,000	The site and surrounding area remains the same as the previous historical map.

2.4 Geographical and Special Features

No geographical and/or special features are recorded that could potentially affect redevelopment.

2.5 Geology

A study of the Envirocheck records and British Geological Survey (BGS) 1:50,000 mapping records (Bedrock and Superficial Editions) for Garstang (Sheet 067) indicates the following geological succession underlying the site.

Rock Name	Rock Type	Geological Age
Till, Devensian	Diamicton	Devensian - Devensian
Bowland Shale Formation	Mudstone and Siltstone	Yeadonian - Yeadonian

There are three fault lines within 1000m of the site.

There are no BGS boreholes located within close proximity to the site.

The Envirocheck Report confirms that there is a low risk to no hazard from the following ground stability hazards on and around the site; running sands, shrinking or swelling clay, collapsible ground, landslides and ground dissolution, however, there is a high risk potential for compressible ground stability hazards.

Both the Radon Atlas for England and Wales, and the Envirocheck Report confirm that the site is in an intermediate probability radon area, as between 1 and 3% of homes are above the action level, however no radon protective measures are deemed necessary in the construction of new dwellings or extensions.

2.5.1 Mining

There are five BGS Recorded Mineral Sites located within 1000m of the site of interest. The closest is located 403m North West.

The Envirocheck report confirms that the site is within an area which is highly unlikely to be affected by coal mining activity. The site lies outside a coal mining referral area, and as such, a Coal Authority report has not been obtained.

2.6 Hydrogeology and Hydrology

The 1:100,000 Sheet 10 Central Lancashire Vulnerability Map indicates that the site, corresponding with the underlying superficial deposits are comprised of Devensian till which is an unproductive Strata and the northern corner of the site is underlain by a Secondary A Aquifer. The underlying solid geology comprises of Mudstones and Siltstones acting as a Secondary A Aquifer.

Unproductive strata are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

Secondary A Aquifer - Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

Soils present on the site are of Low Leaching Potential - Soils in which pollutants are unlikely to penetrate the soil layer because water movement is largely horizontal or they have large ability to attenuate diffuse pollutants. Lateral flow from these soils contribute to groundwater recharge elsewhere in the catchment.

The site is not situated within a Source Protection Zone (SPZ).

The nearest surface water feature is a tertiary river (Higgin Brook) located on the south side of the site boundary.

There is one surface water abstractions within 1000m of the site located 445m south east which is a field drain located in Lyndhurst, Longridge.

There are no potable water abstractions within 1000m of the site.

There are two groundwater abstractions within 1000m of the site, the nearest is located at Mill Farm borehole located 889m north west of the site.

There are no Pollution incidents, Discharge Consents, Local Authority Pollution Prevention and Controls permits arising from the site.

The site lies in Flood Zone 1 and is therefore at no risk from flooding.

2.7 Landfill

The Envirocheck report confirms that there are no BGS Recorded Landfill within 1000m of the site boundary.

There are no historical landfill recorded within 1000m of the site.

There are two recorded Registered Landfill site within 1000m of the site. The nearest is located 843m north west, the licence holder was William Pye Ltd at Lords Quarry, Longridge, the site is still in operation.

2.8 Public Utility Records

Public utility information has been obtained as a part of this report.

2.9 Preliminary Unexploded Ordnance (UXO) Risk Assessment

The site of interest is located in Longridge, Preston, Lancashire.

Risk mapping for UXOs has placed the site within a Low risk area.

Low-risk regions are those with a bombing density of up to 10 bombs per 1000 acres.

These areas are considered to have a significant but low UXB risk. In general, further action to mitigate the risk is considered prudent, although not essential. Care is required when assessing the risk for specific sites where the risk may be higher because of local wartime activity. Historical maps for the site and surrounding area do not show any evidence of bomb damage post WWII. There are no primary Luftwaffe target within 1000m of the site.

The site has been redeveloped since the end of WW2, increasing the likelihood of detecting any UXO items that may be present on-site.

In light of these findings and in accordance with CIRIA's publication on managing UXO risks, it is recommended that no further action is warranted to address the level of UXO risk at the Site.

2.10 Other Significant Features Potentially Affecting Re-Development

No other significant features are noted that could potentially affect re-development.

3.0 Conclusions

3.1 Conceptual Model

The following sub-sections present a non-exhaustive list of the possible sources, pathways and receptors that exist within the site conceptual model for the site.

Potential source-pathway-receptor linkages that may arise are discussed in the following section, the Qualitative Risk Assessment.

A Diagrammatic Conceptual Model is provided in Appendix A3.

3.1.1 Potential Sources

Potential Source (S1): Made-ground Soils On Site
Low Likelihood due to historical evidence of no developments on the site. The nature and type of contamination may include, amongst others; ash and fill, hydrocarbons (e.g. fuel oils), heavy metals, herbicides / pesticides and asbestos.

Potential Source (S2): Made-ground Soils Off Site
Off-site soils have been exposed to patterns of development and demolition so there is potential for contamination to be present in made ground around the site. Taking into account the close proximity of the railway to the west of the site. Potential contaminants could arise due to geological origin, construction activities, atmospheric deposition and land management. The nature and type of general contamination may include, amongst others; ash and fill, hydrocarbons (e.g. fuel oils), heavy metals and asbestos.

Potential Source (S3): Natural Soils both On and Off Site
Regionally elevated levels of metals may be present within the shallow soils, however the superficial and bedrock deposits beneath the site and within the immediate surrounding area are not considered to present significant sources of natural contamination.

Potential Source (S4): Ground Gas Generating Sources
May be present due to made ground deposits surrounding the site from historical developments and land use. There are no records of organic rich drift deposits (e.g. peat) or coal measures.

Potential Source (S5): Geological Deposits with Potential to Generate Radon
Both the Radon Atlas for England and Wales, and the Envirocheck Report confirm that the site is in an intermediate probability radon area, as between 1 and 3% of homes are above the action level, however no radon protective measures are deemed necessary in the construction of new dwellings or extensions.

Potential Source (S6): Unexploded Ordinance
Risk mapping for UXOs has placed the site within a Low risk area. The historical maps for the site and surrounding area show no bomb damage post WWII and there were no primary targets located within 1000m of the site. It should be taken into consideration that the site and surrounding area has undergone several stages of redevelopment since this time, lowering the risk of UXO on site.

Potential Source (S7): Mining Workings
No mining works are considered to affect the site.

3.1.2 Potential Pathways

Potential Pathway (P1): Direct Contact, Ingestion and Inhalation (dust and vapours)
May occur where the end user is exposed to; solid, dust or volatile components of made-ground soils on site.

Potential Pathway (P2): Vertical Migration
May occur within the made-ground deposits on-site both upwards, due to processes including; capillary action, burrowing animals inducing soil mixing, and downwards into the natural deposits due to processes including; infiltration and burrowing animals. Includes ground gas migration. Soils of negligible leaching potential are found onsite.

Potential Pathway (P3): Horizontal Migration
May occur within the made-ground or natural deposits due to processes including; the influence of perched or natural groundwater flow patterns and natural or man-made high permeability zones, e.g. sand lenses or drainage runs or pores/voids within natural and made-ground soils for ground gases.

Potential Pathway (P4): Collapse
Unlikely on this site.

3.1.3 Potential Receptors

Potential Receptor (R1): End Users
Residents, visitors, site maintenance staff and the general public.

Potential Receptor (R2): Controlled Waters (Groundwater)
Corresponding with the underlying solid geology, the site is underlain by a Secondary A Aquifer. The site is not situated within a Source Protection Zone (SPZ). There is one groundwater abstraction within 1000m of the site, which is Mill Farm borehole located 917m north east of the site.

Potential Receptor (R3): Controlled Waters (Surface Waters)
The nearest surface water feature is Higgin brook (Tertiary River) located on site towards the eastern boundary. There is one surface water abstractions within 1000m of the site located 446m south east which is a field drain located in Lyndhurst, Longridge. There are no potable water abstractions within 1000m of the site.

Potential Receptor (R4): Construction Workers
Whilst unlikely, during the development of the site, construction workers may come into contact with any contamination that is on site. However, wearing the correct personal protective equipment will reduce the risk.

Potential Receptor (R5): Construction Materials
Buried concrete and water supply pipes.

Potential Receptor (R6): Local Ecology
Protected species and local habitats; e.g. hedgerow, grassland and water.

3.2 Qualitative Risk Assessment

The qualitative risk assessment details both the source-pathway-receptor linkages and associate level of risk that have been identified for the site.

The rationale for the qualitative risk assessment is described within Appendix A4 and a tabulated summary provided in Table A4.1.

The term ‘risk’ in this instance refers to the risk that the source, pathway, receptor linkage for a given source of contamination is complete. Unless specifically noted it does not necessarily refer to an immediate risk to individuals or features present on the site from potential contaminants and is intended to be used as a tool to assess the necessity of further investigation.

3.2.1 End User

Assessment of Risk to End Users from Made-Ground Soils On-Site	
Potential Source	**S1: Made-ground soils on site**
Likelihood of Occurrence	*Low Likelihood, due to no historical evidence of development on the site.*
Potential Pathway	**P1: Direct contact, ingestion and inhalation**
Details	*Recreational grounds, landscaped areas and internal airspaces.*
Potential Receptor	**R1: End users**
Consequence *(Potential Severity)*	*Medium due to human health effects (chronic and acute) for a sensitive receptor (Residents, visitors, site management staff and general public).*
Risk	**Moderate/Low**
Recommendation	*Environmental sampling of site shallow soils to confirm quality and composition.*

Assessment of Risk to End Users from Made-Ground Soils Off-Site	
Potential Source	**S2: Made-ground soils off site**
Likelihood of Occurrence	*Likely, due to historical evidence of development and demolition off-site, and given the age of the developments, it is possible that some asbestos may have been present on the site, but it should only remain if demolition activity was poorly managed.* *Potential contaminants could arise due to geological origin, construction activities, atmospheric deposition and land management. The nature and type of general contamination may include, amongst others; ash and fill, hydrocarbons (e.g. fuel oils), heavy metals and asbestos.*
Potential Pathway	**P3 & P1: Horizontal migration then direct contact, ingestion and/or inhalation**
Details	*Recreational grounds, landscaped areas and internal airspaces.*
Potential Receptor	**R1: End users**
Consequence *(Potential Severity)*	*Medium due to human health effects (chronic and acute) for a sensitive receptor (Residents, visitors, site management staff and general public).*
Risk	**Moderate**
Recommendation	*Environmental sampling of site shallow soils to confirm quality.*

Assessment of Risk to End Users from Natural Soils On and Off Site	
Potential Source	**S3: Natural soils on and off site**
Likelihood of Occurrence	*Low likelihood, due to the nature of the site geology but accounting for contamination of natural soils by on-site and surrounding sources.*
Potential Pathway	**P1 & P3: Direct contact, ingestion and inhalation and horizontal migration**
Details	*Either horizontal migration from off site or on-site presence; private gardens, home-grown produce, landscaped areas and internal airspaces.*
Potential Receptor	**R1: End users**
Consequence *(Potential Severity)*	*Medium due to human health effects (chronic and acute) for a sensitive receptor (Residents, visitors, site management staff and general public).*
Risk	**Moderate/Low**
Recommendation	*Environmental sampling of site natural soils to confirm quality.*

Assessment of Risk to End Users from Ground Gas Generating Sources	
Potential Source	**S4: Ground gas generation sources (e.g. landfills or made-ground)**
Likelihood of Occurrence	*Low Likelihood, however taking into account made ground deposits across the site from historical developments and land use.* *There are four BGS Recorded Landfill within 1000m of the site boundary.* *There are no historical landfill recorded within 1000m of the site.* *There are two recorded Registered Landfill site within 1000m of the site.* *There are no records of organic rich drift deposits (e.g. peat) or coal measures.*
Potential Pathway	**P2 & P3: Vertical and horizontal migration**
Details	*Direct gassing of on-site soils or migration along natural low permeability horizons within superficial or bedrock deposits.*
Potential Receptor	**R1: End users**
Consequence *(Potential Severity)*	*Severe due to human health effects (explosive, toxic and asphyxiate gases) for all receptors.*
Risk	**High/Moderate**
Recommendation	*Ground gas monitoring*

Assessment of Risk to End Users from Radon	
Potential Source	**S5: Geological deposits with potential to generate radon**
Likelihood of Occurrence	*Unlikely as both the Radon Atlas for England and Wales, and the Envirocheck Report confirm that the site is in an intermediate probability radon area, as between 1 and 3% of homes are above the action level, however no radon protective measures are deemed necessary in the construction of new dwellings or extensions.* *No radon protective measures are necessary in the construction of new dwellings or extensions.*
Potential Pathway	**P2 & P3: Vertical and horizontal migration**
Details	*Direct gassing of on-site soils or migration along natural low permeability horizons within superficial or bedrock deposits.*
Potential Receptor	**R1: End users**
Consequence *(Potential Severity)*	*Medium due to human health effects (chronic and acute) for a sensitive receptor (Residents, visitors, site management staff and general public).*
Risk	**Low**
Recommendation	*No action required*

Assessment of Risk to End Users from Unexploded Ordnance (UXO)	
Potential Source	**S6: Unexploded Ordnance**
Likelihood of Occurrence	*Unlikely as the historical maps for the sites show no primary targets within close proximity of the site and no ruins within close proximity of the site.* *The surrounding area shows no bomb damage post WWII, taking into consideration that the site and surrounding area has undergone several stages of redevelopment since this time, lowering the risk of UXO on site, as the likelihood of the bombs already being exploded would increase with this kind of activity.*
Potential Pathway	**P1: Direct contact**
Details	*All groundwork activities.*
Potential Receptor	**R1: End Users**
Consequence *(Potential Severity)*	*Severe due to human health effects (explosive) for receptor.*

Risk	**Moderate / Low**
Recommendation	*No Detailed UXO Report required for the site.*

3.2.2 Groundwater

Assessment of Risk to Groundwater from Made-Ground Soils On-Site	
Potential Source	**S1: Made-ground soils on site**
Likelihood of Occurrence	*Likely, due to historical evidence of development on both sites.*
Potential Pathway	**P2: Vertical migration**
Details	*Leaching or percolation of potential contaminants.*
Potential Receptor	**R2: Controlled waters (Groundwater)**
Consequence *(Potential Severity)*	*Medium as the site is underlain by a Secondary A Aquifer.* *There is one groundwater abstraction within 1000m of the site, which is Mill Farm borehole located 917m north east of the site.* *The site is not situated within a Source Protection Zone (SPZ).*
Risk	**Moderate**
Recommendation	*Environmental sampling of site shallow soils and groundwater to confirm quality.*

3.2.3 Surface Water

Assessment of Risk to Surface Water from Made-Ground Soils On-Site	
Potential Source	**S1: Made-ground soils on site**
Likelihood of Occurrence	*Low Likelihood, due to historical evidence of no development on the site.* *The nearest surface water feature is Higgin brook (Tertiary River) located on site towards the eastern boundary.* *There is one surface water abstractions within 1000m of the site located 446m south east which is a field drain located in Lyndhurst, Longridge.*
Potential Pathway	**P3: Horizontal migration**
Details	*Leaching or percolation of potential contaminants.*
Potential Receptor	**R3: Controlled waters (Surface Waters)**
Consequence *(Potential Severity)*	*Medium due to anticipated sensitivity/grade of the closest surface water feature.*
Risk	**Moderate**

Recommendation	*Environmental sampling of site shallow soils to confirm quality.*

3.2.4 Construction Workers

Assessment of Risk to Construction Workers from Made-Ground & Natural Soils On and Off Site	
Potential Source	**S1 & S2 & S3: Made-ground & natural soils on and off site**
Likelihood of Occurrence	*Made Ground* *On-site: Low Likelihood as discussed previously.* *Off-site: Likely as discussed previously.* *Natural* *On-site: Unlikely as discussed previously.* *Off-site: Unlikely as discussed previously.*
Potential Pathway	**P1: Direct contact, ingestion and inhalation**
Details	*Groundwork and landscaping activities.*
Potential Receptor	**R4: Construction workers**
Consequence (Potential Severity)	*Minor due to correct use of personal protective equipment (PPE).*
Risk	**Negligible**
Recommendation	*Environmental sampling of site shallow soils and groundwater to confirm quality.*

Assessment of Risk to Construction Workers from Unexploded Ordnance (UXO)	
Potential Source	**S6: Unexploded Ordnance**
Likelihood of Occurrence	*Unlikely of being present on-site due to lack of primary targets within close proximity of the site and no ruins within close proximity of the site.*
Potential Pathway	**P1: Direct contact**
Details	*All groundwork activities.*
Potential Receptor	**R4: End Users**
Consequence (Potential Severity)	*Severe due to human health effects (explosive) for receptor.*
Risk	**Moderate / Low**
Recommendation	*No Detailed UXO Report required for this site.*

3.2.5 Construction Materials

Assessment of Risk to Construction Materials from Made-Ground Soils On Site	
Potential Source	**S1: Made-ground soils on site**
Likelihood of Occurrence	*Low Likelihood, due to no historical evidence of development the site.*
Potential Pathway	**P1: Direct contact**
Details	*Soil pore water chemistry inducing chemical degradation/fouling.*
Potential Receptor	**R5: Construction materials**
Consequence (Potential Severity)	*Mild due to reduced performance of construction materials and human health affects (water supply contamination).*
Risk	**Low**
Recommendation	*Environmental sampling of site shallow soils to confirm quality.*

3.2.6 Local Ecology

Assessment of Risk to Local Ecology from Made-Ground Soils On-Site	
Potential Source	**S1: Made-ground soils on site**
Likelihood of Occurrence	*Lowe Likelihood, due to the historic evidence of development on both sites, and industry within close proximity to the site boundary.*
Potential Pathway	**P1 & P3: Direct contact, ingestion and inhalation & horizontal migration**
Details	*Protected species within on-site and local habitats; e.g. woodland, hedgerow, grassland and water.*
Potential Receptor	**R6: Local ecology**
Consequence (Potential Severity)	*Minor (no known sensitive ecology on site).*
Risk	**Negligible**
Recommendation	*Advice of an ecologist obtained with respect to any requirements.*

3.2.7 Recommendations

The qualitative risk assessment determined an overall **Negligible** to **Moderate** level of risk from potential contaminants. The risk to the end user from ground gases is determined to be **High/Moderate**.

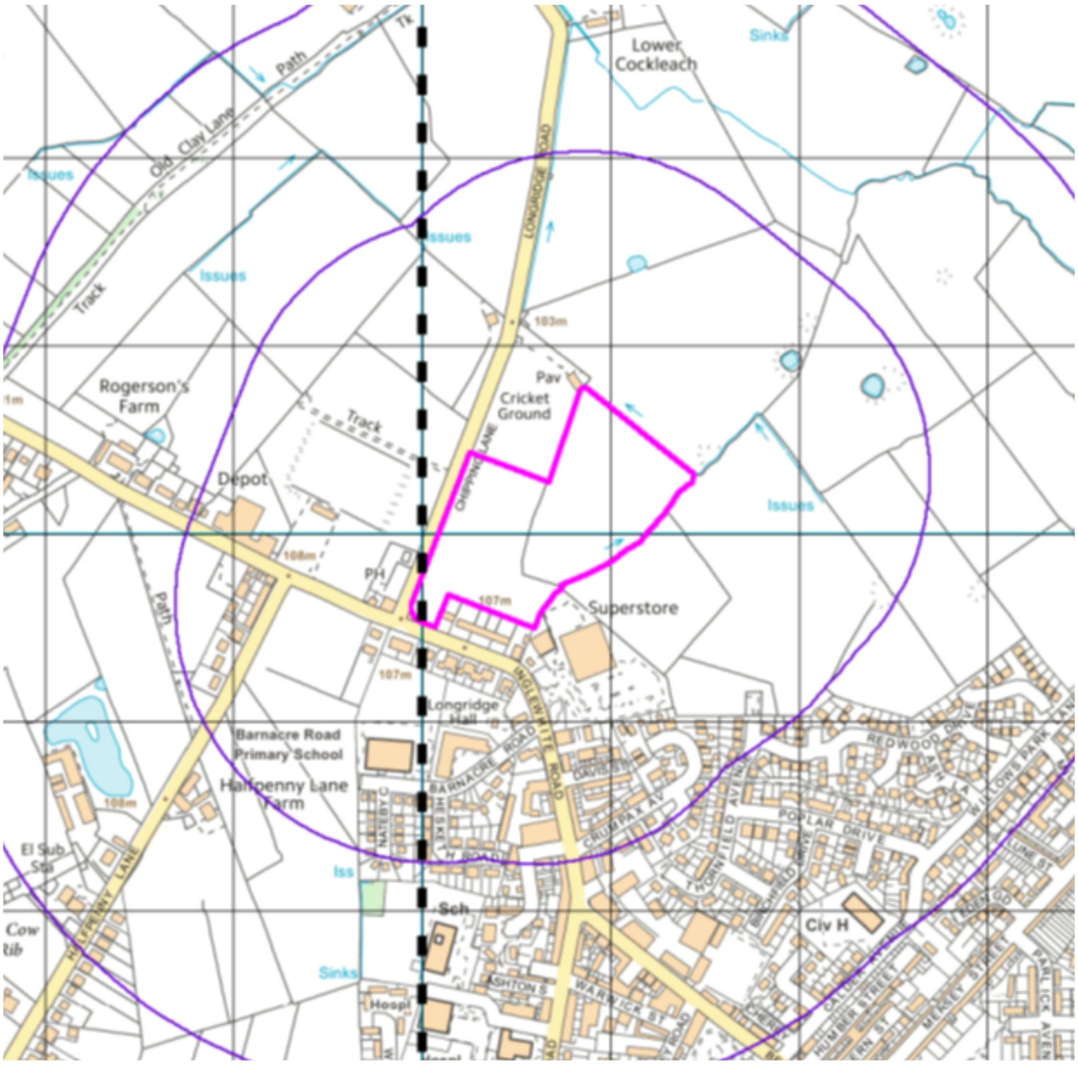
Consequently it is recommended that an intrusive investigation is undertaken to confirm the conceptual model or otherwise.

Environmental soil samples for chemical analysis should be obtained to determine if any contamination of the shallow soils and natural ground is present on site. Geotechnical samples should also be obtained in support of the design of foundations and roads.

In addition, the intrusive investigation will allow for the monitoring and sampling of groundwater / gas at the borehole locations.

Appendix A1 – Site Location Plan

Site Location Plan



Key

Approximate site boundary

Project	**Job Reference**	**Author**
Boland Meadow, Higgin Brook	EB1355	GL
Drawing Title	**Date**	**Checked**
Site Location Plan	28.03.2014	AW

curtins
10 Oxford Court,
Bishopsgate,
Manchester
M2 3WQ

Tel: 0161 236 2394

Appendix A2 – Envirocheck Report

Envirocheck® Report:

Datasheet

Order Details:

Order Number:
55312619_1_1

Customer Reference:
EB1355

National Grid Reference:
360190, 438070

Slice:
A

Site Area (Ha):
7.22

Search Buffer (m):
1000

Site Details:

Site at 360130, 438020

Client Details:

Ms G Lownsbrough
Curtins Consulting Ltd
10 Oxford Court
Bishopsgate
Manchester
M2 3WQ

Contents

Introduction

The Environment Act 1995 has made site sensitivity a key issue, as the legislation pays as much attention to the pathways by which contamination could spread, and to the vulnerable targets of contamination, as it does the potential sources of contamination.
For this reason, Landmark's Site Sensitivity maps and Datasheet(s) place great emphasis on statutory data provided by the Environment Agency and the Scottish Environment Protection Agency; it also incorporates data from Natural England (and the Scottish and Welsh equivalents) and Local Authorities; and highlights hydrogeological features required by environmental and geotechnical consultants. It does not include any information concerning past uses of land. The datasheet is produced by querying the Landmark database to a distance defined by the client from a site boundary provided by the client.

In the attached datasheet the National Grid References (NGRs) are rounded to the nearest 10m in accordance with Landmark's agreements with a number of Data Suppliers.

Report Version v47.0

Summary

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Agency & Hydrological					
Contaminated Land Register Entries and Notices					
Discharge Consents	pg 1			6	10
Enforcement and Prohibition Notices					
Integrated Pollution Controls					
Integrated Pollution Prevention And Control					
Local Authority Integrated Pollution Prevention And Control	pg 5				1
Local Authority Pollution Prevention and Controls	pg 5			3	3
Local Authority Pollution Prevention and Control Enforcements					
Nearest Surface Water Feature	pg 5	Yes			
Pollution Incidents to Controlled Waters	pg 6	2	3	5	13
Prosecutions Relating to Authorised Processes					
Prosecutions Relating to Controlled Waters					
Registered Radioactive Substances					
River Quality	pg 9			1	
River Quality Biology Sampling Points					
River Quality Chemistry Sampling Points					
Substantiated Pollution Incident Register	pg 10				1
Water Abstractions	pg 10			1	2
Water Industry Act Referrals					
Groundwater Vulnerability	pg 10	Yes	n/a	n/a	n/a
Bedrock Aquifer Designations	pg 10	Yes	n/a	n/a	n/a
Superficial Aquifer Designations	pg 11	Yes	n/a	n/a	n/a
Source Protection Zones					
Extreme Flooding from Rivers or Sea without Defences				n/a	n/a
Flooding from Rivers or Sea without Defences				n/a	n/a
Areas Benefiting from Flood Defences				n/a	n/a
Flood Water Storage Areas				n/a	n/a
Flood Defences				n/a	n/a
Detailed River Network Lines	pg 11	Yes	Yes	Yes	n/a
Detailed River Network Offline Drainage	pg 14		Yes		n/a

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Waste					
BGS Recorded Landfill Sites					
Historical Landfill Sites					
Integrated Pollution Control Registered Waste Sites					
Licensed Waste Management Facilities (Landfill Boundaries)	pg 15				2
Licensed Waste Management Facilities (Locations)	pg 15				1
Local Authority Recorded Landfill Sites					
Registered Landfill Sites	pg 15				4
Registered Waste Transfer Sites	pg 17				1
Registered Waste Treatment or Disposal Sites					
Hazardous Substances					
Control of Major Accident Hazards Sites (COMAH)					
Explosive Sites					
Notification of Installations Handling Hazardous Substances (NIHHS)					
Planning Hazardous Substance Consents					
Planning Hazardous Substance Enforcements					
Geological					
BGS 1:625,000 Solid Geology	pg 18	Yes	n/a	n/a	n/a
BGS Estimated Soil Chemistry	pg 18	Yes	Yes	Yes	Yes
BGS Recorded Mineral Sites	pg 37			1	4
BGS Urban Soil Chemistry					
BGS Urban Soil Chemistry Averages					
Brine Compensation Area			n/a	n/a	n/a
Coal Mining Affected Areas			n/a	n/a	n/a
Mining Instability			n/a	n/a	n/a
Man-Made Mining Cavities					
Natural Cavities					
Non Coal Mining Areas of Great Britain	pg 38	Yes		n/a	n/a
Potential for Collapsible Ground Stability Hazards	pg 38	Yes		n/a	n/a
Potential for Compressible Ground Stability Hazards	pg 39	Yes	Yes	n/a	n/a
Potential for Ground Dissolution Stability Hazards	pg 39	Yes	Yes	n/a	n/a
Potential for Landslide Ground Stability Hazards	pg 39	Yes		n/a	n/a
Potential for Running Sand Ground Stability Hazards	pg 40	Yes	Yes	n/a	n/a
Potential for Shrinking or Swelling Clay Ground Stability Hazards	pg 40	Yes		n/a	n/a
Radon Potential - Radon Affected Areas	pg 40	Yes	n/a	n/a	n/a
Radon Potential - Radon Protection Measures			n/a	n/a	n/a

Summary

Data Type	Page Number	On Site	0 to 250m	251 to 500m	501 to 1000m (*up to 2000m)
Industrial Land Use					
Contemporary Trade Directory Entries	pg 41		6	20	26
Fuel Station Entries	pg 45		1	1	1
Sensitive Land Use					
Areas of Adopted Green Belt					
Areas of Unadopted Green Belt					
Areas of Outstanding Natural Beauty					
Environmentally Sensitive Areas					
Forest Parks					
Local Nature Reserves					
Marine Nature Reserves					
National Nature Reserves					
National Parks					
Nitrate Sensitive Areas					
Nitrate Vulnerable Zones	pg 46		1		
Ramsar Sites					
Sites of Special Scientific Interest					
Special Areas of Conservation					
Special Protection Areas					

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
1	**Discharge Consents** Operator: Fred Wareing Property Type: Domestic Property (Single) Location: Norwood Inglewhite Road, Longridge, Near Preston, Lancashire, Pr3 2db Authority: Environment Agency, North West Region Catchment Area: Loud Reference: 01488 Permit Version: 1 Effective Date: 3rd October 1956 Issued Date: 3rd October 1956 Revocation Date: Not Supplied Discharge Type: Sewage Discharges - Final/Treated Effluent - Not Water Company Discharge Environment: Freshwater Stream/River Receiving Water: Trib Of Higgin Brook **Status: Pre National Rivers Authority Legislation where issue date < 01/09/1989** Positional Accuracy: Located by supplier to within 10m	A12NE (W)	439	1	359577 438077
2	**Discharge Consents** Operator: United Utilities Water Plc Property Type: Water Treatment Works Location: Dilworth Wtp Dilworth, Longridge, Preston, Lancashire Authority: Environment Agency, North West Region Catchment Area: Loud Reference: 017190879 Permit Version: 2 Effective Date: 15th May 2008 Issued Date: 15th May 2008 Revocation Date: Not Supplied Discharge Type: Trade Discharges - Process Effluent - Water Company (Wtw) Discharge Environment: Freshwater Stream/River Receiving Water: Higgin Brook, Trib River Loud **Status: Modified (Water Resources Act 1991, Schedule 10 as amended by Environment Act 1995)** Positional Accuracy: Located by supplier to within 10m	A14SW (E)	457	1	360830 438010
2	**Discharge Consents** Operator: United Utilities Water Plc Property Type: Water Treatment Works Location: Dilworth Wtp Dilworth, Longridge, Preston, Lancashire Authority: Environment Agency, North West Region Catchment Area: Loud Reference: 017190879 Permit Version: 1 Effective Date: 15th August 2005 Issued Date: 15th August 2005 Revocation Date: 14th May 2008 Discharge Type: Trade Discharges - Process Effluent - Water Company (Wtw) Discharge Environment: Freshwater Stream/River Receiving Water: Higgin Brook, Trib River Loud **Status: Modified (Water Resources Act 1991, Schedule 10 as amended by Environment Act 1995)** Positional Accuracy: Located by supplier to within 10m	A14SW (E)	457	1	360830 438010
3	**Discharge Consents** Operator: Frank & Marion Judith Holden Property Type: Domestic Property (Single) Location: Copperfield 46 Halfpenny Lane, Longridge, Preston, Lancashire, Pr3 2ea Authority: Environment Agency, North West Region Catchment Area: Brock Reference: 017290607 Permit Version: 1 Effective Date: 9th June 2005 Issued Date: 9th June 2005 Revocation Date: Not Supplied Discharge Type: Sewage Discharges - Final/Treated Effluent - Not Water Company Discharge Environment: Freshwater Stream/River Receiving Water: Trib Of Blundell Brook **Status: New Consent (Water Resources Act 1991, Section 88 & Schedule 10 as amended by Environment Act 1995)** Positional Accuracy: Located by supplier to within 10m	A7NE (SW)	491	1	359670 437540

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
4	**Discharge Consents** Operator: Ridgmont Care Homes Ltd Property Type: Domestic Property (Multiple) Location: Belmont Residential Home Inglewhite Rd, Longridge, Preston, Lancashire Authority: Environment Agency, North West Region Catchment Area: Upper Ribble Reference: 017190181 Permit Version: 1 Effective Date: 22nd October 1985 Issued Date: Not Supplied Revocation Date: 30th April 1996 Discharge Type: Sewage Discharges - Final/Treated Effluent - Not Water Company Discharge Environment: Freshwater Stream/River Receiving Water: Savick Brook **Status: Lapsed (under Environment Act 1995, Schedule 23)** Positional Accuracy: Located by supplier to within 100m	A12SW (W)	495	1	359500 438000
4	**Discharge Consents** Operator: Mr G Higson Property Type: Not Given Location: Belmont Residential Care Home , Inglewhite Road , Longridge, PRESTON , Lancashire Authority: Environment Agency, North West Region Catchment Area: Not Given Reference: 017290331-01 Permit Version: Not Supplied Effective Date: Not Supplied Issued Date: Not Supplied Revocation Date: Not Supplied Discharge Type: Public Sewage: Tertiary Treatment Discharge Environment: Freshwater Stream/River Receiving Water: Treated Sewage Effluent; Outlet To Watercourse; Tributary Blundel Brook **Status: Not Supplied** Positional Accuracy: Located by supplier to within 100m	A12SW (W)	544	1	359450 438000
5	**Discharge Consents** Operator: Mr William Whitwell And Mrs Margaret Pye Property Type: Domestic Property (Single) Location: Higher Cockleach Farm Chipping Road, Thornley, Longridge, Lancaster, Pr3 2nb Authority: Environment Agency, North West Region Catchment Area: Not Supplied Reference: Npswqd005155 Permit Version: 1 Effective Date: 24th October 2008 Issued Date: 24th October 2008 Revocation Date: Not Supplied Discharge Type: Sewage Discharges - Final/Treated Effluent - Not Water Company Discharge Environment: Land/Soakaway Receiving Water: Groundwaters Via Soakaway **Status: New Consent (Water Resources Act 1991, Section 88 & Schedule 10 as amended by Environment Act 1995)** Positional Accuracy: Located by supplier to within 10m	A18NW (N)	496	1	360171 438770
6	**Discharge Consents** Operator: Ridgmont Care Homes Ltd Property Type: Domestic Property (Multiple) Location: Belmont Residential Home Inglewhite Rd, Longridge, Preston, Lancashire Authority: Environment Agency, North West Region Catchment Area: Not Given Reference: 017290331 Permit Version: 1 Effective Date: 7th June 1996 Issued Date: Not Supplied Revocation Date: Not Supplied Discharge Type: Sewage Discharges - Final/Treated Effluent - Not Water Company Discharge Environment: Freshwater Stream/River Receiving Water: Trib Blundel Brook **Status: Post National Rivers Authority Legislation where issue date > 31/08/1989** Positional Accuracy: Located by supplier to within 100m	A12SW (W)	543	1	359450 437995

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
7	**Discharge Consents** Operator: J M Bruton Esquire Property Type: Domestic Property (Single) Location: Broadfield Inglewhite Road, Longridge, Preston, Lancashire Authority: Environment Agency, North West Region Catchment Area: Not Given Reference: 017190541 Permit Version: 1 Effective Date: 19th July 1995 Issued Date: Not Supplied Revocation Date: Not Supplied Discharge Type: Sewage Discharges - Final/Treated Effluent - Not Water Company Discharge Environment: Freshwater Stream/River Receiving Water: Trib Blundell Brook **Status:** **Post National Rivers Authority Legislation where issue date > 31/08/1989** Positional Accuracy: Located by supplier to within 100m	A12SW (W)	592	1	359410 438050
8	**Discharge Consents** Operator: G.S. Porter Property Type: Domestic Property (Single) Location: Bungalow, 37 Halfpenny La, Longridge, Preston, Lancashire, Pr3 2ea Authority: Environment Agency, North West Region Catchment Area: Brock Reference: 011224 Permit Version: 1 Effective Date: 29th November 1962 Issued Date: 29th November 1962 Revocation Date: Not Supplied Discharge Type: Sewage Discharges - Final/Treated Effluent - Not Water Company Discharge Environment: Freshwater Stream/River Receiving Water: Trib Of Blundell Brook **Status:** **Pre National Rivers Authority Legislation where issue date < 01/09/1989** Positional Accuracy: Located by supplier to within 100m	A7NW (SW)	595	1	359520 437550
9	**Discharge Consents** Operator: Orchard Homes Ltd Property Type: Domestic Property (Single) Location: Plot Adjacent To Rydal House, Whittingham Road, Longridge, Near Preston, Pr3 2ab Authority: Environment Agency, North West Region Catchment Area: Savick Brook Reference: 017290600 Permit Version: 1 Effective Date: 3rd May 2005 Issued Date: 3rd May 2005 Revocation Date: Not Supplied Discharge Type: Sewage Discharges - Final/Treated Effluent - Not Water Company Discharge Environment: Freshwater Stream/River Receiving Water: Trib Of Blundell Brook **Status:** **New Consent (Water Resources Act 1991, Section 88 & Schedule 10 as amended by Environment Act 1995)** Positional Accuracy: Located by supplier to within 10m	A7SE (SW)	722	1	359640 437280
10	**Discharge Consents** Operator: David W Melling Property Type: Domestic Property (Single) Location: Copper Beeches, Whittingham Road, Longridge, Preston, Pr3 2ab Authority: Environment Agency, North West Region Catchment Area: Brock Reference: 017190918 Permit Version: 1 Effective Date: 18th September 2006 Issued Date: 18th September 2006 Revocation Date: Not Supplied Discharge Type: Sewage Discharges - Final/Treated Effluent - Not Water Company Discharge Environment: Freshwater Stream/River Receiving Water: Savick Brook **Status:** **New Consent (Water Resources Act 1991, Section 88 & Schedule 10 as amended by Environment Act 1995)** Positional Accuracy: Located by supplier to within 100m	A8SW (S)	794	1	359900 437100

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Discharge Consents				
11	Operator: Mr A J Davies Property Type: Domestic Property (Single) Location: Land Adj To Rydal House Whittingham Road, Longridge, Preston, Lancashire, Pr3 2ab Authority: Environment Agency, North West Region Catchment Area: Not Given Reference: 017290393 Permit Version: 1 Effective Date: 6th May 1999 Issued Date: 6th May 1999 Revocation Date: Not Supplied Discharge Type: Sewage Discharges - Final/Treated Effluent - Not Water Company Discharge Environment: Freshwater Stream/River Receiving Water: Highway Drain To Blundel Brook **Status:** **New Consent (Water Resources Act 1991, Section 88 & Schedule 10 as amended by Environment Act 1995)** Positional Accuracy: Located by supplier to within 100m	A7SE (SW)	810	1	359640 437180
	Discharge Consents				
12	Operator: Mr Anthony Jerome Dyson & Mrs Jaqueline Hines Property Type: Domestic Property (Single) Location: Whittingham Road, Longridge, Preston, Lancashire, Pr3 2ab Authority: Environment Agency, North West Region Catchment Area: Brock Reference: 017290569 Permit Version: 1 Effective Date: 21st March 2005 Issued Date: 21st March 2005 Revocation Date: Not Supplied Discharge Type: Sewage Discharges - Final/Treated Effluent - Not Water Company Discharge Environment: Freshwater Stream/River Receiving Water: Trib Of Blundel Brook **Status:** **New Consent (Water Resources Act 1991, Section 88 & Schedule 10 as amended by Environment Act 1995)** Positional Accuracy: Located by supplier to within 100m	A7SW (SW)	864	1	359500 437200
	Discharge Consents				
13	Operator: United Utilities Water Plc Property Type: Water Treatment Works Location: Dilworth Wtp Dilworth, Longridge, Preston, Lancashire Authority: Environment Agency, North West Region Catchment Area: Not Given Reference: 017160050 Permit Version: 1 Effective Date: 19th October 1979 Issued Date: Not Supplied Revocation Date: Not Supplied Discharge Type: Trade Discharges - Process Effluent - Water Company (Wtw) Discharge Environment: Freshwater Stream/River Receiving Water: Higgin Brook **Status:** **Pre National Rivers Authority Legislation where issue date < 01/09/1989** Positional Accuracy: Located by supplier to within 100m	A15NW (E)	939	1	361350 438140
	Discharge Consents				
14	Operator: Mr. David Newby Property Type: Domestic Property (Single) Location: Willow Tree Barn, Ashley Lane, Goosnargh, Preston, Pr3 2ee Authority: Environment Agency, North West Region Catchment Area: Brock Reference: 017290898 Permit Version: 1 Effective Date: 10th March 2006 Issued Date: 10th March 2006 Revocation Date: Not Supplied Discharge Type: Sewage Discharges - Final/Treated Effluent - Not Water Company Discharge Environment: Freshwater Stream/River Receiving Water: Un-Named Trib Blundell Brook **Status:** **New Consent (Water Resources Act 1991, Section 88 & Schedule 10 as amended by Environment Act 1995)** Positional Accuracy: Located by supplier to within 10m	A11NE (W)	943	1	359090 438210

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
15	**Local Authority Integrated Pollution Prevention And Control** Name: Jones Stroud Insulations Ltd Location: Queens Street, Longridge, Preston, Lancashire, PR3 3BS Authority: Ribble Valley Borough Council, Environmental Health Department Permit Reference: RVBC/PPC/2/05 Dated: 1st April 2004 Process Type: Other Activities Description: SG6 Surface treatment using organic solvents **Status:** **Permit Issued** Positional Accuracy: Manually positioned to the address or location	A3NW (S)	935	2	360003 436939
16	**Local Authority Pollution Prevention and Controls** Name: Booths Service Station Location: Berry Lane, Longridge, PRESTON, Lancashire, PR3 3NH Authority: Ribble Valley Borough Council, Environmental Health Department Permit Reference: RVBC/PPC/23 Dated: 31st July 2000 Process Type: Local Authority Pollution Prevention and Control Description: PG1/14 Petrol filling station **Status:** **Permitted** Positional Accuracy: Manually positioned to the address or location	A8NE (S)	324	2	360266 437550
16	**Local Authority Pollution Prevention and Controls** Name: Syd Brown & Sons Location: Berry Lane, Longridge, PRESTON, Lancashire, PR3 3NH Authority: Ribble Valley Borough Council, Environmental Health Department Permit Reference: Rvbc/Epa/17/96 Dated: 29th February 1996 Process Type: Local Authority Air Pollution Control Description: PG1/1Waste oil burners, less than 0.4MW net rated thermal input **Status:** **Authorisation revokedRevoked** Positional Accuracy: Manually positioned to the address or location	A8NE (S)	324	2	360266 437550
17	**Local Authority Pollution Prevention and Controls** Name: Longridge Dry Cleaners Location: 6 Townley Parade, Longridge, Preston, Pr3 3hu Authority: Ribble Valley Borough Council, Environmental Health Department Permit Reference: RVBC/PPC/53 Dated: 5th December 2006 Process Type: Local Authority Pollution Prevention and Control Description: PG6/46 Dry cleaning **Status:** **Permitted** Positional Accuracy: Manually positioned to the address or location	A8NE (S)	429	2	360368 437466
18	**Local Authority Pollution Prevention and Controls** Name: Bonds Of Longridge Location: Kestor Lane, Longridge, PRESTON, Lancashire, PR3 3AE Authority: Ribble Valley Borough Council, Environmental Health Department Permit Reference: RVBC/PPC/21 Dated: 31st July 2000 Process Type: Local Authority Pollution Prevention and Control Description: PG1/14 Petrol filling station **Status:** **Permitted** Positional Accuracy: Automatically positioned to the address	A8SW (S)	716	2	360145 437155
19	**Local Authority Pollution Prevention and Controls** Name: T D G Ltd Location: Daniel Platt Garage, Whittingham Road, Longridge, PRESTON, Lancashire, PR3 2AD Authority: Preston City Council, Environmental Health Department Permit Reference: Pn 24 Dated: 18th June 1996 Process Type: Local Authority Air Pollution Control Description: PG1/1Waste oil burners, less than 0.4MW net rated thermal input **Status:** **Authorised** Positional Accuracy: Manually positioned to the address or location	A8SW (S)	752	3	359896 437144
20	**Local Authority Pollution Prevention and Controls** Name: Jones Stroud Insulations Plc Location: Queen Street, Longridge, PRESTON, Lancashire, PR3 3BS Authority: Ribble Valley Borough Council, Environmental Health Department Permit Reference: PPC/02/05 Dated: 31st January 1994 Process Type: Local Authority Pollution Prevention and Control Description: PG6/10 Coating manufacturing **Status:** **Transferred to LAIPPC** Positional Accuracy: Manually positioned to the address or location	A3NW (S)	965	2	359960 436914
	Nearest Surface Water Feature	A13SW (S)	0	-	360148 437943

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
21	**Pollution Incidents to Controlled Waters** Property Type: Not Given Location: Higgins Bk Near , LONGRIDGE Authority: Environment Agency, North West Region Pollutant: Chemicals - Paints / Dyes Note: Higgin Bk; Poss Paint Incident Date: 18th June 1997 Incident Reference: 97340065 Catchment Area: Hodder Receiving Water: Freshwater Stream/River Cause of Incident: Unknown Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	A13SW (SW)	0	1	360100 437895
21	**Pollution Incidents to Controlled Waters** Property Type: Office Location: Higgin Brook Authority: Environment Agency, North West Region Pollutant: Miscellaneous - Inert Suspended Solids Note: Not Supplied Incident Date: Not Supplied Incident Reference: CE980843 Catchment Area: Hodder Receiving Water: Freshwater Stream/River Cause of Incident: Land Runoff Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	A13SW (SW)	0	1	360105 437895
21	**Pollution Incidents to Controlled Waters** Property Type: Not Given Location: Lancashire Authority: Environment Agency, North West Region Pollutant: Oils - Unknown Note: Higgin Bk; Light Oil Incident Date: 10th May 1996 Incident Reference: 96340038 Catchment Area: Hodder Receiving Water: Not Given Cause of Incident: Other Incident/Unknown Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	A13SW (SW)	1	1	360100 437900
22	**Pollution Incidents to Controlled Waters** Property Type: Spillage; Accident - Static Site Location: Location Description Not Available Authority: Environment Agency, North West Region Pollutant: Organic Wastes: Milk Note: Higgin Brook Incident Date: 8th November 1993 Incident Reference: 93340102 Catchment Area: Hodder Receiving Water: Not Given Cause of Incident: Unknown Incident Severity: Category 2 - Significant Incident Positional Accuracy: Located by supplier to within 100m	A13SW (S)	80	1	360200 437800
23	**Pollution Incidents to Controlled Waters** Property Type: Farm Drainage Location: Location Description Not Available Authority: Environment Agency, North West Region Pollutant: Organic Wastes: Silage Liquor Note: Higgin Brook Incident Date: 6th August 1994 Incident Reference: 94340119 Catchment Area: Hodder Receiving Water: Not Given Cause of Incident: Leaking Silo Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	A18SW (N)	225	1	360200 438500
24	**Pollution Incidents to Controlled Waters** Property Type: Farm Drainage Location: Location Description Not Available Authority: Environment Agency, North West Region Pollutant: Organic Wastes: Pig Slurry Note: Higgin Brook Catchment Incident Date: 10th November 1991 Incident Reference: 91340110 Catchment Area: Hodder Receiving Water: Not Given Cause of Incident: Unknown Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	A12SE (W)	289	1	359700 437900

Map ID	Details		Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Pollution Incidents to Controlled Waters					
25	Property Type:	Construction: Construction Of Buildings	A18SW (N)	319	1	360200 438595
	Location:	Lower Cockleach Farm				
	Authority:	Environment Agency, North West Region				
	Pollutant:	Organic Chemicals : Red Gas Oil				
	Note:	Not Supplied				
	Incident Date:	30th January 1999				
	Incident Reference:	1921				
	Catchment Area:	Higgin Brook				
	Receiving Water:	River Stretch (Freshwater)				
	Cause of Incident:	Not Given				
	Incident Severity:	Category 3 - Minor Incident				
	Positional Accuracy:	Located by supplier to within 100m				
	Pollution Incidents to Controlled Waters					
25	Property Type:	Not Given	A18SW (N)	324	1	360200 438600
	Location:	Chipping Lane, LONGRIDGE				
	Authority:	Environment Agency, North West Region				
	Pollutant:	Miscellaneous - Urban Runoff				
	Note:	Not Supplied				
	Incident Date:	14th July 1998				
	Incident Reference:	CE980634				
	Catchment Area:	Ribble - Non-Tidal				
	Receiving Water:	Freshwater Stream/River				
	Cause of Incident:	Unknown				
	Incident Severity:	Category 3 - Minor Incident				
	Positional Accuracy:	Located by supplier to within 100m				
	Pollution Incidents to Controlled Waters					
26	Property Type:	Not Given	A18SW (N)	345	1	360100 438600
	Location:	Location Description Not Available				
	Authority:	Environment Agency, North West Region				
	Pollutant:	Industrial Effluent				
	Note:	Higgin Brook; Milk Waste				
	Incident Date:	17th September 1993				
	Incident Reference:	93340084				
	Catchment Area:	Hodder				
	Receiving Water:	Not Given				
	Cause of Incident:	Unknown				
	Incident Severity:	Category 2 - Significant Incident				
	Positional Accuracy:	Located by supplier to within 100m				
	Pollution Incidents to Controlled Waters					
27	Property Type:	Not Given	A12SE (W)	396	1	359600 438000
	Location:	Location Description Not Available				
	Authority:	Environment Agency, North West Region				
	Pollutant:	Animal Waste/Slurry				
	Note:	Not Supplied				
	Incident Date:	21st November 1991				
	Incident Reference:	91310203				
	Catchment Area:	Wyre				
	Receiving Water:	Not Given				
	Cause of Incident:	Unknown				
	Incident Severity:	Category 3 - Minor Incident				
	Positional Accuracy:	Located by supplier to within 100m				
	Pollution Incidents to Controlled Waters					
28	Property Type:	Farm Drainage	A7NE (SW)	501	1	359600 437600
	Location:	Location Description Not Available				
	Authority:	Environment Agency, North West Region				
	Pollutant:	Organic Wastes: Pig Slurry				
	Note:	Tributary Blundells Bk				
	Incident Date:	23rd June 1992				
	Incident Reference:	92310110				
	Catchment Area:	Wyre				
	Receiving Water:	Not Given				
	Cause of Incident:	Unknown				
	Incident Severity:	Category 2 - Significant Incident				
	Positional Accuracy:	Located by supplier to within 100m				
	Pollution Incidents to Controlled Waters					
28	Property Type:	Not Given	A7NE (SW)	504	1	359600 437595
	Location:	Lancashire				
	Authority:	Environment Agency, North West Region				
	Pollutant:	Not Given				
	Note:	Not Supplied				
	Incident Date:	22nd June 1992				
	Incident Reference:	92310106				
	Catchment Area:	Wyre				
	Receiving Water:	Not Given				
	Cause of Incident:	Not Given				
	Incident Severity:	Category 3 - Minor Incident				
	Positional Accuracy:	Located by supplier to within 100m				

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Pollution Incidents to Controlled Waters				
29	Property Type: Private Sewage: Sewage Works And Septic Tanks Location: Location Description Not Available Authority: Environment Agency, North West Region Pollutant: Sewage - Septic Tank Effluent Note: Tributary Blundell Brk Incident Date: 11th August 1993 Incident Reference: 93310109 Catchment Area: Wyre Receiving Water: Not Given Cause of Incident: Unknown Incident Severity: Category 2 - Significant Incident Positional Accuracy: Located by supplier to within 100m	A7NE (SW)	568	1	359600 437500
	Pollution Incidents to Controlled Waters				
30	Property Type: Private Sewage: Sewage Works And Septic Tanks Location: Location Description Not Available Authority: Environment Agency, North West Region Pollutant: Sewage - Septic Tank Effluent Note: Blundel Brook Incident Date: 30th January 1995 Incident Reference: 95310010 Catchment Area: Wyre Receiving Water: Not Given Cause of Incident: Deliberate Disposal To Drain Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	A7NW (SW)	710	1	359500 437400
	Pollution Incidents to Controlled Waters				
31	Property Type: Farm Drainage Location: Location Description Not Available Authority: Environment Agency, North West Region Pollutant: Organic Wastes: Cattle slurry Note: Savick Brook Incident Date: 18th February 1994 Incident Reference: 94410020 Catchment Area: Ribble - Tidal Receiving Water: Not Given Cause of Incident: Land Runoff Incident Severity: Category 2 - Significant Incident Positional Accuracy: Located by supplier to within 100m	A12NW (W)	779	1	359300 438300
	Pollution Incidents to Controlled Waters				
32	Property Type: Private Sewage: Sewage Works And Septic Tanks Location: Location Description Not Available Authority: Environment Agency, North West Region Pollutant: Sewage - Septic Tank Effluent Note: Blundel Brook Incident Date: 25th October 1994 Incident Reference: 94310129 Catchment Area: Wyre Receiving Water: Not Given Cause of Incident: Deliberate Disposal To Drain Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	A7SW (SW)	851	1	359400 437300
	Pollution Incidents to Controlled Waters				
32	Property Type: Private Sewage: Sewage Works And Septic Tanks Location: Location Description Not Available Authority: Environment Agency, North West Region Pollutant: Sewage - Septic Tank Effluent Note: Blundel Brook Incident Date: 23rd March 1995 Incident Reference: 95310038 Catchment Area: Wyre Receiving Water: Not Given Cause of Incident: Deliberate Disposal To Drain Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	A7SW (SW)	855	1	359400 437295
	Pollution Incidents to Controlled Waters				
33	Property Type: Not Given Location: Lancashire Authority: Environment Agency, North West Region Pollutant: Unknown Note: None Affected; Petrol To Drains Incident Date: 7th November 1996 Incident Reference: 96340091 Catchment Area: Hodder Receiving Water: Not Given Cause of Incident: Road Traffic Accident Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	A3NW (S)	873	1	360001 437001

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Pollution Incidents to Controlled Waters				
34	Property Type: Connection To Surface Drains Location: Location Description Not Available Authority: Environment Agency, North West Region Pollutant: Crude Sewage Note: Savick Brook Incident Date: 8th March 1994 Incident Reference: 94410033 Catchment Area: Ribble - Tidal Receiving Water: Not Given Cause of Incident: Wrong Connection Incident Severity: Category 2 - Significant Incident Positional Accuracy: Located by supplier to within 100m	A3NW (S)	891	1	359900 437000
	Pollution Incidents to Controlled Waters				
35	Property Type: Domestic & Residential: Private Dwellings Location: Longridge, LONGRIDGE, Lancashire Authority: Environment Agency, North West Region Pollutant: Sewage - Septic Tank Effluent Note: Not Supplied Incident Date: 12th August 1999 Incident Reference: 31556 Catchment Area: Not Given Receiving Water: Not Given Cause of Incident: Unauthorised Activity : Unconsented Discharge Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 10m	A2NE (S)	918	1	359800 437000
	Pollution Incidents to Controlled Waters				
36	Property Type: Boats/Ships Location: Lancashire Authority: Environment Agency, North West Region Pollutant: Unknown Note: None Found Incident Date: 24th May 1994 Incident Reference: 94410079 Catchment Area: Ribble - Tidal Receiving Water: Canal Cause of Incident: Other Incident/Unknown Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	A2NE (SW)	954	1	359700 437000
	Pollution Incidents to Controlled Waters				
37	Property Type: Not Given Location: Lancashire Authority: Environment Agency, North West Region Pollutant: Miscellaneous - Inert Suspended Solids Note: Higgin Bk; Soil Incident Date: 17th December 1996 Incident Reference: 96340101 Catchment Area: Hodder Receiving Water: Not Given Cause of Incident: Land Runoff Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	A3NE (S)	975	1	360300 436900
	Pollution Incidents to Controlled Waters				
38	Property Type: Farm Drainage Location: Location Description Not Available Authority: Environment Agency, North West Region Pollutant: Organic Wastes: Poultry Manure (solid) Note: Tributary Savick Brook Incident Date: 11th December 1991 Incident Reference: 91320263 Catchment Area: Ribble - Tidal Receiving Water: Not Given Cause of Incident: Unknown Incident Severity: Category 2 - Significant Incident Positional Accuracy: Located by supplier to within 100m	A2NE (SW)	991	1	359600 437000
	River Quality				
	Name: Higgin Bk GQA Grade: River Quality D Reach: Qsl At Cockleach To Loud Estimated Distance (km): .9 Flow Rate: Flow less than 0.31 cumecs Flow Type: River Year: 2000	A18SW (N)	393	1	360036 438627

Map ID	Details		Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Substantiated Pollution Incident Register					
39	Authority: Incident Date: Incident Reference: Water Impact: Air Impact: Land Impact: Positional Accuracy: Pollutant:	Environment Agency - North West Region, North Area 3rd March 2008 568402 Category 2 - Significant Incident Category 4 - No Impact Category 2 - Significant Incident Located by supplier to within 10m Inert : Construction / Demolition Material	A12NE (W)	521	1	359582 438309
	Water Abstractions					
40	Operator: Licence Number: Permit Version: Location: Authority: Abstraction: Abstraction Type: Source: Daily Rate (m3): Yearly Rate (m3): Details: Authorised Start: Authorised End: Permit Start Date: Permit End Date: Positional Accuracy:	Martin Carefoot 2672409010 Not Supplied Lyndhurst, LONGRIDGE Environment Agency, North West Region Not Supplied Not Supplied Unknown 0 0 Unnamed Watercourse (Field Drains) Not Supplied Not Supplied Not Supplied Not Supplied Located by supplier to within 100m	A7NE (SW)	445	1	359600 437700
	Water Abstractions					
41	Operator: Licence Number: Permit Version: Location: Authority: Abstraction: Abstraction Type: Source: Daily Rate (m3): Yearly Rate (m3): Details: Authorised Start: Authorised End: Permit Start Date: Permit End Date: Positional Accuracy:	Singletons Dairy Ltd Nw/071/0348/002 1 Mill Farm Borehole Environment Agency, North West Region Dairies: General Use (Medium Loss) Water may be abstracted from a single point Groundwater Not Supplied Not Supplied Premises At Mill Farm, Preston 01 April 31 March 27th June 2013 Not Supplied Located by supplier to within 10m	A3NW (S)	889	1	360176 436984
	Water Abstractions					
42	Operator: Licence Number: Permit Version: Location: Authority: Abstraction: Abstraction Type: Source: Daily Rate (m3): Yearly Rate (m3): Details: Authorised Start: Authorised End: Permit Start Date: Permit End Date: Positional Accuracy:	Singletons Dairy Ltd 2671348013 100 Borehole At Mill Farm,Preston Road, Longridge Environment Agency, North West Region Other Industrial/Commercial/Public Services: General Use (Medium Loss) Water may be abstracted from a single point Groundwater 327 119469 Land & Premises At Mill Farm 01 January 31 December 15th August 1989 Not Supplied Located by supplier to within 100m	A3NW (S)	973	1	360200 436900
	Groundwater Vulnerability					
	Soil Classification: Map Sheet: Scale:	Soils of Low Leaching Potential - Soils in which pollutants are unlikely to penetrate the soil layer because water movement is largely horizontal or they have large ability to attenuate diffuse pollutants. Lateral flow from these soils contribute to groundwater recharge elsewhere in the catchment Sheet 10 Central Lancashire 1:100,000	A13SW (W)	0	1	360193 438069
	Drift Deposits					
	Drift Deposit: Map Sheet: Scale:	Low permeability drift deposits occuring at the surface and overlying Major and Minor Aquifers are head, clay-with-flints, brickearth, peat, river terrace deposits and marine and estuarine alluvium Sheet 10 Central Lancashire 1:100,000	A13SW (W)	0	1	360193 438069
	Bedrock Aquifer Designations					
	Aquifer Desination:	Secondary Aquifer - A	A13SW (W)	0	4	360193 438069

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Bedrock Aquifer Designations Aquifer Desination: Secondary Aquifer - A	A13SW (W)	0	4	360001 438069
	Superficial Aquifer Designations Aquifer Designation: Secondary Aquifer - A	A13NW (N)	0	4	360179 438154
	Superficial Aquifer Designations Aquifer Designation: Unproductive Strata	A13SW (W)	0	4	360001 438069
	Superficial Aquifer Designations Aquifer Designation: Unproductive Strata	A13SW (W)	0	4	360193 438069
	Extreme Flooding from Rivers or Sea without Defences None				
	Flooding from Rivers or Sea without Defences None				
	Areas Benefiting from Flood Defences None				
	Flood Water Storage Areas None				
	Flood Defences None				
43	**Detailed River Network Lines** River Type: Tertiary River River Name: Not Supplied Hydrographic Area: D011 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A13SE (E)	0	1	360289 438064
44	**Detailed River Network Lines** River Type: Extended Culvert (greater than 50m) River Name: Not Supplied Hydrographic Area: D011 River Flow Type: Primary Flow Path River Surface Level: Below Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A13NW (N)	0	1	360174 438159
45	**Detailed River Network Lines** River Type: Tertiary River River Name: Higgin Brook Hydrographic Area: D011 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A13SE (SE)	0	1	360254 438014

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
46	**Detailed River Network Lines** River Type: Tertiary River River Name: Not Supplied Hydrographic Area: D011 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A13NE (NE)	0	1	360233 438111
47	**Detailed River Network Lines** River Type: Tertiary River River Name: Higgin Brook Hydrographic Area: D011 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A13NW (NW)	0	1	360106 438235
48	**Detailed River Network Lines** River Type: Tertiary River River Name: Not Supplied Hydrographic Area: D011 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A13NE (NE)	153	1	360415 438384
49	**Detailed River Network Lines** River Type: Tertiary River River Name: Not Supplied Hydrographic Area: D011 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A18SE (N)	176	1	360232 438451
50	**Detailed River Network Lines** River Type: Extended Culvert (greater than 50m) River Name: Not Supplied Hydrographic Area: D011 River Flow Type: Primary Flow Path River Surface Level: Below Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A18SE (N)	201	1	360299 438460
51	**Detailed River Network Lines** River Type: Secondary River River Name: Not Supplied Hydrographic Area: D011 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A18SW (N)	235	1	360189 438509

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
52	**Detailed River Network Lines** River Type: Tertiary River River Name: Not Supplied Hydrographic Area: D011 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A14NW (NE)	250	1	360574 438392
53	**Detailed River Network Lines** River Type: Tertiary River River Name: Not Supplied Hydrographic Area: D011 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A14NW (NE)	250	1	360574 438392
54	**Detailed River Network Lines** River Type: Secondary River River Name: Not Supplied Hydrographic Area: D011 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A18SW (N)	272	1	360163 438543
55	**Detailed River Network Lines** River Type: Tertiary River River Name: Not Supplied Hydrographic Area: D011 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A18SE (NE)	305	1	360387 438536
56	**Detailed River Network Lines** River Type: Tertiary River River Name: Not Supplied Hydrographic Area: D011 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A19SW (NE)	327	1	360644 438432
57	**Detailed River Network Lines** River Type: Tertiary River River Name: Not Supplied Hydrographic Area: D011 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A19SW (NE)	327	1	360644 438432

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
58	**Detailed River Network Lines** River Type: Tertiary River River Name: Not Supplied Hydrographic Area: D011 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A18SW (NW)	333	1	359887 438489
59	**Detailed River Network Lines** River Type: Secondary River River Name: Not Supplied Hydrographic Area: D011 River Flow Type: Primary Flow Path River Surface Level: Surface Drain Feature: Not a Drain Flood Risk Management Status: Other Rivers Water Course Name: Not Supplied Water Course Reference: Not Supplied	A18SW (N)	390	1	360091 438644
60	**Detailed River Network Offline Drainage** River Type: Tertiary River Hydrographic Area: D011	A13NW (NW)	119	1	360006 438305
61	**Detailed River Network Offline Drainage** River Type: Tertiary River Hydrographic Area: D011	A13NW (NW)	159	1	359977 438333

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
62	**Licensed Waste Management Facilities (Landfill Boundaries)** Name: Lords Delph Licence Number: 54034 Location: Land/premises At, Forty Acre Lane, Longridge, Preston, Lancashire, PR3 2TY Licence Holder: William Pye Ltd Authority: Environment Agency - North West Region, North Area Site Category: Landfills Taking Non-biodegradeable Wastes (Not Construction) Max Input Rate: Not Supplied **Licence Status: Issued** Issued Not Supplied Positional Accuracy: Positioned by the supplier Boundary Accuracy: As Supplied	A14NE (E)	748	1	361162 438202
63	**Licensed Waste Management Facilities (Landfill Boundaries)** Name: Chapel Hill Quarry Licence Number: 54011 Location: Chapel Hill Quarry, Longridge, Preston, Lancashire, PR3 Licence Holder: United Utilities Water Ltd Authority: Environment Agency - North West Region, North Area Site Category: Landfills Taking Non-biodegradeable Wastes (Not Construction) Max Input Rate: Not Supplied **Licence Status: Issued** Issued Not Supplied Positional Accuracy: Positioned by the supplier Boundary Accuracy: As Supplied	A3NE (S)	957	1	360413 436933
64	**Licensed Waste Management Facilities (Locations)** Licence Number: 54034 Location: Land/premises At, Forty Acre Lane, Longridge, Preston, Lancashire, PR3 2TY Operator Name: William Pye Ltd Operator Location: Not Supplied Authority: Environment Agency - North West Region, North Area Site Category: Landfills Taking Non-biodegradeable Wastes (Not Construction) **Licence Status: Issued** Issued: 2nd June 1989 Last Modified: Not Supplied Expires: Not Supplied Suspended: Not Supplied Revoked: Not Supplied Surrendered: Not Supplied IPPC Reference: Not Supplied Positional Accuracy: Located by supplier to within 100m	A14NE (E)	694	1	361100 438100
	Local Authority Landfill Coverage Name: Ribble Valley Borough Council - Had landfill data but passed it to the relevant environment agency		0	2	360193 438069
	Local Authority Landfill Coverage Name: Lancashire County Council - Had landfill data but passed it to the relevant environment agency		0	8	360193 438069
	Local Authority Landfill Coverage Name: Preston Borough Council - Has no landfill data to supply		10	3	360054 438123
65	**Registered Landfill Sites** Licence Holder: William Pye Ltd Licence Reference: L 294 Site Location: Lords Quarry, Forty Acre Lane, Longridge, Preston, Lancashire, Pr3 2ty Licence Easting: 361250 Licence Northing: 438100 Operator Location: Shay Lane Industrial Estate, Longridge, PRESTON, Lancashire, PR3 3BT Authority: Environment Agency - North West Region, Central Area Site Category: Landfill Max Input Rate: Small (Equal to or greater than 10,000 and less than 25,000 tonnes per year) Waste Source Restrictions: Some restriction on source of waste Status: Operational as far as is knownOperational Dated: 1st April 1990 Preceded By Licence: L 294 Superseded By Licence: Not Given Positional Accuracy: Manually positioned to the address or location Boundary Accuracy: Not Applicable Authorised Waste Calc.Carb.Peaty Silt Ex Water Treat. Calcium Carbonate Beads And Max.Waste Permitted By Licence Uncontam.Soil,Rock,Clay,Nat.Sand Excav Prohibited Waste Asbestos In Any Form Waste In Demountables Waste N.O.S. Whether/Not Pre-Trt/Pack'	A15NW (E)	843	1	361250 438100

Map ID	Details		Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Registered Landfill Sites					
65	Licence Holder:	William Pye Ltd	A15NW (E)	843	1	361250 438100
	Licence Reference:	L 294				
	Site Location:	Lords Quarry, Forty Acre Lane, Longridge, Preston, Lancashire, Pr3 2ty				
	Licence Easting:	361250				
	Licence Northing:	438100				
	Operator Location:	Shay Lane Ind Estate, Longridge, Preston, Lancashire				
	Authority:	Environment Agency - North West Region, Central Area				
	Site Category:	Landfill				
	Max Input Rate:	Undefined				
	Waste Source Restrictions:	Some restriction on source of waste				
	Status:	Record supersededSuperseded				
	Dated:	2nd June 1989				
	Preceded By Licence:	L 161				
	Superseded By Licence:	L 294				
	Positional Accuracy:	Manually positioned to the address or location				
	Boundary Accuracy:	Not Applicable				
	Authorised Waste	Calc.Carb.Peaty Silt Ex Water Treat. Calcium Carbonate Beads And Uncontam.Soil,Rock,Clay,Nat.Sand Excav				
	Prohibited Waste	Clinical Waste As In Doe Wmp 25				
	Registered Landfill Sites					
65	Licence Holder:	Bridgewater Estates Plc	A15NW (E)	843	1	361250 438100
	Licence Reference:	L 161				
	Site Location:	Lords Quarry At Forty Acre Lane, Thornton, Longridge, Preston, Lancashire				
	Licence Easting:	361250				
	Licence Northing:	438100				
	Operator Location:	Estate Office, Worsley, MANCHESTER, Greater Manchester, M28 4WJ				
	Authority:	Environment Agency - North West Region, Central Area				
	Site Category:	Landfill				
	Max Input Rate:	Undefined				
	Waste Source Restrictions:	Some restriction on source of waste				
	Status:	Record supersededSuperseded				
	Dated:	22nd September 1982				
	Preceded By Licence:	Not Given				
	Superseded By Licence:	L 294				
	Positional Accuracy:	Manually positioned to the address or location				
	Boundary Accuracy:	Not Applicable				
	Authorised Waste	Ceramic Waste Constr'N/Demol. Inert/Non-Haz/Non-Tox Foundry Sand Glass/Cullet Industrial Wastes Metal Scrap Plastic/Polythene (Including Sacks) Wood Waste/Timber				
	Prohibited Waste	Clinical Wastes As In Doe Wmp 25 Poisonous, Noxious, Polluting Wastes				
	Registered Landfill Sites					
66	Licence Holder:	United Utilities Water Ltd	A3NE (S)	960	1	360416 436930
	Licence Reference:	L 79				
	Site Location:	Chapel Hill Quarry, Chapel Lane, Longridge, Preston, Lancashire				
	Licence Easting:	Not Supplied				
	Licence Northing:	Not Supplied				
	Operator Location:	Lingley Mere, Lingley Green Avenue, Great Sankey, Warrington, Cheshire, Wa5 3lp				
	Authority:	Environment Agency - North West Region, Central Area				
	Site Category:	Landfill				
	Max Input Rate:	Small (Equal to or greater than 10,000 and less than 25,000 tonnes per year)				
	Waste Source Restrictions:	Some restriction on source of waste				
	Status:	Site dormant				
	Dated:	1st October 1992				
	Preceded By Licence:	L 79				
	Superseded By Licence:	Not Given				
	Positional Accuracy:	Positioned by the supplier				
	Boundary Accuracy:	Moderate				
	Authorised Waste	Concrete, Brick, Tarmac Fully Polymerised Mat'L Max.Waste Permitted By Licence Soil, Clay, Natural Sand, Rock				
	Prohibited Waste	Clinical Wastes Liable To Cause Environmental Harm Waste N.O.S.				

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Registered Waste Transfer Sites				
67	Licence Holder: Walter Carefoot & Sons Ltd Licence Reference: L 523 Site Location: Blackpool Road, Longridge, Preston, Lancashire Operator Location: As Site Address Authority: Environment Agency - North West Region, Central Area Site Category: Transfer Max Input Rate: Very Small (Less than 10,000 tonnes per year) Waste Source Restrictions: Some restriction on source of waste Licence Status: Licence has completion certificateSurrendered Dated: 1st July 1993 Preceded By Licence: Not Given Superseded By Licence: Not Given Positional Accuracy: Manually positioned to the address or location Boundary Quality: Not Supplied Authorised Waste: Foliage,Shavings,Sawdust Or Their Prod Glass,Cement Max.Waste Permitted By Licence Non-Haz.Metals Plasterboard/Plaster Plastic Packaging & Paper Slate,Concrete,Brick,Ceramics,Stone Soil,Clay,Nat'L Sand, Rock Timber, Treated Or Untreated Prohibited Waste: Clinical Wastes Waste N.O.S. Whether Treated Or Not	A8SW (S)	631	1	360050 437240

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS 1:625,000 Solid Geology Description: Tournaisian and Visean (Carboniferous Limestone Series)	A13SW (W)	0	4	360193 438069
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13SW (W)	0	5	360193 438069
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13SW (W)	0	5	360000 438000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13SE (SE)	0	5	360286 437976
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13SW (S)	0	5	360193 438000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13NW (N)	0	5	360179 438153
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13NW (NW)	0	5	360120 438142

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13NW (NW)	0	5	360137 438160
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13SW (W)	17	5	360000 438031
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13NW (NW)	23	5	360059 438226
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13SW (W)	29	5	360000 438069
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13NW (NW)	44	5	360047 438163
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13NW (NW)	44	5	360050 438217

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13SW (W)	49	5	359966 438000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13SE (SE)	52	5	360310 438000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13NW (NW)	53	5	360046 438256
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13NE (N)	56	5	360250 438324
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13NW (NW)	60	5	360032 438243
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13NW (N)	76	5	360180 438343

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13NW (N)	86	5	360198 438360
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13NE (N)	89	5	360263 438357
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13NW (NW)	92	5	360000 438162
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13NW (NW)	99	5	359995 438167
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13NW (NW)	100	5	360000 438171
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13SE (SE)	100	5	360377 437868

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13NE (N)	101	5	360215 438377
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13NW (NW)	103	5	360000 438213
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13NW (N)	106	5	360169 438370
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13NW (NW)	115	5	359979 438193
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13NW (N)	119	5	360192 438393
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13NE (NE)	148	5	360421 438370

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13SE (E)	159	5	360460 438000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A18SE (NE)	184	5	360394 438414
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A18SE (NE)	195	5	360409 438426
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13SE (E)	201	5	360520 438000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A12SE (W)	202	5	359802 438000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A12SE (W)	241	5	359760 438000

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A18SE (N)	244	5	360333 438491
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A14NW (NE)	269	5	360654 438322
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 90 - 120 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A13SE (SE)	273	5	360512 437771
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A14NW (E)	329	5	360739 438246
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A14NW (NE)	341	5	360729 438330
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 90 - 120 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A14SW (E)	366	5	360725 438000

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A8NW (S)	374	5	360000 437508
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 90 - 120 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A14NW (E)	446	5	360855 438142
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A14SE (E)	572	5	360961 438031
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A9NW (SE)	581	5	360820 437708
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 90 - 120 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A14NE (E)	587	5	361000 438089
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A14NE (E)	593	5	361000 438289

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: <15 mg/kg	A14SE (E)	597	5	361000 438069
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A9NW (SE)	615	5	360759 437532
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A19SE (NE)	615	5	360937 438524
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A18NW (N)	619	5	360066 438876
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A14SE (E)	620	5	361000 438000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A19SE (NE)	629	5	361000 438428

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A18NE (N)	635	5	360483 438866
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A19NW (NE)	636	5	360623 438815
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A19NW (NE)	639	5	360653 438804
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A9NW (SE)	644	5	360681 437410
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 90 - 120 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A8SW (S)	651	5	360000 437225
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A19SE (NE)	656	5	361000 438495

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A19SE (NE)	661	5	361000 438507
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A19NW (NE)	663	5	360769 438762
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A14SE (E)	685	5	361063 437983
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: <15 mg/kg	A14SE (E)	694	5	361078 438000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A19SE (NE)	697	5	361044 438497
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: <15 mg/kg	A14NE (E)	700	5	361109 438129

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A18NW (N)	724	5	360193 439000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A14SE (E)	725	5	361000 437761
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A18NW (N)	726	5	360160 439000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: <15 mg/kg	A14SE (E)	728	5	361113 438000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A18NW (N)	731	5	360120 439000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A19SE (NE)	736	5	361000 438646

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A19SE (NE)	747	5	361106 438480
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A18NW (N)	756	5	360000 439000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A19SE (NE)	756	5	361000 438678
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 90 - 120 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A14NE (E)	764	5	361172 438290
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A19SE (NE)	765	5	361016 438672
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A9NE (SE)	784	5	361000 437662

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A7NW (W)	786	5	359226 437714
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 90 - 120 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A14SE (E)	791	5	361071 437750
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 90 - 120 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A14SE (E)	807	5	361193 437993
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 90 - 120 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A14SE (E)	810	5	361198 438000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A19NE (NE)	816	5	360884 438867
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A19NE (NE)	824	5	360913 438856

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A15SW (E)	827	5	361215 438000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A19SE (NE)	827	5	361118 438635
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A15SW (E)	831	5	361221 438007
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A15SW (E)	838	5	361227 438000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 90 - 120 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A20SW (E)	839	5	361215 438447
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A19SE (NE)	843	5	361201 438502

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 90 - 120 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A15NW (E)	853	5	361248 438378
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A19NE (NE)	853	5	361000 438820
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A19NE (NE)	854	5	361003 438819
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A23SE (N)	860	5	360253 439135
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A19SE (NE)	862	5	361169 438616
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: <15 mg/kg	A20SW (E)	862	5	361231 438472

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A11SE (W)	867	5	359125 438000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 90 - 120 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A3NW (S)	869	5	360193 437000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 90 - 120 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A3NW (S)	874	5	360000 437000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 30 - 45 mg/kg	A3NE (S)	874	5	360289 437000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 90 - 120 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A20SW (E)	884	5	361268 438428
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A3NE (S)	886	5	360387 437000

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: <15 mg/kg	A20SW (E)	894	5	361275 438441
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 90 - 120 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A9SE (SE)	896	5	360994 437365
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 90 - 120 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A9SE (SE)	915	5	361000 437372
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: <15 mg/kg	A15SW (E)	916	5	361306 438000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A2NE (S)	925	5	359778 437000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A19SE (NE)	942	5	361193 438729

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: <15 mg/kg	A15NW (E)	944	5	361336 438399
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A19NE (NE)	958	5	361000 438959
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 90 - 120 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A4NW (S)	961	5	360634 437000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A20SW (NE)	974	5	361251 438697
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A19NE (NE)	989	5	360996 439000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A11SE (W)	989	5	359000 438000

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 15 - 25 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A19NE (NE)	991	5	361000 439000
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A11SE (W)	991	5	359000 438069
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: 25 - 35 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A20SW (NE)	992	5	361283 438678
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: 15 - 30 mg/kg	A19NE (NE)	995	5	361000 439005
	BGS Estimated Soil Chemistry Source: British Geological Survey, National Geoscience Information Service Soil Sample Type: RuSoilExAs Arsenic Concentration: <15 mg/kg Cadmium Concentration: <1.8 mg/kg Chromium Concentration: 60 - 90 mg/kg Lead Concentration: <150 mg/kg Nickel Concentration: <15 mg/kg	A15NW (E)	996	5	361392 438384
68	**BGS Recorded Mineral Sites** Site Name: Thornley Brick & Tile Works Location: Old Clay Lane, Longridge, Lancashire Source: British Geological Survey, National Geoscience Information Service Reference: 92685 Type: Opencast **Status: Ceased** Operator: Unknown Operator Operator Location: Unknown Operator Periodic Type: Carboniferous Geology: Hodder Mudstone Formation Commodity: Common Clay and Shale Positional Accuracy: Located by supplier to within 10m	A17SE (NW)	403	4	359847 438548

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	BGS Recorded Mineral Sites				
69	Site Name: Severn Acres Location: , Longridge, Lancashire Source: British Geological Survey, National Geoscience Information Service Reference: 92704 Type: Opencast **Status: Ceased** Operator: Unknown Operator Operator Location: Unknown Operator Periodic Type: Carboniferous Geology: Pendle Grit Member Commodity: Sandstone Positional Accuracy: Located by supplier to within 10m	A14SE (E)	711	4	361051 437881
	BGS Recorded Mineral Sites				
70	Site Name: Lords Location: , Longridge, Preston, Lancashire Source: British Geological Survey, National Geoscience Information Service Reference: 7181 Type: Opencast **Status: Ceased** Operator: Unknown Operator Operator Location: Unknown Operator Periodic Type: Carboniferous Geology: Pendle Grit Member Commodity: Sandstone Positional Accuracy: Located by supplier to within 10m	A15NW (E)	838	4	361245 438100
	BGS Recorded Mineral Sites				
71	Site Name: Tootle Heigh Quarry Location: , Longridge, Lancashire Source: British Geological Survey, National Geoscience Information Service Reference: 92703 Type: Opencast **Status: Ceased** Operator: Unknown Operator Operator Location: Unknown Operator Periodic Type: Carboniferous Geology: Pendle Grit Member Commodity: Sandstone Positional Accuracy: Located by supplier to within 10m	A15SW (E)	908	4	361239 437820
	BGS Recorded Mineral Sites				
72	Site Name: Tootle Height Quarry Location: , Longridge, Preston, Lancashire Source: British Geological Survey, National Geoscience Information Service Reference: 5699 Type: Opencast **Status: Ceased** Operator: Unknown Operator Operator Location: Unknown Operator Periodic Type: Carboniferous Geology: Pendle Grit Member Commodity: Sandstone Positional Accuracy: Located by supplier to within 10m	A15SW (E)	955	4	361335 437950
	BGS Measured Urban Soil Chemistry No data available				
	BGS Urban Soil Chemistry Averages No data available				
	Coal Mining Affected Areas In an area that might not be affected by coal mining				
	Non Coal Mining Areas of Great Britain Risk: Highly Unlikely Source: British Geological Survey, National Geoscience Information Service	A13SW (W)	0	4	360193 438069
	Non Coal Mining Areas of Great Britain Risk: Highly Unlikely Source: British Geological Survey, National Geoscience Information Service	A13SW (W)	0	4	360001 438069
	Potential for Collapsible Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13SW (W)	0	4	360193 438069
	Potential for Collapsible Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13SW (W)	0	4	360001 438069
	Potential for Collapsible Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13NW (N)	0	4	360179 438154

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Potential for Collapsible Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13NW (NW)	44	4	360047 438163
	Potential for Collapsible Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13NW (NW)	93	4	360001 438162
	Potential for Collapsible Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13NE (NE)	149	4	360422 438371
	Potential for Compressible Ground Stability Hazards Hazard Potential: Moderate Source: British Geological Survey, National Geoscience Information Service	A13NW (N)	0	4	360179 438154
	Potential for Compressible Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13SW (W)	0	4	360001 438069
	Potential for Compressible Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13SW (W)	0	4	360193 438069
	Potential for Compressible Ground Stability Hazards Hazard Potential: High Source: British Geological Survey, National Geoscience Information Service	A13NW (NW)	44	4	360047 438163
	Potential for Compressible Ground Stability Hazards Hazard Potential: High Source: British Geological Survey, National Geoscience Information Service	A13NW (NW)	93	4	360001 438162
	Potential for Compressible Ground Stability Hazards Hazard Potential: Moderate Source: British Geological Survey, National Geoscience Information Service	A13NE (NE)	149	4	360422 438371
	Potential for Ground Dissolution Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13NW (NW)	0	4	360138 438160
	Potential for Ground Dissolution Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	A13NW (NW)	0	4	360120 438142
	Potential for Ground Dissolution Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	A13SW (W)	29	4	360001 438069
	Potential for Ground Dissolution Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13NW (NW)	44	4	360047 438163
	Potential for Ground Dissolution Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13NW (NW)	44	4	360050 438217
	Potential for Ground Dissolution Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	A13NE (N)	57	4	360251 438325
	Potential for Ground Dissolution Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13NW (NW)	71	4	359995 438168
	Potential for Ground Dissolution Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13NW (NW)	93	4	360001 438162
	Potential for Ground Dissolution Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13NW (NW)	100	4	360001 438172
	Potential for Ground Dissolution Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A18SE (NE)	185	4	360394 438415
	Potential for Landslide Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13SW (W)	0	4	360001 438069
	Potential for Landslide Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13SW (W)	0	4	360193 438069

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Potential for Running Sand Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13SW (W)	0	4	360001 438069
	Potential for Running Sand Ground Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	A13NW (N)	0	4	360179 438154
	Potential for Running Sand Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13SW (W)	0	4	360193 438069
	Potential for Running Sand Ground Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	A13NE (NE)	149	4	360422 438371
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13SW (W)	0	4	360001 438069
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13SW (W)	0	4	360193 438069
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13NW (NW)	44	4	360047 438163
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13NW (NW)	93	4	360001 438162
	Radon Potential - Radon Protection Measures Protection Measure: No radon protective measures are necessary in the construction of new dwellings or extensions Source: British Geological Survey, National Geoscience Information Service	A13SW (W)	0	4	360193 438069
	Radon Potential - Radon Protection Measures Protection Measure: No radon protective measures are necessary in the construction of new dwellings or extensions Source: British Geological Survey, National Geoscience Information Service	A13SW (W)	0	4	360001 438069
	Radon Potential - Radon Affected Areas Affected Area: The property is in an intermediate probability radon area, as between 1 and 3% of homes are above the action level Source: British Geological Survey, National Geoscience Information Service	A13SW (W)	0	4	360193 438069
	Radon Potential - Radon Affected Areas Affected Area: The property is in an intermediate probability radon area, as between 1 and 3% of homes are above the action level Source: British Geological Survey, National Geoscience Information Service	A13SW (W)	0	4	360001 438069

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
73	**Contemporary Trade Directory Entries** Name: Irelands Ltd Location: 60, Inglewhite Road, Longridge, Preston, PR3 2NA Classification: Garage Services **Status:** **Active** Positional Accuracy: Automatically positioned to the address	A13SW (S)	19	-	360131 437886
74	**Contemporary Trade Directory Entries** Name: Uk Blinds Location: 48, Inglewhite Road, Longridge, Preston, PR3 3JS Classification: Blinds, Awnings & Canopies **Status:** **Active** Positional Accuracy: Automatically positioned to the address	A13SW (S)	106	-	360150 437778
75	**Contemporary Trade Directory Entries** Name: Barritt Associates Ltd Location: 6, Firwood Close, Longridge, Preston, PR3 3HB Classification: Glass Engravers & Decorators **Status:** **Inactive** Positional Accuracy: Automatically positioned to the address	A13SE (SE)	178	-	360397 437799
76	**Contemporary Trade Directory Entries** Name: Sparkle Gems Cleaning Services Location: 16, Inglewhite Road, Longridge, Preston, PR3 3JS Classification: Cleaning Services - Domestic **Status:** **Active** Positional Accuracy: Automatically positioned to the address	A8NW (S)	200	-	360168 437683
77	**Contemporary Trade Directory Entries** Name: R Whalley Location: 14, Thornfield Avenue, Longridge, Preston, PR3 3HL Classification: Carpet, Curtain & Upholstery Cleaners **Status:** **Active** Positional Accuracy: Automatically positioned to the address	A8NE (S)	202	-	360311 437687
78	**Contemporary Trade Directory Entries** Name: Linear Motion Systems Ltd Location: Unit 5, 90, Berry Lane, Longridge, Preston, PR3 3WH Classification: Bearing Manufacturers **Status:** **Active** Positional Accuracy: Automatically positioned to the address	A8NW (S)	226	-	360197 437649
78	**Contemporary Trade Directory Entries** Name: T H G Motor Bodies Location: 90, Berry Lane, Longridge, Preston, PR3 3WH Classification: Car Body Repairs **Status:** **Inactive** Positional Accuracy: Automatically positioned to the address	A8NW (S)	258	-	360189 437618
78	**Contemporary Trade Directory Entries** Name: T H G North West Ltd Location: Unit 2, 90, Berry Lane, Longridge, Preston, Lancashire, PR3 3WH Classification: Car Body Repairs **Status:** **Active** Positional Accuracy: Automatically positioned to the address	A8NW (S)	258	-	360189 437618
78	**Contemporary Trade Directory Entries** Name: D D Cooling Location: 90, Berry Lane, Longridge, Preston, PR3 3WH Classification: Air Conditioning & Refrigeration Contractors **Status:** **Inactive** Positional Accuracy: Automatically positioned to the address	A8NW (S)	258	-	360189 437618
78	**Contemporary Trade Directory Entries** Name: D D Cooling Location: Flat 1, 90, Berry Lane, Longridge, Preston, PR3 3WH Classification: Air Conditioning & Refrigeration Contractors **Status:** **Active** Positional Accuracy: Automatically positioned to the address	A8NW (S)	258	-	360189 437618
79	**Contemporary Trade Directory Entries** Name: J & M Walker Ltd Location: 12, Derby Road, Longridge, Preston, PR3 3NP Classification: Painting & Decorating Supplies **Status:** **Inactive** Positional Accuracy: Automatically positioned to the address	A8NW (S)	290	-	360146 437584
79	**Contemporary Trade Directory Entries** Name: Domestics Location: 89, Berry Lane, Longridge, Preston, Lancashire, PR3 3WH Classification: Domestic Appliances - Servicing, Repairs & Parts **Status:** **Inactive** Positional Accuracy: Automatically positioned to the address	A8NW (S)	301	-	360186 437575

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
80	**Contemporary Trade Directory Entries** Name: Booths Petrol Location: Berry Lane, Longridge, Preston, PR3 3NH Classification: Petrol Filling Stations **Status:** **Active** Positional Accuracy: Automatically positioned to the address	A8NE (S)	302	-	360294 437577
80	**Contemporary Trade Directory Entries** Name: Syd Brown & Sons Ltd Location: Berry Lane, Longridge, Preston, PR3 3NH Classification: Car Dealers **Status:** **Inactive** Positional Accuracy: Automatically positioned to the address	A8NE (S)	342	-	360293 437537
80	**Contemporary Trade Directory Entries** Name: Arnold Swift & Son Ltd Location: 53-57, Berry Lane, Longridge, Preston, PR3 3NH Classification: Hardware **Status:** **Active** Positional Accuracy: Automatically positioned to the address	A8NE (S)	362	-	360260 437512
81	**Contemporary Trade Directory Entries** Name: Liberty Printers Location: 5, Stanley Street, Longridge, PRESTON, PR3 3NJ Classification: Printers **Status:** **Inactive** Positional Accuracy: Automatically positioned to the address	A8NE (S)	339	-	360214 437535
81	**Contemporary Trade Directory Entries** Name: Acorn Recycling Location: Stanley St, Longridge, Preston, Lancashire, PR3 3NJ Classification: Recycling Centres **Status:** **Inactive** Positional Accuracy: Manually positioned to the road within the address or location	A8NE (S)	339	-	360222 437534
81	**Contemporary Trade Directory Entries** Name: Perfect Workwear & Ppe Location: Warwick St, Longridge, Preston, Lancashire, PR3 3EB Classification: Distribution Services **Status:** **Active** Positional Accuracy: Manually positioned within the geographical locality	A8NW (S)	352	-	360192 437523
81	**Contemporary Trade Directory Entries** Name: Linotype Service (Blackburn) Ltd Location: The Printworks, Warwick Street, Longridge, Preston, PR3 3EB Classification: Printers **Status:** **Inactive** Positional Accuracy: Automatically positioned to the address	A8NE (S)	363	-	360226 437510
81	**Contemporary Trade Directory Entries** Name: John Barton Location: The Printworks, Warwick Street, Longridge, Preston, PR3 3EB Classification: Printers **Status:** **Active** Positional Accuracy: Automatically positioned to the address	A8NE (S)	363	-	360226 437510
81	**Contemporary Trade Directory Entries** Name: Warwick Street Motors Ltd Location: Warwick Street, Longridge, Preston, PR3 3EB Classification: Garage Services **Status:** **Active** Positional Accuracy: Automatically positioned to the address	A8NW (S)	373	-	360185 437503
81	**Contemporary Trade Directory Entries** Name: Ats Euromaster Ltd Location: Warwick Street, Longridge, Preston, Lancashire, PR3 3EB Classification: Tyre Dealers **Status:** **Inactive** Positional Accuracy: Automatically positioned to the address	A8NW (S)	396	-	360197 437478
82	**Contemporary Trade Directory Entries** Name: Quilters Quarters Location: 32, Derby Road, Longridge, Preston, Lancashire, PR3 3NP Classification: Clothing & Fabrics - Manufacturers **Status:** **Inactive** Positional Accuracy: Manually positioned to the address or location	A8NW (S)	339	-	360137 437533
83	**Contemporary Trade Directory Entries** Name: Advanced Print Solutions Location: The Old Corn Mill, Warwick Street, Longridge, Preston, PR3 3EB Classification: Printers **Status:** **Active** Positional Accuracy: Automatically positioned to the address	A8NE (S)	372	-	360248 437501

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
84	**Contemporary Trade Directory Entries** Name: Longridge Community Hospital Location: St. Wilfrids Terrace, Longridge, Preston, PR3 3WQ Classification: Hospitals **Status: Active** Positional Accuracy: Automatically positioned to the address	A8NW (S)	397	-	360015 437480
85	**Contemporary Trade Directory Entries** Name: Longridge Dry Cleaning Centre Location: 6, Towneley Parade, Longridge, Preston, PR3 3HU Classification: Dry Cleaners **Status: Active** Positional Accuracy: Automatically positioned to the address	A8NE (S)	429	-	360368 437466
86	**Contemporary Trade Directory Entries** Name: Belmont Garage Ltd Location: Inglewhite Road, Longridge, Preston, PR3 2DB Classification: Garage Services **Status: Active** Positional Accuracy: Automatically positioned to the address	A12NW (W)	512	-	359513 438113
87	**Contemporary Trade Directory Entries** Name: Dreem Kitchens Location: 29-33, Berry Lane, Longridge, Preston, PR3 3JA Classification: Kitchen Furniture Manufacturers **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A8SE (S)	550	-	360436 437362
88	**Contemporary Trade Directory Entries** Name: Hesketh Transport Location: 64, Derby Road, Longridge, Preston, PR3 3FE Classification: Road Haulage Services **Status: Active** Positional Accuracy: Automatically positioned to the address	A8SW (S)	561	-	360106 437308
89	**Contemporary Trade Directory Entries** Name: Catlow Car Location: New Fold Garage,Neville St, Longridge, Preston, Lancashire, PR3 3FD Classification: Car Dealers - Used **Status: Inactive** Positional Accuracy: Manually positioned within the geographical locality	A8SW (S)	602	-	360170 437272
89	**Contemporary Trade Directory Entries** Name: J Greenwood Vehicles Location: New Fold Garage, Neville Street, Longridge, Preston, PR3 3FD Classification: Car Dealers **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A8SW (S)	602	-	360170 437272
90	**Contemporary Trade Directory Entries** Name: Sharples Location: Cedarwood, Inglewhite Road, Longridge, Preston, PR3 2DB Classification: Electrical Engineers **Status: Active** Positional Accuracy: Automatically positioned to the address	A12NW (W)	614	-	359414 438139
91	**Contemporary Trade Directory Entries** Name: S A C P A C Location: 14, Bowland Close, Longridge, PRESTON, PR3 3TU Classification: Packaging Materials Manufacturers & Suppliers **Status: Active** Positional Accuracy: Automatically positioned to the address	A9NW (SE)	658	-	360858 437659
92	**Contemporary Trade Directory Entries** Name: Bonds Of Longridge Ltd Location: Stonebridge Garage, Kestor Lane, Longridge, Preston, PR3 3AE Classification: Petrol Filling Stations **Status: Active** Positional Accuracy: Automatically positioned to the address	A8SW (S)	716	-	360145 437155
93	**Contemporary Trade Directory Entries** Name: V Baines Location: 32, Kestor Lane, Longridge, Preston, PR3 3JX Classification: Washing Machines - Servicing & Repairs **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A8SE (S)	735	-	360399 437157
94	**Contemporary Trade Directory Entries** Name: T D G Ltd Location: Daniel Platt Garage, Whittingham Road, Longridge, Preston, PR3 2AD Classification: Road Haulage Services **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A7SE (S)	756	-	359836 437160

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
95	**Contemporary Trade Directory Entries** Name: Feather & Fiber Interiors Location: 47, Kestor Lane, Longridge, Preston, Lancashire, PR3 3JU Classification: Soft Furnishings - Manufacturers **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A8SE (S)	767	-	360216 437106
96	**Contemporary Trade Directory Entries** Name: Longridge Tyer Exhausts Location: Stonebrow, Kestor Lane, Longridge, Preston, PR3 3JX Classification: Tyre Dealers **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A9SW (S)	778	-	360560 437167
97	**Contemporary Trade Directory Entries** Name: Diamond Commercials Location: 2, Ashley Cottages, Inglewhite Road, Longridge, Preston, PR3 2DB Classification: Car Dealers - Used **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A12NW (W)	813	-	359265 438306
98	**Contemporary Trade Directory Entries** Name: John Carlisle Location: Stonebridge Mill, Preston Road, Longridge, Preston, PR3 3AN Classification: Garage Services **Status: Active** Positional Accuracy: Automatically positioned to the address	A3NW (S)	828	-	360136 437042
98	**Contemporary Trade Directory Entries** Name: Greenwoods Vehicle Re-Finishers Location: Stonebridge Mill, Kestor Lane, Longridge, Preston, PR3 3AD Classification: Car Body Repairs **Status: Active** Positional Accuracy: Automatically positioned to the address	A3NW (S)	828	-	360136 437042
98	**Contemporary Trade Directory Entries** Name: Harlequin Glass Location: Unit 5, Stonebridge Mill, Preston Road, Longridge, Preston, PR3 3AN Classification: Stained Glass Designers & Producers **Status: Active** Positional Accuracy: Automatically positioned to the address	A3NW (S)	828	-	360136 437042
98	**Contemporary Trade Directory Entries** Name: Longridge Furniture Polishers Location: Stonebridge Mill, Preston Road, Longridge, Preston, PR3 3AN Classification: French Polishing **Status: Active** Positional Accuracy: Automatically positioned to the address	A3NW (S)	828	-	360136 437042
98	**Contemporary Trade Directory Entries** Name: Ribble Valley Tyre & Auto Services Location: Stonebridge Mill, Kestor Lane, Longridge, Preston, PR3 3AD Classification: Mot Testing Centres **Status: Active** Positional Accuracy: Automatically positioned to the address	A3NW (S)	828	-	360136 437042
98	**Contemporary Trade Directory Entries** Name: S J Mccarthy Location: Stonebridge Mill, Preston Road, Longridge, Preston, Lancashire, PR3 3AN Classification: Antiques - Repairing & Restoring **Status: Inactive** Positional Accuracy: Manually positioned to the address or location	A3NW (S)	828	-	360136 437042
98	**Contemporary Trade Directory Entries** Name: Longridge Tyre & Exhaust Location: Stonebridge Mill, Kestor Lane, Longridge, Preston, PR3 3AD Classification: Tyre Dealers **Status: Inactive** Positional Accuracy: Automatically positioned to the address	A3NW (S)	828	-	360136 437042
98	**Contemporary Trade Directory Entries** Name: Mlt Autos Location: Stonebridge Mill, Preston Road, Longridge, Preston, PR3 3AN Classification: Mechanical Engineers **Status: Active** Positional Accuracy: Automatically positioned to the address	A3NW (S)	828	-	360136 437042

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
99	**Contemporary Trade Directory Entries** Name: Palm Scaffolding Location: Sandbank Idustrial Estate,Cumeragh La, Whittingham, Preston, Lancashire, PR3 2AJ Classification: Scaffolding & Work Platforms **Status:** **Active** Positional Accuracy: Manually positioned within the geographical locality	A7SW (SW)	919	-	359356 437248
99	**Contemporary Trade Directory Entries** Name: Do It Yourself Pest Control Location: Sandbank Estate,Cumeragh La, Whittingham, Preston, Lancashire, PR3 2AJ Classification: Pest & Vermin Control **Status:** **Active** Positional Accuracy: Manually positioned within the geographical locality	A7SW (SW)	919	-	359356 437248
100	**Contemporary Trade Directory Entries** Name: Singleton'S Dairy Ltd Location: Mill Farm, Preston Road, Longridge, Preston, PR3 3AN Classification: Dairies **Status:** **Active** Positional Accuracy: Automatically positioned to the address	A3NW (S)	924	-	360195 436950
101	**Contemporary Trade Directory Entries** Name: J F Gornall Location: Larkfield, Dilworth Lane, Longridge, Preston, PR3 3ST Classification: Road Haulage Services **Status:** **Inactive** Positional Accuracy: Automatically positioned to the address	A9SE (SE)	936	-	360951 437270
102	**Contemporary Trade Directory Entries** Name: Jones Stroud Insulations Ltd Location: Queen Street, Longridge, Preston, PR3 3BS Classification: Insulation Materials **Status:** **Active** Positional Accuracy: Automatically positioned to the address	A3NW (S)	964	-	359960 436914
103	**Fuel Station Entries** Name: Irelands Garage Location: 60 Inglewhite Road, LONGRIDGE, Lancashire, PR3 2NA Brand: Obsolete Premises Type: Not Applicable **Status:** **Obsolete** Positional Accuracy: Automatically positioned to the address	A13SW (S)	19	-	360131 437885
104	**Fuel Station Entries** Name: Booths Service Station Location: Berry Lane, Longridge, Preston, PR3 3NH Brand: BP Premises Type: Petrol Station **Status:** **Open** Positional Accuracy: Manually positioned to the address or location	A8NE (S)	339	-	360283 437537
105	**Fuel Station Entries** Name: Stonebridge Garage Location: Stonebridge Garage, Kestor Lane, Longridge, Preston, PR3 3AE Brand: Texaco Premises Type: Petrol Station **Status:** **Open** Positional Accuracy: Automatically positioned to the address	A8SW (S)	716	-	360145 437155

Map ID	Details		Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Nitrate Vulnerable Zones					
106	Name:	Not Supplied	A12SE (SW)	228	7	359789 437808
	Description:	NVZ Deferred Slurry Storage Area				
	Source:	Department for Environment, Food and Rural Affairs (DEFRA - formerly FRCA)				

Agency & Hydrological	Version	Update Cycle
Contaminated Land Register Entries and Notices		
Ribble Valley Borough Council - Environmental Health Department	February 2013	Annual Rolling Update
Preston City Council - Environmental Health Department	March 2013	Annual Rolling Update
South Ribble Borough Council - Environmental Health Department	March 2013	Annual Rolling Update
Wyre Borough Council - Environmental Health Department	October 2012	Annual Rolling Update
Discharge Consents		
Environment Agency - North West Region	February 2014	Quarterly
Enforcement and Prohibition Notices		
Environment Agency - North West Region	March 2013	As notified
Integrated Pollution Controls		
Environment Agency - North West Region	October 2008	Not Applicable
Integrated Pollution Prevention And Control		
Environment Agency - North West Region	February 2014	Quarterly
Local Authority Integrated Pollution Prevention And Control		
Preston City Council - Environmental Health Department	December 2013	Annual Rolling Update
South Ribble Borough Council - Environmental Health Department	January 2013	Annual Rolling Update
Ribble Valley Borough Council - Environmental Health Department	November 2012	Annual Rolling Update
Wyre Borough Council - Environmental Health Department	September 2013	Annual Rolling Update
Local Authority Pollution Prevention and Controls		
Preston City Council - Environmental Health Department	December 2013	Annual Rolling Update
South Ribble Borough Council - Environmental Health Department	January 2013	Annual Rolling Update
Ribble Valley Borough Council - Environmental Health Department	November 2012	Annual Rolling Update
Wyre Borough Council - Environmental Health Department	September 2013	Annual Rolling Update
Local Authority Pollution Prevention and Control Enforcements		
Preston City Council - Environmental Health Department	December 2013	Annual Rolling Update
South Ribble Borough Council - Environmental Health Department	January 2013	Annual Rolling Update
Ribble Valley Borough Council - Environmental Health Department	November 2012	Annual Rolling Update
Wyre Borough Council - Environmental Health Department	September 2013	Annual Rolling Update
Nearest Surface Water Feature		
Ordnance Survey	July 2012	Quarterly
Pollution Incidents to Controlled Waters		
Environment Agency - North West Region	January 2000	Not Applicable
Prosecutions Relating to Authorised Processes		
Environment Agency - North West Region	March 2013	As notified
Prosecutions Relating to Controlled Waters		
Environment Agency - North West Region	March 2013	As notified
Registered Radioactive Substances		
Environment Agency - North West Region	February 2014	Quarterly
River Quality		
Environment Agency - Head Office	November 2001	Not Applicable
River Quality Biology Sampling Points		
Environment Agency - Head Office	July 2012	Annually
River Quality Chemistry Sampling Points		
Environment Agency - Head Office	July 2012	Annually
Substantiated Pollution Incident Register		
Environment Agency - North West Region - Central Area	February 2014	Quarterly
Environment Agency - North West Region - North Area	February 2014	Quarterly
Water Abstractions		
Environment Agency - North West Region	December 2014	Quarterly
Water Industry Act Referrals		
Environment Agency - North West Region	February 2014	Quarterly

Agency & Hydrological	Version	Update Cycle
Groundwater Vulnerability Environment Agency - Head Office	January 2011	Not Applicable
Drift Deposits Environment Agency - Head Office	January 1999	Not Applicable
Bedrock Aquifer Designations British Geological Survey - National Geoscience Information Service	October 2012	Annually
Superficial Aquifer Designations British Geological Survey - National Geoscience Information Service	October 2012	Annually
Source Protection Zones Environment Agency - Head Office	December 2014	Quarterly
Extreme Flooding from Rivers or Sea without Defences Environment Agency - Head Office	February 2014	Quarterly
Flooding from Rivers or Sea without Defences Environment Agency - Head Office	February 2014	Quarterly
Areas Benefiting from Flood Defences Environment Agency - Head Office	February 2014	Quarterly
Flood Water Storage Areas Environment Agency - Head Office	February 2014	Quarterly
Flood Defences Environment Agency - Head Office	February 2014	Quarterly
Detailed River Network Lines Environment Agency - Head Office	March 2012	Annually
Detailed River Network Offline Drainage Environment Agency - Head Office	March 2012	Annually

Waste	Version	Update Cycle
BGS Recorded Landfill Sites		
British Geological Survey - National Geoscience Information Service	June 1996	Not Applicable
Historical Landfill Sites		
Environment Agency - North West Region - Central Area	February 2014	Quarterly
Environment Agency - North West Region - North Area	February 2014	Quarterly
Environment Agency - South East Region - Kent & South London Area	February 2014	Quarterly
Environment Agency - South East Region - North East Thames Area	February 2014	Quarterly
Environment Agency - South East Region - Solent & South Downs Area	February 2014	Quarterly
Environment Agency - South East Region - West Thames Area	February 2014	Quarterly
Integrated Pollution Control Registered Waste Sites		
Environment Agency - North West Region	October 2008	Not Applicable
Licensed Waste Management Facilities (Landfill Boundaries)		
Environment Agency - North West Region - Central Area	February 2014	Quarterly
Environment Agency - North West Region - North Area	February 2014	Quarterly
Environment Agency - South East Region - Kent & South London Area	February 2014	Quarterly
Environment Agency - South East Region - North East Thames Area	February 2014	Quarterly
Environment Agency - South East Region - Solent & South Downs Area	February 2014	Quarterly
Environment Agency - South East Region - West Thames Area	February 2014	Quarterly
Licensed Waste Management Facilities (Locations)		
Environment Agency - North West Region - Central Area	February 2014	Quarterly
Environment Agency - North West Region - North Area	February 2014	Quarterly
Local Authority Landfill Coverage		
Lancashire County Council - Waste Management Group	May 2000	Not Applicable
Preston City Council - Environmental Health Department	May 2000	Not Applicable
Ribble Valley Borough Council - Environmental Health Department	May 2000	Not Applicable
South Ribble Borough Council - Environmental Health Department	May 2000	Not Applicable
Wyre Borough Council - Environmental Health Department	May 2000	Not Applicable
Local Authority Recorded Landfill Sites		
Lancashire County Council - Waste Management Group	May 2000	Not Applicable
Preston City Council - Environmental Health Department	May 2000	Not Applicable
Ribble Valley Borough Council - Environmental Health Department	May 2000	Not Applicable
Wyre Borough Council - Environmental Health Department	May 2000	Not Applicable
South Ribble Borough Council - Environmental Health Department	May 2003	Not Applicable
Registered Landfill Sites		
Environment Agency - North West Region - Central Area	March 2003	Not Applicable
Environment Agency - North West Region - North Area	March 2003	Not Applicable
Registered Waste Transfer Sites		
Environment Agency - North West Region - Central Area	March 2003	Not Applicable
Environment Agency - North West Region - North Area	March 2003	Not Applicable
Registered Waste Treatment or Disposal Sites		
Environment Agency - North West Region - Central Area	March 2003	Not Applicable
Environment Agency - North West Region - North Area	March 2003	Not Applicable

Hazardous Substances	Version	Update Cycle
Control of Major Accident Hazards Sites (COMAH) Health and Safety Executive	March 2014	Bi-Annually
Explosive Sites Health and Safety Executive	November 2013	Bi-Annually
Notification of Installations Handling Hazardous Substances (NIHHS) Health and Safety Executive	November 2000	Not Applicable
Planning Hazardous Substance Enforcements		
Ribble Valley Borough Council	June 2013	Annual Rolling Update
Lancashire County Council	November 2012	Annual Rolling Update
Preston City Council	November 2012	Annual Rolling Update
South Ribble Borough Council	November 2012	Annual Rolling Update
Wyre Borough Council - Planning Department	October 2012	Annual Rolling Update
Planning Hazardous Substance Consents		
Ribble Valley Borough Council	June 2013	Annual Rolling Update
Lancashire County Council	November 2012	Annual Rolling Update
Preston City Council	November 2012	Annual Rolling Update
South Ribble Borough Council	November 2012	Annual Rolling Update
Wyre Borough Council - Planning Department	October 2012	Annual Rolling Update

Geological	Version	Update Cycle
BGS 1:625,000 Solid Geology British Geological Survey - National Geoscience Information Service	August 1996	Not Applicable
BGS Estimated Soil Chemistry British Geological Survey - National Geoscience Information Service	January 2010	Variable
BGS Recorded Mineral Sites British Geological Survey - National Geoscience Information Service	October 2013	Bi-Annually
Brine Compensation Area Cheshire Brine Subsidence Compensation Board	August 2011	Not Applicable
Coal Mining Affected Areas The Coal Authority - Mining Report Service	December 2013	As notified
Mining Instability Ove Arup & Partners	October 2000	Not Applicable
Non Coal Mining Areas of Great Britain British Geological Survey - National Geoscience Information Service	February 2011	Not Applicable
Potential for Collapsible Ground Stability Hazards British Geological Survey - National Geoscience Information Service	October 2013	As notified
Potential for Compressible Ground Stability Hazards British Geological Survey - National Geoscience Information Service	October 2013	As notified
Potential for Ground Dissolution Stability Hazards British Geological Survey - National Geoscience Information Service	October 2013	As notified
Potential for Landslide Ground Stability Hazards British Geological Survey - National Geoscience Information Service	October 2013	As notified
Potential for Running Sand Ground Stability Hazards British Geological Survey - National Geoscience Information Service	October 2013	As notified
Potential for Shrinking or Swelling Clay Ground Stability Hazards British Geological Survey - National Geoscience Information Service	October 2013	As notified
Radon Potential - Radon Affected Areas British Geological Survey - National Geoscience Information Service	July 2011	As notified
Radon Potential - Radon Protection Measures British Geological Survey - National Geoscience Information Service	July 2011	As notified

Industrial Land Use	Version	Update Cycle
Contemporary Trade Directory Entries Thomson Directories	February 2014	Quarterly
Fuel Station Entries Catalist Ltd - Experian	March 2014	Quarterly

Sensitive Land Use	Version	Update Cycle
Areas of Adopted Green Belt		
Preston City Council	February 2014	As notified
Ribble Valley Borough Council	February 2014	As notified
South Ribble Borough Council	February 2014	As notified
Wyre Borough Council - Planning Department	February 2014	As notified
Areas of Unadopted Green Belt		
Preston City Council	February 2014	As notified
Ribble Valley Borough Council	February 2014	As notified
South Ribble Borough Council	February 2014	As notified
Wyre Borough Council - Planning Department	February 2014	As notified
Areas of Outstanding Natural Beauty Natural England	January 2014	Bi-Annually
Environmentally Sensitive Areas Natural England	July 2013	Annually
Forest Parks Forestry Commission	April 1997	Not Applicable
Local Nature Reserves Natural England	July 2013	Bi-Annually
Marine Nature Reserves Natural England	July 2013	Bi-Annually
National Nature Reserves Natural England	January 2014	Bi-Annually
National Parks Natural England	January 2014	Bi-Annually
Nitrate Sensitive Areas Department for Environment, Food and Rural Affairs (DEFRA - formerly FRCA)	February 2012	Not Applicable
Nitrate Vulnerable Zones Department for Environment, Food and Rural Affairs (DEFRA - formerly FRCA)	February 2013	Annually
Ramsar Sites Natural England	July 2013	Bi-Annually
Sites of Special Scientific Interest Natural England	July 2013	Bi-Annually
Special Areas of Conservation Natural England	July 2013	Bi-Annually
Special Protection Areas Natural England	July 2013	Bi-Annually

A selection of organisations who provide data within this report

Data Supplier	Data Supplier Logo
Ordnance Survey	
Environment Agency	
Scottish Environment Protection Agency	
The Coal Authority	
British Geological Survey	
Centre for Ecology and Hydrology	
Countryside Council for Wales	
Scottish Natural Heritage	
Natural England	
Public Health England	
Ove Arup	
Peter Brett Associates	

curtins

Useful Contacts

Contact	Name and Address	Contact Details
1	**Environment Agency - National Customer Contact Centre (NCCC)** PO Box 544, Templeborough, Rotherham, S60 1BY	Telephone: 08708 506 506 Email: enquiries@environment-agency.gov.uk
2	**Ribble Valley Borough Council - Environmental Health Department** Council Offices, Church Walk, Clitheroe, Lancashire, BB7 2RA	Telephone: 01200 425111 Fax: 01200 26339 Website: www.ribblevalley.gov.uk
3	**Preston City Council - Environmental Health Department** Strategic Services, Town Hall, Lancaster Road, Preston, Lancashire, PR1 2RL	Telephone: 01772 906000 Fax: 01772 906195 Email: info@preston.gov.uk Website: www.preston.gov.uk
4	**British Geological Survey - Enquiry Service** British Geological Survey, Kingsley Dunham Centre, Keyworth, Nottingham, Nottinghamshire, NG12 5GG	Telephone: 0115 936 3143 Fax: 0115 936 3276 Email: enquiries@bgs.ac.uk Website: www.bgs.ac.uk
5	**Landmark Information Group Limited** Imperium, Imperial Way, Reading, Berkshire, RG2 0TD	Telephone: 0844 844 9952 Fax: 0844 844 9951 Email: customerservices@landmark.co.uk Website: www.landmarkinfo.co.uk
6	**Natural England** Northminster House, Northminster Road, Peterborough, Cambridgeshire, PE1 1UA	Telephone: 0845 600 3078 Fax: 01733 455103 Email: enquiries@naturalengland.org.uk Website: www.naturalengland.org.uk
7	**Department for Environment, Food and Rural Affairs (DEFRA - formerly FRCA)** Government Buildings, Otley Road, Lawnswood, Leeds, West Yorkshire, LS16 5QT	Telephone: 0113 2613333 Fax: 0113 230 0879
8	**Lancashire County Council - Waste Management Group** Environment Directorate, Guild House, Cross Street, Preston, Lancashire, PR1 8RD	Website: www.lancashire.gov.uk
-	**Public Health England - Radon Survey, Centre for Radiation, Chemical and Environmental Hazards** Chilton, Didcot, Oxfordshire, OX11 0RQ	Telephone: 01235 822622 Fax: 01235 833891 Email: radon@phe.gov.uk Website: www.ukradon.org
-	**Landmark Information Group Limited** Imperium, Imperial Way, Reading, Berkshire, RG2 0TD	Telephone: 0844 844 9952 Fax: 0844 844 9951 Email: customerservices@landmarkinfo.co.uk Website: www.landmarkinfo.co.uk

Please note that the Environment Agency / SEPA have a charging policy in place for enquiries.

Historical Mapping Legends

Ordnance Survey County Series and Ordnance Survey Plan 1:2,500

Quarry · Gravel Pit · Sand Pit
Clay Pit · Shingle · Refuse Heap
Sloping Masonry · Flat Rock
Marsh · Reeds · Osiers
Rough Pasture · Furze · Wood
Mixed Wood · Brushwood · Orchard
Fir · Ford · Stepping Stones
Ferry · Waterfall · Lock
Trig. Station · 507 Altitude at Trig. Station
B.M. 325·9 Bench Mark · 342 Surface Level
Arrow denotes flow of water · Antiquities (site of)
Cutting · Embankment
Railway crossing Road · Level Crossing · Road crossing Railway
Railway crossing River or Canal · Road over single stream · Road over River or Canal

County Boundary (Geographical)
County & Civil Parish Boundary
Administrative County & Civil Parish Boundary
Co. Boro. Bdy. County Borough Boundary (England)
Co. Burgh Bdy. County Burgh Boundary (Scotland)

B.P. B.S.	Boundary Post or Stone	P.C.B	Police Call Box
B.R.	Bridle Road	P	Pump
E.P	Electricity Pylon	S.P	Signal Post
F.B.	Foot Bridge	Sl.	Sluice
F.P.	Foot Path	Sp.	Spring
G.P	Guide Post or Board	T.C.B	Telephone Call Box
M.S	Mile Stone	Tr.	Trough
M.P M.R	Mooring Post or Ring	W	Well

Ordnance Survey Plan, Additional SIMs and Supply of Unpublished Survey Information 1:2,500 and 1:1,250

Inactive Quarry, Chalk Pit or Clay Pit · Active Quarry, Chalk Pit or Clay Pit
Rock · Boulders
Cliff · Slopes (Top)
Roofed Building · Glazed Roof Building
Sloping Masonry (Top) · Archway
Non-Coniferous Tree (surveyed) · Coniferous Tree (surveyed)
Non-Coniferous Trees (not surveyed) · Coniferous Trees (not surveyed)
Orchard Tree · Scrub · Bracken
Coppice, Osier · Reeds · Marsh, Saltings
Rough Grassland · Heath · Culvert
Direction of water flow · B M Bench Mark · Antiquity (site of)
Cave Entrance · Triangulation Station · Electricity Pylon
E T L Electricity Transmission Line

County Boundary (Geographical)
County & Civil Parish Boundary
Civil Parish Boundary
Admin. County or County Bor. Boundary
L B Bdy London Borough Boundary
Symbol marking point where boundary mereing changes

BH	Beer House	P	Pillar, Pole or Post
BP, BS	Boundary Post or Stone	PO	Post Office
Cn, C	Capstan, Crane	PC	Public Convenience
Chy	Chimney	PH	Public House
D Fn	Drinking Fountain	Pp	Pump
El P	Electricity Pillar or Post	SB, S Br	Signal Box or Bridge
FAP	Fire Alarm Pillar	SP, SL	Signal Post or Light
FB	Foot Bridge	Spr	Spring
GP	Guide Post	Tk	Tank or Track
H	Hydrant or Hydraulic	TCB	Telephone Call Box
LC	Level Crossing	TCP	Telephone Call Post
MH	Manhole	Tr	Trough
MP	Mile Post or Mooring Post	Wr Pt, Wr T	Water Point, Water Tap
MS	Mile Stone	W	Well
NTL	Normal Tidal Limit	Wd Pp	Wind Pump

Large-Scale National Grid Data 1:2,500 and 1:1,250

Cliff · Slopes (Top)
Rock · Rock (scattered)
Boulders · Boulders (scattered)
Positioned Boulder · Scree
Non-Coniferous Tree (surveyed) · Coniferous Tree (surveyed)
Non-Coniferous Trees (not surveyed) · Coniferous Trees (not surveyed)
Orchard Tree · Scrub · Bracken
Coppice, Osier · Reeds · Marsh, Saltings
Rough Grassland · Heath · Culvert
Direction of water flow · Triangulation Station · Antiquity (site of)
E T L Electricity Transmission Line · Electricity Pylon
BM 231.60m Bench Mark · Buildings with Building Seed
Roofed Building · Glazed Roof Building

Civil parish/community boundary
District boundary
County boundary
Boundary post/stone
Boundary mereing symbol (note: these always appear in opposed pairs or groups of three)

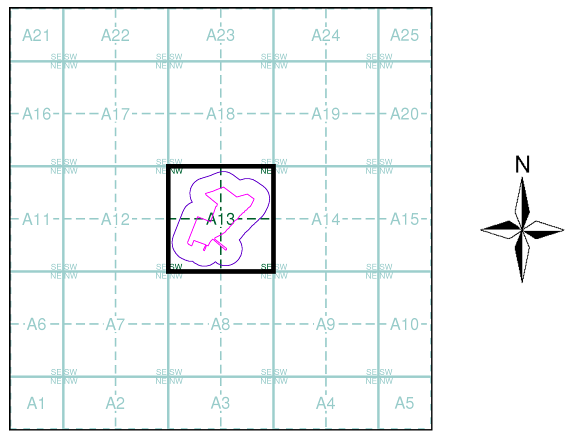
Bks	Barracks	P	Pillar, Pole or Post
Bty	Battery	PO	Post Office
Cemy	Cemetery	PC	Public Convenience
Chy	Chimney	Pp	Pump
Cis	Cistern	Ppg Sta	Pumping Station
Dismtd Rly	Dismantled Railway	PW	Place of Worship
El Gen Sta	Electricity Generating Station	Sewage Ppg Sta	Sewage Pumping Station
El P	Electricity Pole, Pillar	SB, S Br	Signal Box or Bridge
El Sub Sta	Electricity Sub Station	SP, SL	Signal Post or Light
FB	Filter Bed	Spr	Spring
Fn / D Fn	Fountain / Drinking Ftn.	Tk	Tank or Track
Gas Gov	Gas Valve Compound	Tr	Trough
GVC	Gas Governer	Wd Pp	Wind Pump
GP	Guide Post	Wr Pt, Wr T	Water Point, Water Tap
MH	Manhole	Wks	Works (building or area)
MP, MS	Mile Post or Mile Stone	W	Well

curtins

Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Lancashire And Furness	1:2,500	1893	2
Lancashire And Furness	1:2,500	1912	3
Lancashire And Furness	1:2,500	1932	4
Ordnance Survey Plan	1:2,500	1961 - 1967	5
Ordnance Survey Plan	1:2,500	1975	6
Additional SIMs	1:2,500	1975 - 1992	7
Additional SIMs	1:2,500	1978 - 1987	8
Additional SIMs	1:2,500	1981 - 1992	9
Additional SIMs	1:2,500	1992	10
Large-Scale National Grid Data	1:2,500	1994	11
Large-Scale National Grid Data	1:2,500	1995	12
Large-Scale National Grid Data	1:2,500	1996	13

Historical Map - Segment A13



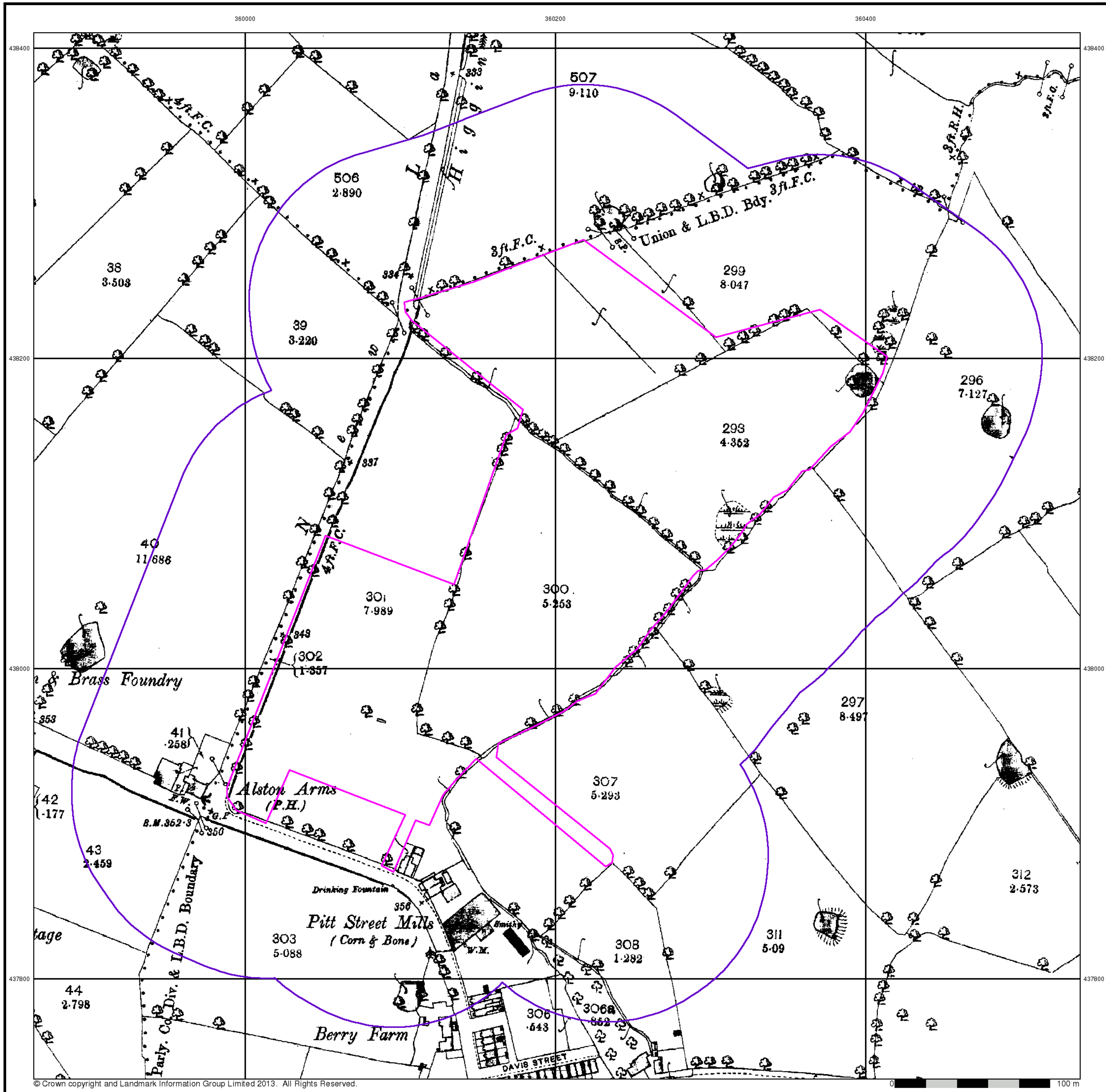
Order Details

Order Number: 55312619_1_1
Customer Ref: EB1355
National Grid Reference: 360190, 438070
Slice: A
Site Area (Ha): 7.22
Search Buffer (m): 100

Site Details

Site at 360130, 438020

Landmark Information Group
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



curtins

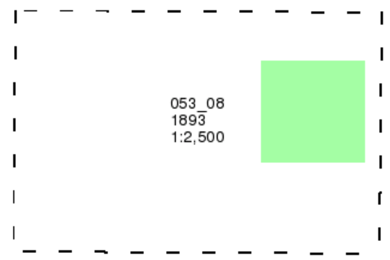
Lancashire And Furness

Published 1893

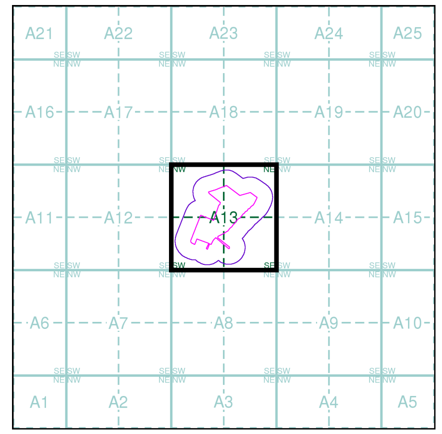
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



N

Order Details

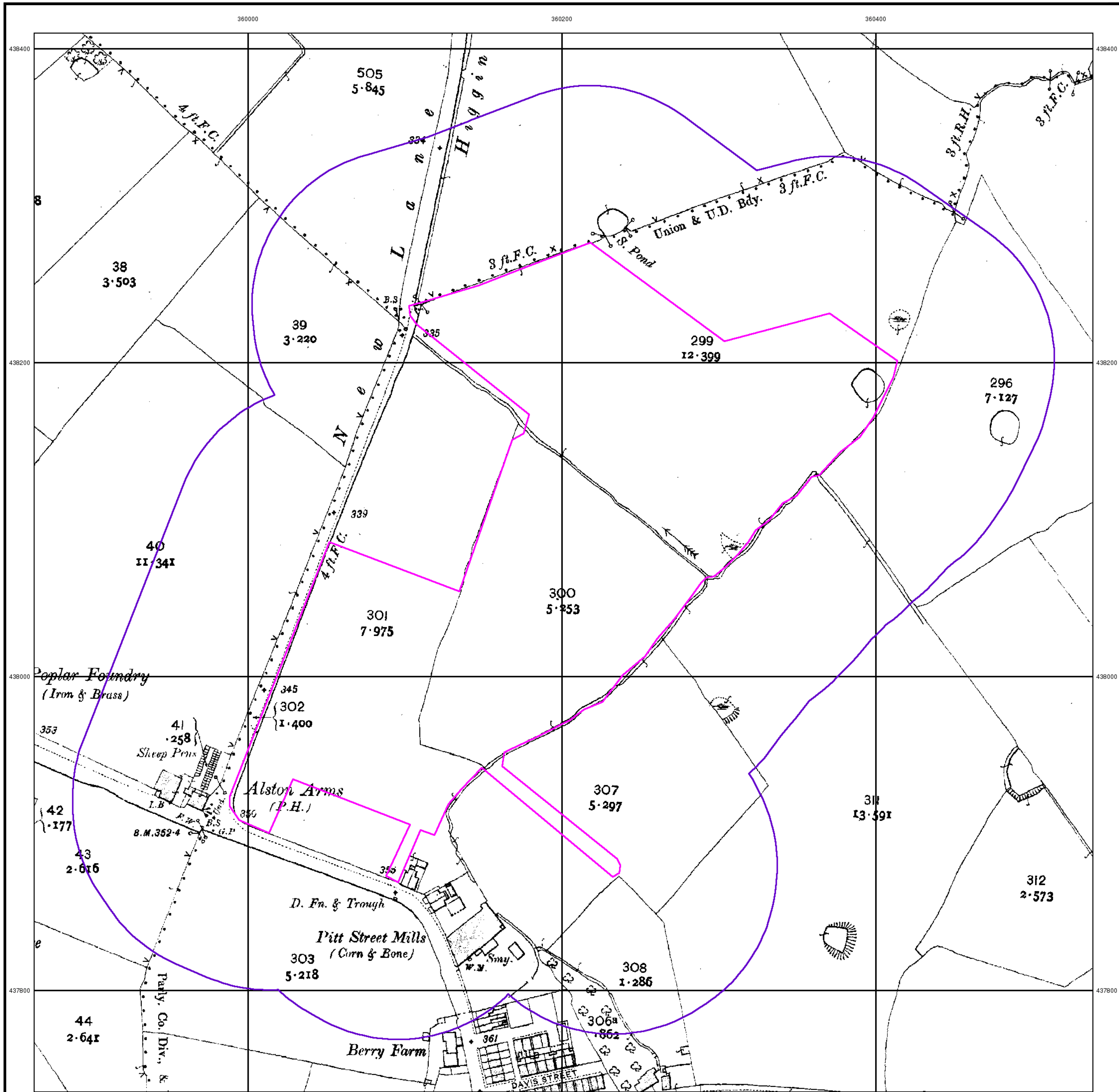
Order Number:	55312619_1_1
Customer Ref:	EB1355
National Grid Reference:	360190, 438070
Slice:	A
Site Area (Ha):	7.22
Search Buffer (m):	100

Site Details

Site at 360130, 438020

Landmark Information Group

Tel:	0844 844 9952
Fax:	0844 844 9951
Web:	www.envirocheck.co.uk



curtins

Lancashire And Furness

Published 1912

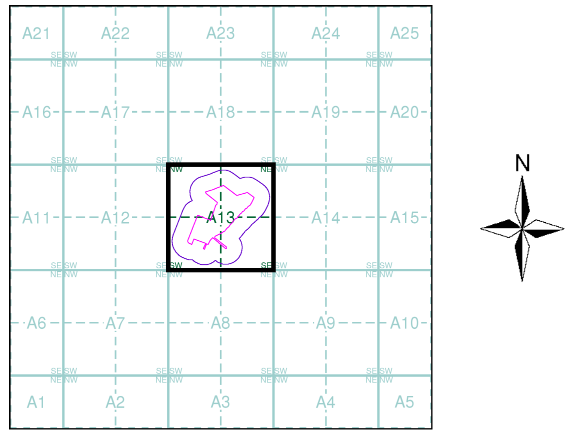
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)

053_08
1912
1:2,500

Historical Map - Segment A13



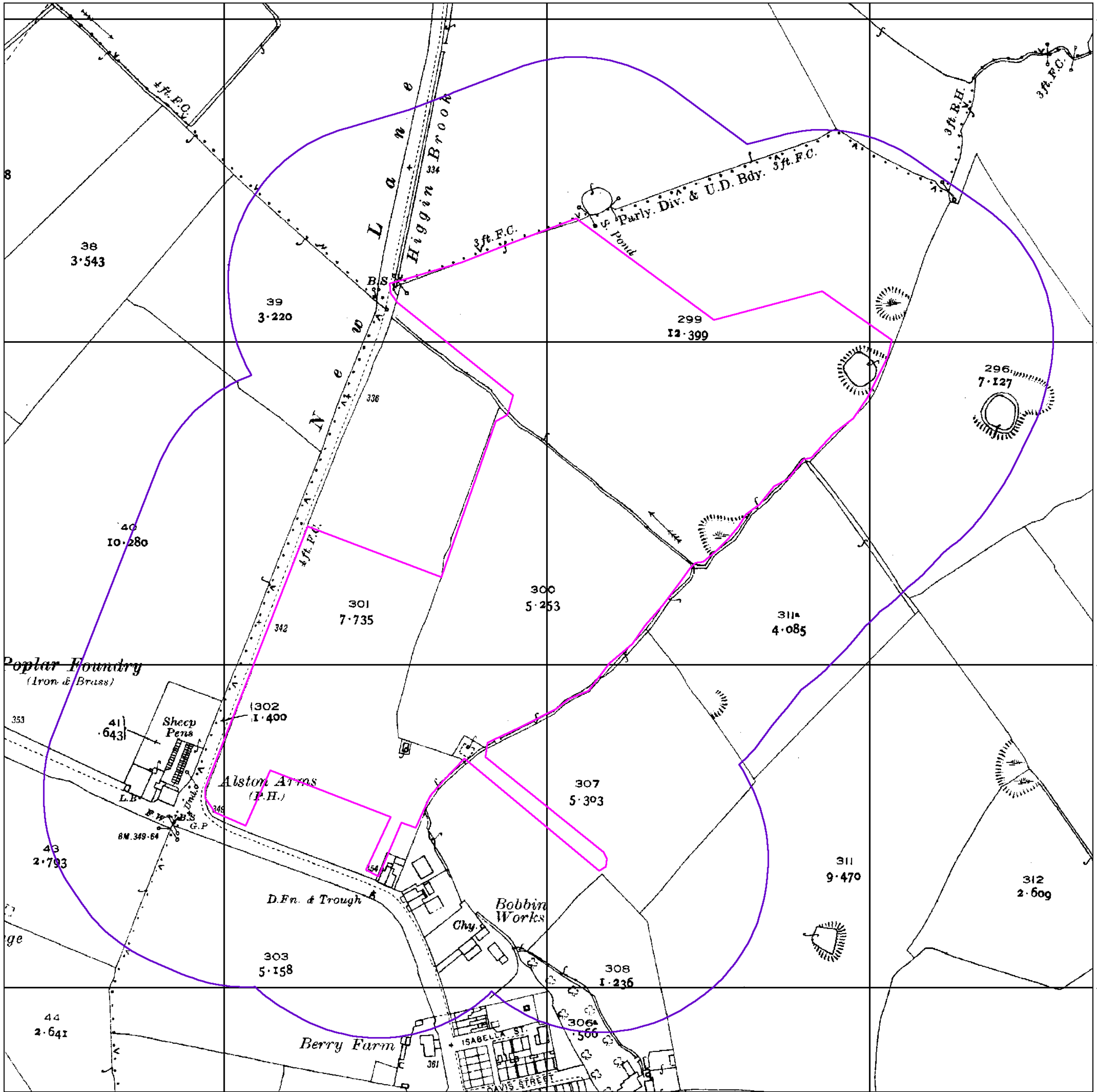
Order Details

Order Number:	55312619_1_1
Customer Ref:	EB1355
National Grid Reference:	360190, 438070
Slice:	A
Site Area (Ha):	7.22
Search Buffer (m):	100

Site Details

Site at 360130, 438020

Landmark Information Group
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



0 100 m

curtins

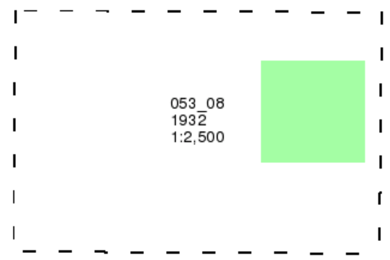
Lancashire And Furness

Published 1932

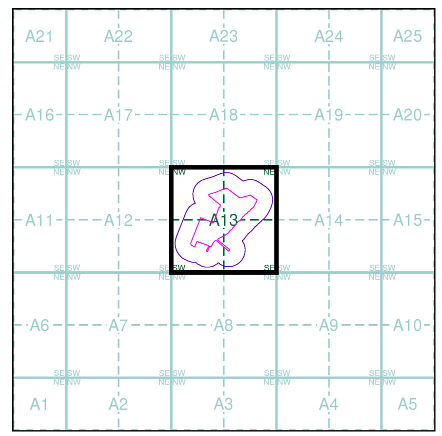
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



N

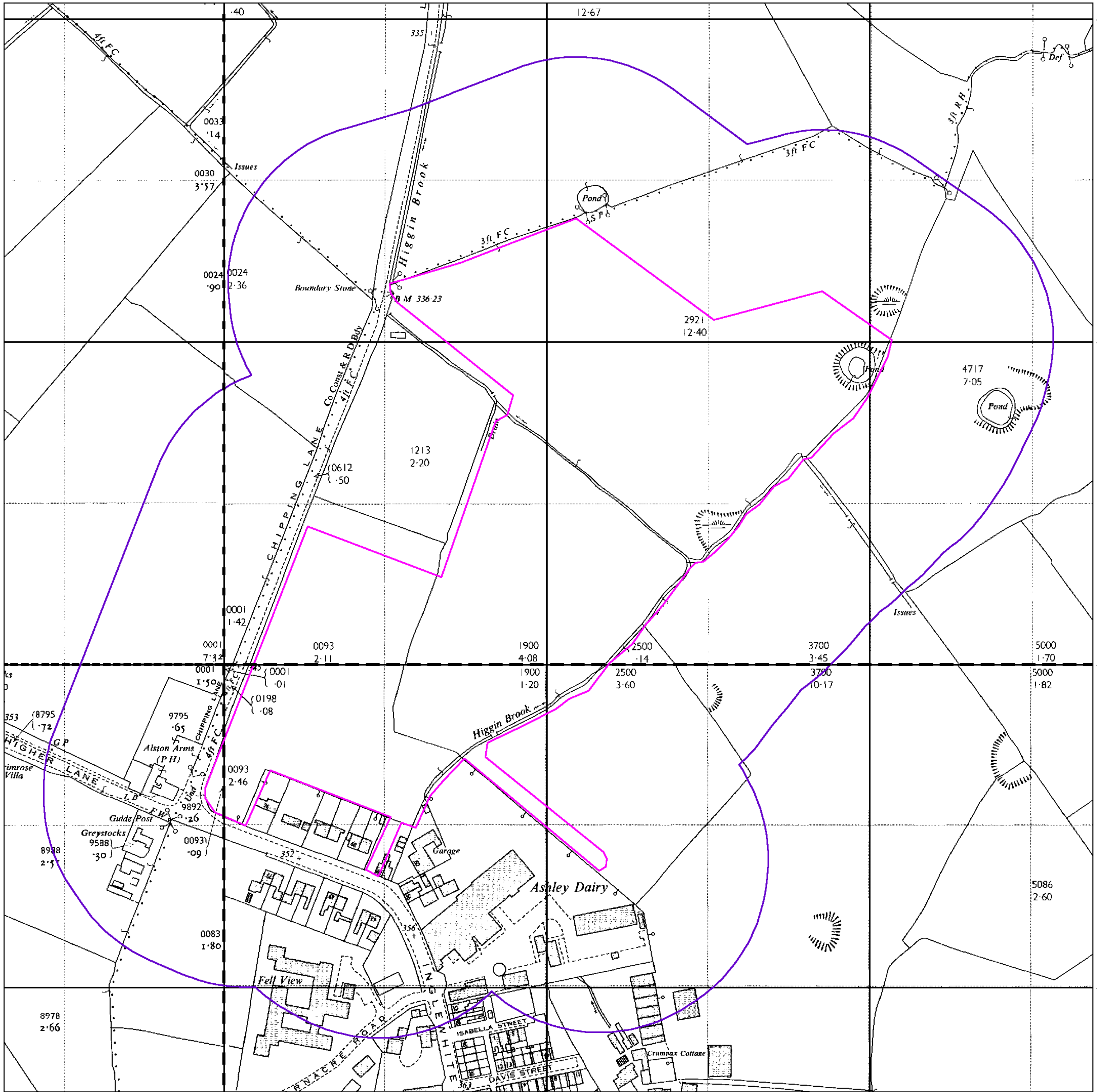
Order Details

Order Number:	55312619_1_1
Customer Ref:	EB1355
National Grid Reference:	360190, 438070
Slice:	A
Site Area (Ha):	7.22
Search Buffer (m):	100

Site Details

Site at 360130, 438020

Landmark Information Group
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



curtins

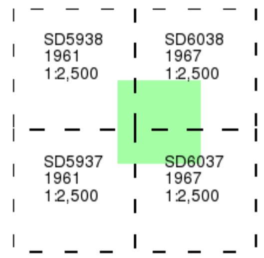
Ordnance Survey Plan

Published 1961 - 1967

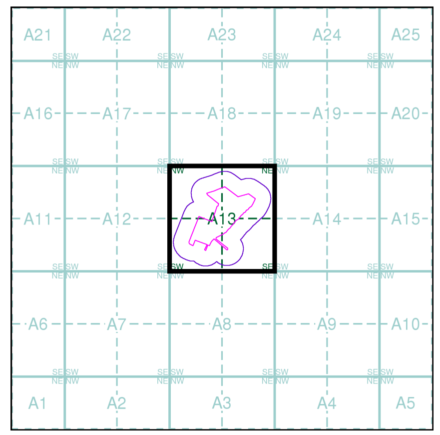
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

Order Number:	55312619_1_1
Customer Ref:	EB1355
National Grid Reference:	360190, 438070
Slice:	A
Site Area (Ha):	7.22
Search Buffer (m):	100

Site Details

Site at 360130, 438020

Landmark Information Group

Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk

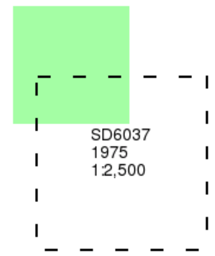
Ordnance Survey Plan

Published 1975

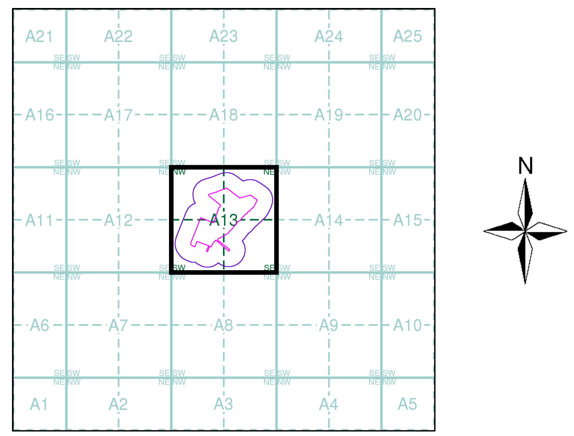
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

Order Number: 55312619_1_1
Customer Ref: EB1355
National Grid Reference: 360190, 438070
Slice: A
Site Area (Ha): 7.22
Search Buffer (m): 100

Site Details

Site at 360130, 438020

Landmark Information Group
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk

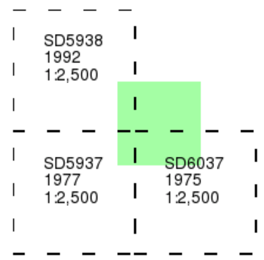
Additional SIMs

Published 1975 - 1992

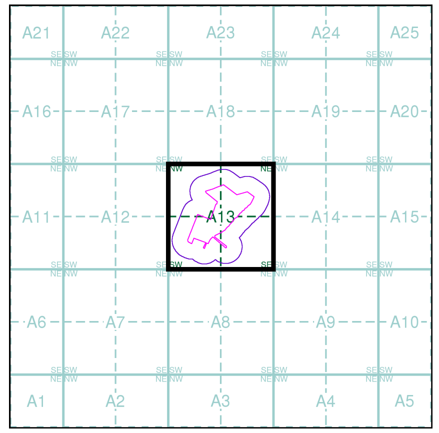
Source map scale - 1:2,500

The SIM cards (Ordnance Survey's `Survey of Information on Microfilm') are further, minor editions of mapping which were produced and published in between the main editions as an area was updated. They date from 1947 to 1994, and contain detailed information on buildings, roads and land-use. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



Historical Map - Segment A13



N

Order Details

Order Number: 55312619_1_1
Customer Ref: EB1355
National Grid Reference: 360190, 438070
Slice: A
Site Area (Ha): 7.22
Search Buffer (m): 100

Site Details

Site at 360130, 438020

Landmark Information Group
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk

curtins

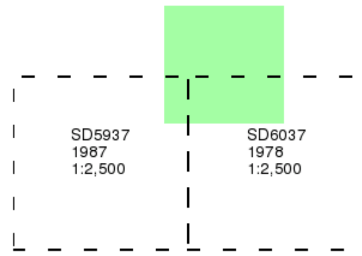
Additional SIMs

Published 1978 - 1987

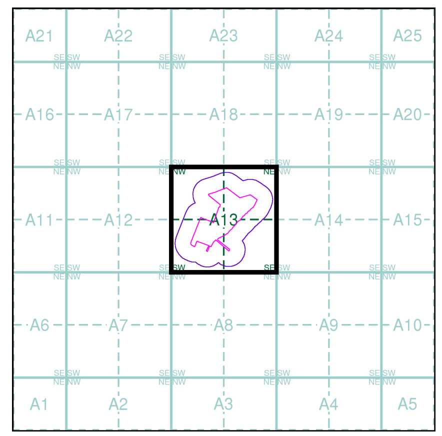
Source map scale - 1:2,500

The SIM cards (Ordnance Survey's `Survey of Information on Microfilm') are further, minor editions of mapping which were produced and published in between the main editions as an area was updated. They date from 1947 to 1994, and contain detailed information on buildings, roads and land-use. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



Historical Map - Segment A13



N

Order Details

Order Number: 55312619_1_1
Customer Ref: EB1355
National Grid Reference: 360190, 438070
Slice: A
Site Area (Ha): 7.22
Search Buffer (m): 100

Site Details

Site at 360130, 438020

Landmark Information Group

Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk

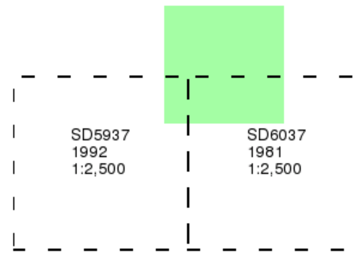
Additional SIMs

Published 1981 - 1992

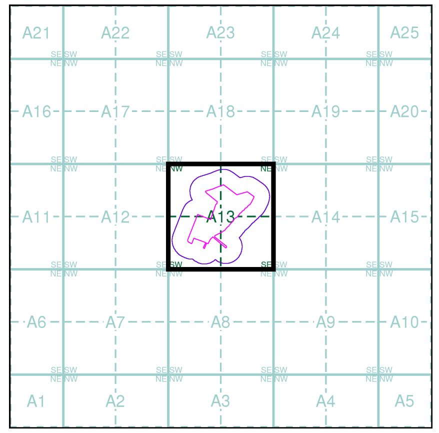
Source map scale - 1:2,500

The SIM cards (Ordnance Survey's `Survey of Information on Microfilm') are further, minor editions of mapping which were produced and published in between the main editions as an area was updated. They date from 1947 to 1994, and contain detailed information on buildings, roads and land-use. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



Historical Map - Segment A13



N

Order Details

Order Number: 55312619_1_1
Customer Ref: EB1355
National Grid Reference: 360190, 438070
Slice: A
Site Area (Ha): 7.22
Search Buffer (m): 100

Site Details

Site at 360130, 438020

Landmark Information Group
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk

curtins

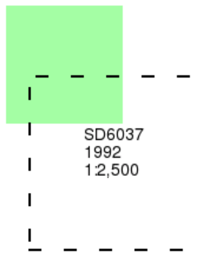
Additional SIMs

Published 1992

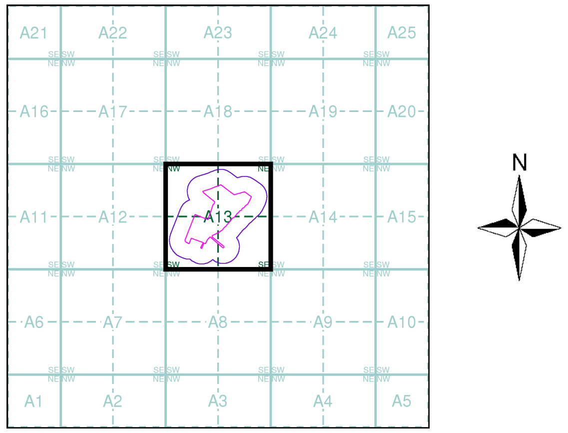
Source map scale - 1:2,500

The SIM cards (Ordnance Survey's `Survey of Information on Microfilm') are further, minor editions of mapping which were produced and published in between the main editions as an area was updated. They date from 1947 to 1994, and contain detailed information on buildings, roads and land-use. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

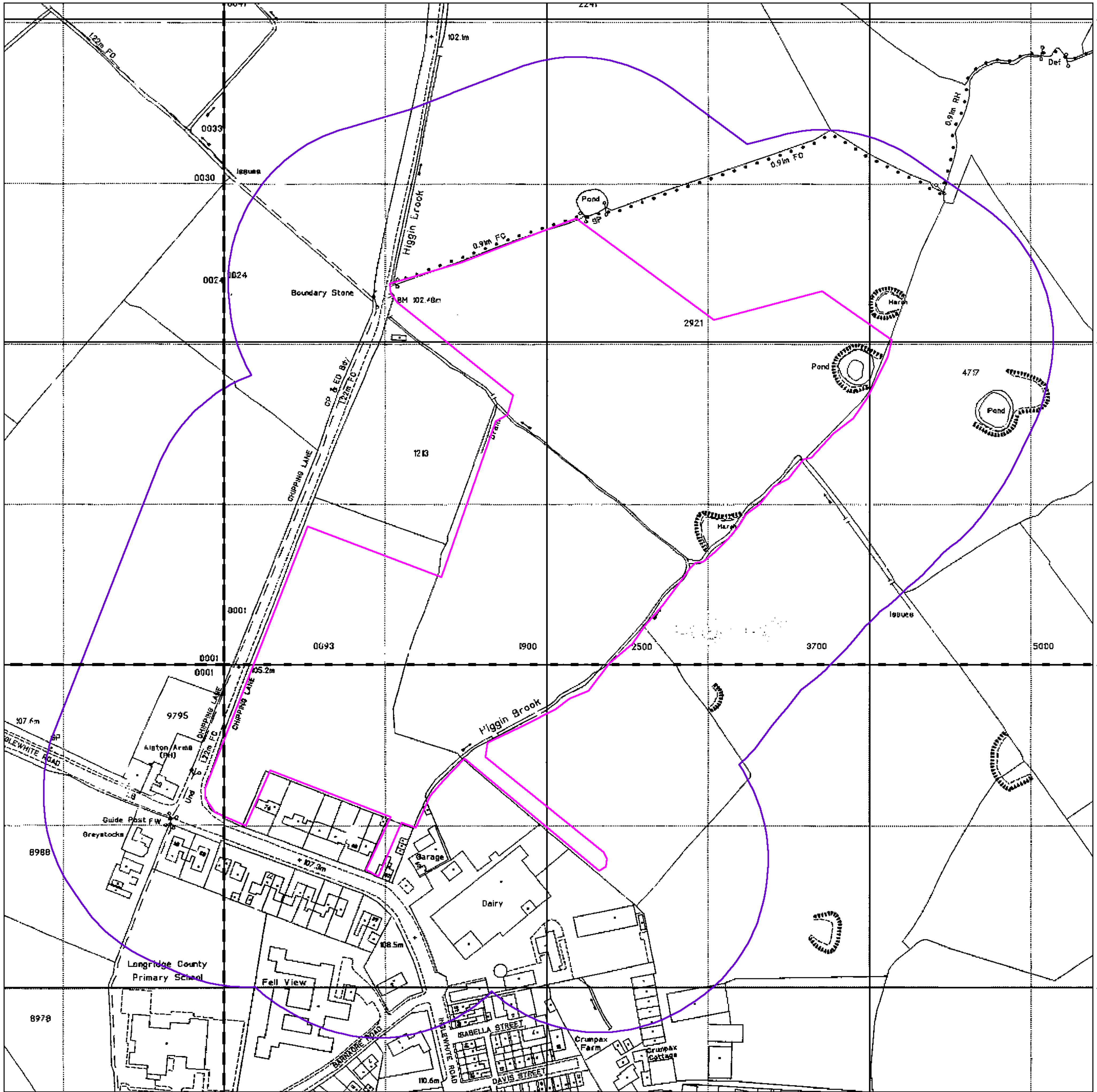
Order Number: 55312619_1_1
Customer Ref: EB1355
National Grid Reference: 360190, 438070
Slice: A
Site Area (Ha): 7.22
Search Buffer (m): 100

Site Details

Site at 360130, 438020

Landmark Information Group

Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



0 100 m

curtins

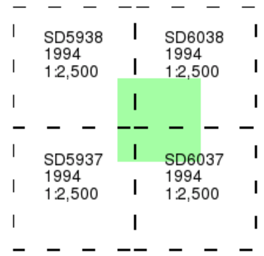
Large-Scale National Grid Data

Published 1994

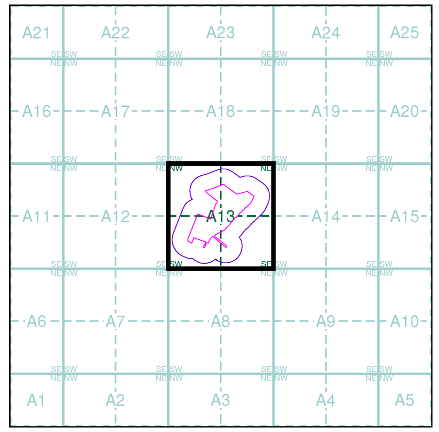
Source map scale - 1:2,500

'Large Scale National Grid Data' superseded SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') in 1992, and continued to be produced until 1999. These maps were the fore-runners of digital mapping and so provide detailed information on houses and roads, but tend to show less topographic features such as vegetation. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



Historical Map - Segment A13



N

Order Details

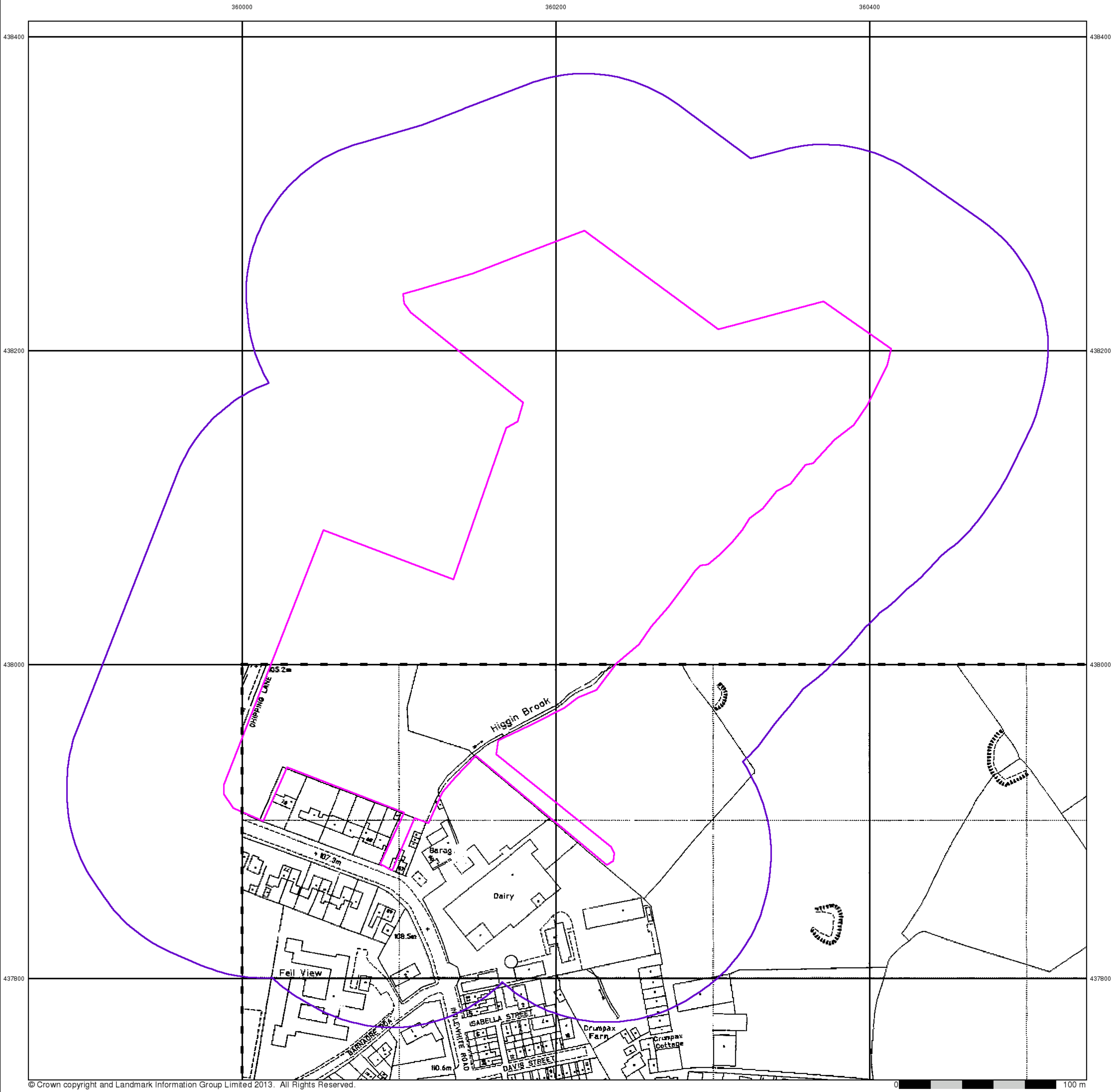
Order Number: 55312619_1_1
Customer Ref: EB1355
National Grid Reference: 360190, 438070
Slice: A
Site Area (Ha): 7.22
Search Buffer (m): 100

Site Details

Site at 360130, 438020

Landmark Information Group

Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



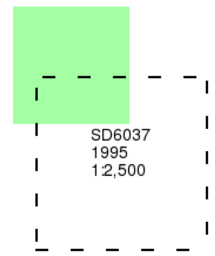
Large-Scale National Grid Data

Published 1995

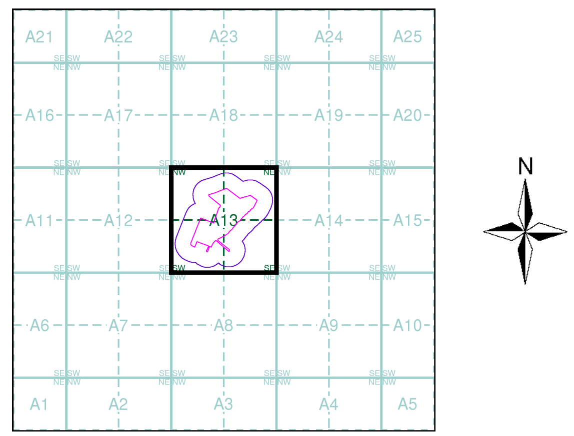
Source map scale - 1:2,500

'Large Scale National Grid Data' superseded SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') in 1992, and continued to be produced until 1999. These maps were the fore-runners of digital mapping and so provide detailed information on houses and roads, but tend to show less topographic features such as vegetation. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



Historical Map - Segment A13



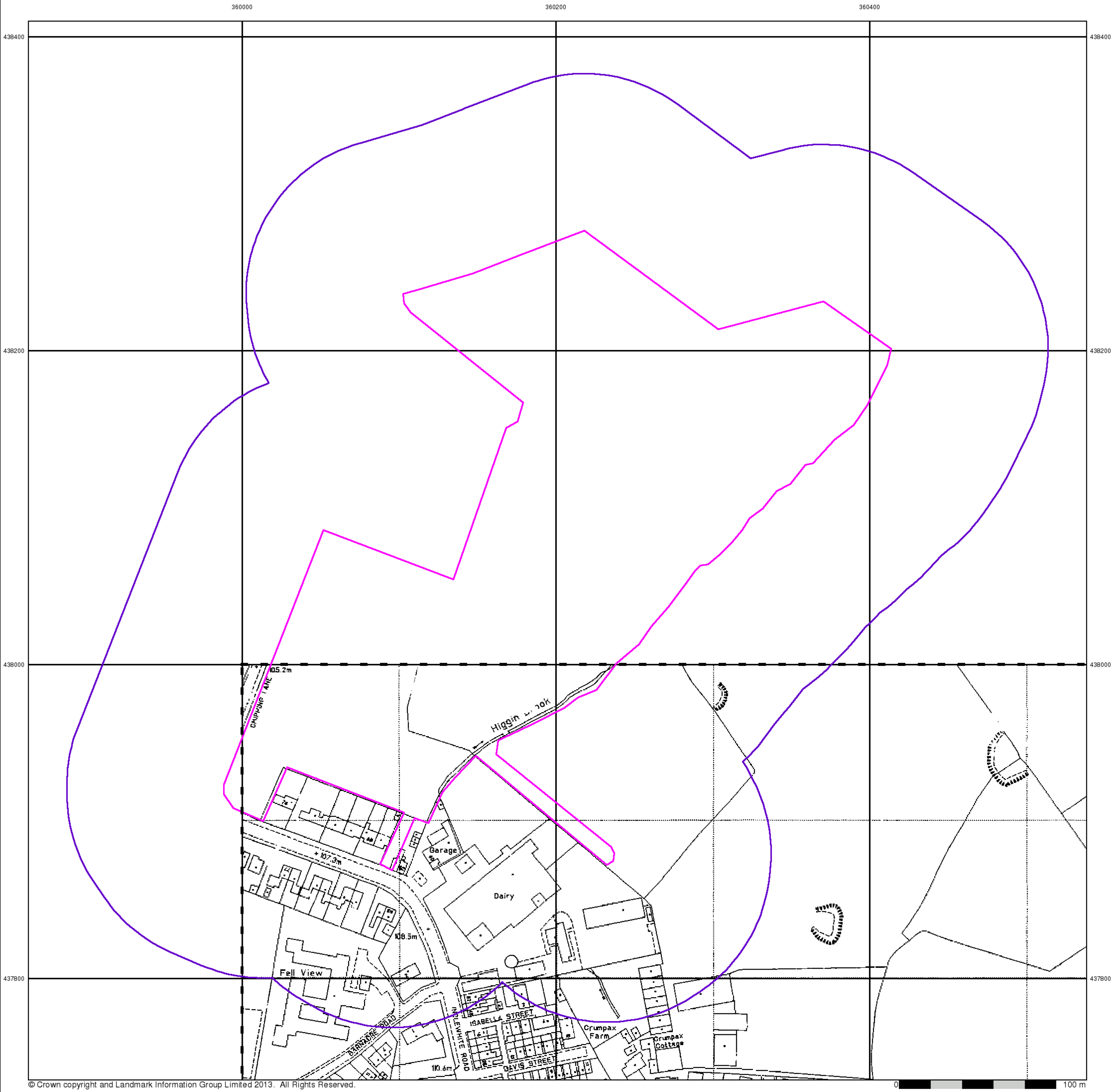
Order Details

Order Number: 55312619_1_1
Customer Ref: EB1355
National Grid Reference: 360190, 438070
Slice: A
Site Area (Ha): 7.22
Search Buffer (m): 100

Site Details

Site at 360130, 438020

Landmark Information Group
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



curtins

Large-Scale National Grid Data

Published 1996

Source map scale - 1:2,500

'Large Scale National Grid Data' superseded SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') in 1992, and continued to be produced until 1999. These maps were the fore-runners of digital mapping and so provide detailed information on houses and roads, but tend to show less topographic features such as vegetation. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)

SD6037
1996
1:2,500

Historical Map - Segment A13

A21 A22 A23 A24 A25
A16 A17 A18 A19 A20
A11 A12 A13 A14 A15
A6 A7 A8 A9 A10
A1 A2 A3 A4 A5

N

Order Details

Order Number: 55312619_1_1
Customer Ref: EB1355
National Grid Reference: 360190, 438070
Slice: A
Site Area (Ha): 7.22
Search Buffer (m): 100

Site Details

Site at 360130, 438020

Landmark Information Group

Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk

Historical Mapping Legends

Ordnance Survey County Series 1:10,560

Gravel Pit
Sand Pit
Other Pits
Quarry
Shingle
Orchard
Osiers
Reeds
Marsh
Mixed Wood
Deciduous
Brushwood
Fir
Furze
Rough Pasture
Arrow denotes flow of water
Trigonometrical Station
Site of Antiquities
Bench Mark
Pump, Guide Post, Signal Post
Well, Spring, Boundary Post
·285 Surface Level
Sketched Contour
Instrumental Contour
Main Roads (Fenced / Un-Fenced)
Minor Roads (Fenced / Un-Fenced)
Sunken Road
Raised Road
Road over Railway
Railway over River
Railway over Road
Level Crossing
Road over River or Canal
Road over Stream
Road over Stream
County Boundary (Geographical)
County & Civil Parish Boundary
Administrative County & Civil Parish Boundary
Co. Boro. Bdy. — County Borough Boundary (England)
Co. Burgh Bdy. — County Burgh Boundary (Scotland)
RD. Bdy. — Rural District Boundary
Civil Parish Boundary

Ordnance Survey Plan 1:10,000

Chalk Pit, Clay Pit or Quarry
Gravel Pit
Sand Pit
Disused Pit or Quarry
Refuse or Slag Heap
Lake, Loch or Pond
Dunes
Boulders
Coniferous Trees
Non-Coniferous Trees
Orchard
Scrub
Coppice
Bracken
Heath
Rough Grassland
Marsh
Reeds
Saltings
Building
Direction of Flow of Water
Shingle
Sand
Glasshouse
Sloping Masonry
Pylon
Pole
Electricity Transmission Line
Cutting
Embankment
Standard Gauge Multiple Track
Road Under
Road Over
Level Crossing
Foot Bridge
Standard Gauge Single Track
Siding, Tramway or Mineral Line
Narrow Gauge
Geographical County
Administrative County, County Borough or County of City
Municipal Borough, Urban or Rural District, Burgh or District Council
Borough, Burgh or County Constituency
Shown only when not coincident with other boundaries
Civil Parish
Shown alternately when coincidence of boundaries occurs

BP, BS	Boundary Post or Stone	Pol Sta	Police Station
Ch	Church	PO	Post Office
CH	Club House	PC	Public Convenience
F E Sta	Fire Engine Station	PH	Public House
FB	Foot Bridge	SB	Signal Box
Fn	Fountain	Spr	Spring
GP	Guide Post	TCB	Telephone Call Box
MP	Mile Post	TCP	Telephone Call Post
MS	Mile Stone	W	Well

1:10,000 Raster Mapping

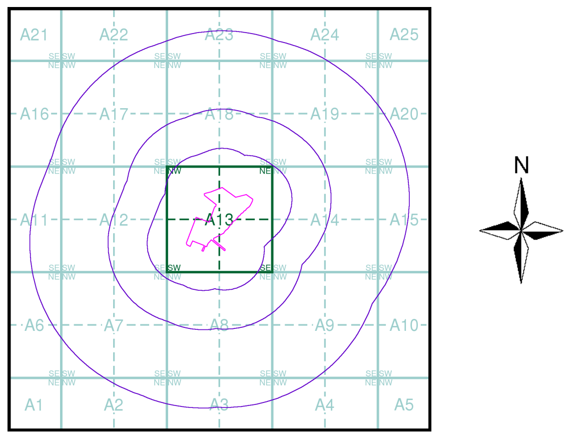
Gravel Pit
Refuse tip or slag heap
Rock
Rock (scattered)
Boulders
Boulders (scattered)
Shingle
Mud
Sand
Sand Pit
Slopes
Top of cliff
General detail
Underground detail
Overhead detail
Narrow gauge railway
Multi-track railway
Single track railway
County boundary (England only)
Civil, parish or community boundary
District, Unitary, Metropolitan, London Borough boundary
Constituency boundary
Area of wooded vegetation
Non-coniferous trees
Non-coniferous trees (scattered)
Coniferous trees
Coniferous trees (scattered)
Positioned tree
Orchard
Coppice or Osiers
Rough Grassland
Heath
Scrub
Marsh, Salt Marsh or Reeds
Water feature
Flow arrows
MHW(S) Mean high water (springs)
MLW(S) Mean low water (springs)
Telephone line (where shown)
Electricity transmission line (with poles)
BM 123.45 m Bench mark (where shown)
Triangulation station
Point feature (e.g. Guide Post or Mile Stone)
Pylon, flare stack or lighting tower
Site of (antiquity)
Glasshouse
General Building
Important Building

curtins

Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Lancashire And Furness	1:10,560	1847	3
Lancashire And Furness	1:10,560	1895	4
Lancashire And Furness	1:10,560	1913 - 1914	5
Lancashire And Furness	1:10,560	1932	6
Ordnance Survey Plan	1:10,000	1956	7
Ordnance Survey Plan	1:10,000	1968	8
Ordnance Survey Plan	1:10,000	1970	9
Ordnance Survey Plan	1:10,000	1970	10
Preston	1:10,000	1976	11
Ordnance Survey Plan	1:10,000	1994	12
10K Raster Mapping	1:10,000	2001	13
10K Raster Mapping	1:10,000	2006	14
VectorMap Local	1:10,000	2014	15

Historical Map - Slice A



Order Details

Order Number: 55312619_1_1
Customer Ref: EB1355
National Grid Reference: 360190, 438070
Slice: A
Site Area (Ha): 7.22
Search Buffer (m): 1000

Site Details

Site at 360130, 438020

Landmark Information Group
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk

Russian Military Mapping Legends

1:5,000 and 1:10,000 mapping

a. Not drawn to scale b. Drawn to scale

- Government and Administrative Buildings
- Military and Industrial Buildings
- Military and Communication Areas
- Subway Entrance
- Fireproof Building
- Prominent Fireproof Building
- Non-fireproof Building
- Non-fireproof Building (non-dwelling)
- Factory, mill, and flour mill, with chimneys
- Factory, mill, and flour mill, without chimneys
- Power Station, drawn to scale
- Hydroelectric Power Station
- Radio Station, drawn to scale
- Telephone Station, drawn to scale
- Abandoned Open-pit Mine or Quarry
- Open-pit Salt Mine
- Pit
- Oil Deposit or Well
- Oil Seepage
- Tailings Pile
- Fuel Storage Tanks
- Natural Gas Tank
- Bench Mark
- Drill Hole
- Burial Mound
- Triangulation Point on Burial Mound
- Single-track Railroad (Fill, Cut)
- Double-track Railroad and Station Building (Small Bridge, Tunnel, Pipe (Culvert))
- Coniferous Forest
- Deciduous Forest
- Mixed Forest
- Lawns
- Citrus Orchard
- Wet Ground
- Scattered Vegetation

243,8 Values for prominent elevations

186,0 Numbers for spot elevations, depth soundings, contour lines, etc.

0,2 Velocity of the current, width of river bed, depth of river

180/12 Fractional terms: length and capacity of bridges; depth of fords and condition of the river bottom; height of forest and the diameter of trees

Russian Alphabet (For reference and phonetic interpretation of map text)

А а (A)	З з (Z)	П п (P)	Ч ч (CH)
Б б (B)	И и (I)	Р р (R)	Ш ш (SH)
В в (V)	Й й (Y)	С с (S)	Щ щ (SHCH)
Г г (G)	К к (K)	Т т (T)	ъ (-)
Д д (D)	Л л (L)	У у (U)	ы (Y)
Е е (E)	М м (M)	Ф ф (F)	ь (')
Ё ё (YO)	Н н (N)	Х х (KH)	Э э (E)
Ж ж (ZH)	О о (O)	Ц ц (TS)	Ю ю (YU or IU)
			Я я (YA or IA)

1:25,000 mapping

a. Not drawn to scale b. Drawn to scale

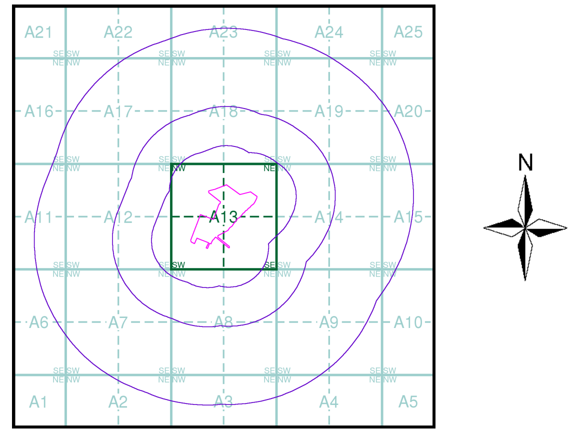
- Government and Administrative Buildings
- Military and Industrial Buildings
- Military and Communication Areas
- Subway Entrance
- Partly Demolished Buildings
- Demolished Buildings
- Built-Up Area with Fireproof Buildings Predominant
- Built-Up Area with Non-Fireproof Buildings Predominant
- Individual Fireproof Building
- Prominent Industrial Building
- Individual Dwelling, Fireproof
- Ruins of an Individual Dwelling
- Factory or Mill Chimney
- Factory or Mill with Chimney
- Factory or Mill without Chimney
- Mine or Open Pit Mine
- Operating Shaft or Mine
- Non-Operating Shaft or Mine
- Salt Mine
- Tailings Pile
- Pit
- Stone Quarry
- Gas Pump or Service Station
- Fuel Storage or Natural Gas Tank
- Oil or Natural Gas Derrick
- Small Hydroelectric Power Station
- Power Station
- Transformer Station
- Cemetery
- Burial Mound (height in metres)
- Triangulation Point on Burial Mound
- Triangulation Point
- Bench Mark
- Bench Mark (monumented)
- Telegraph Office
- Telephone Station
- Radio Station
- Radio Tower
- Airfield or Seaplane Base
- Landing Strip
- Main Highway (Cut, Fill, Km Post, Plantings, Telegraph/Telephone Lines)
- Highway under Construction
- Improved Dirt Road (former truck road) (Width of Road, Steep Grade)
- Double-track Railroad with First Class Station (Small Bridge, Pipe (Culvert), Tunnel)
- Dismantled Railroad
- Railroad Under Construction
- Shore Embankment
- River or Ditch with Embankment
- Direction and velocity of current (Water Gauge, Water Level Mark)
- Well
- Water Reservoir or Rain Water Pit
- Spring
- Isobath with value
- Heavy (Index) Contour Line
- Contour Line and Value
- Half Contour Line
- Spot Elevation Value
- Coniferous
- Deciduous
- Mixed
- Scrub

Key to Numbers on Mapping

Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Lancashire And Furness	1:10,560	1847	3
Lancashire And Furness	1:10,560	1895	4
Lancashire And Furness	1:10,560	1913 - 1914	5
Lancashire And Furness	1:10,560	1932	6
Ordnance Survey Plan	1:10,000	1956	7
Ordnance Survey Plan	1:10,000	1968	8
Ordnance Survey Plan	1:10,000	1970	9
Ordnance Survey Plan	1:10,000	1970	10
Preston	1:10,000	1976	11
Ordnance Survey Plan	1:10,000	1994	12
10K Raster Mapping	1:10,000	2001	13
10K Raster Mapping	1:10,000	2006	14
VectorMap Local	1:10,000	2014	15

Russian Map - Slice A



Order Details

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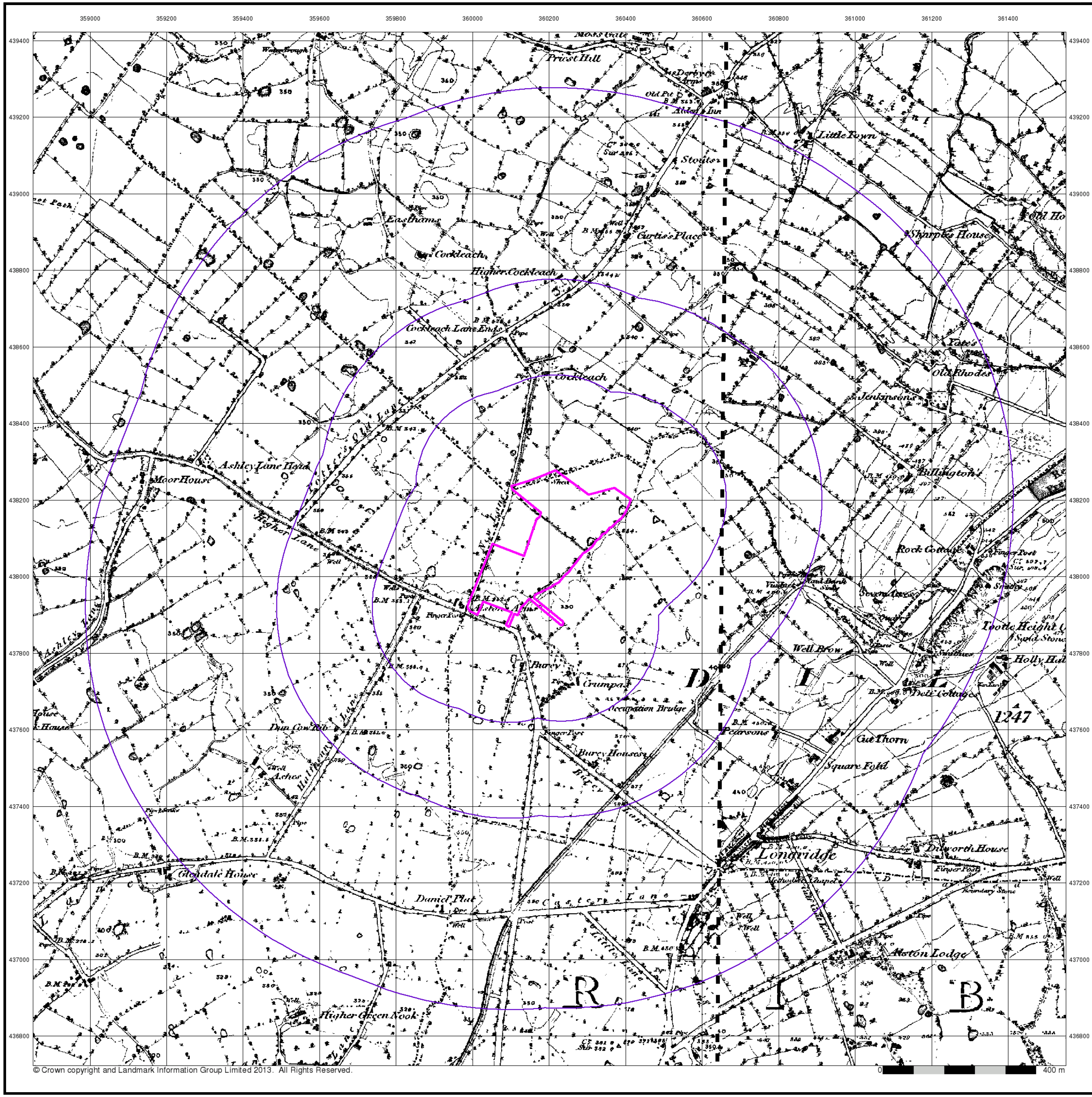

Lancashire And Furness

Published 1847

Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

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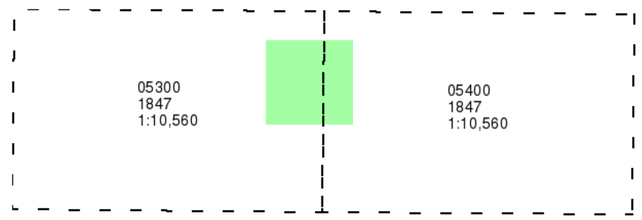
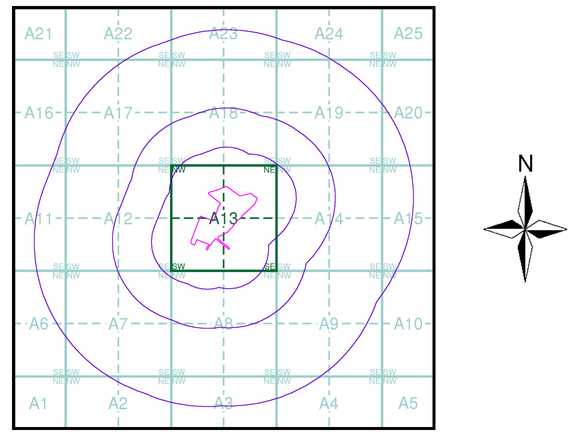


Historical Map - Slice A



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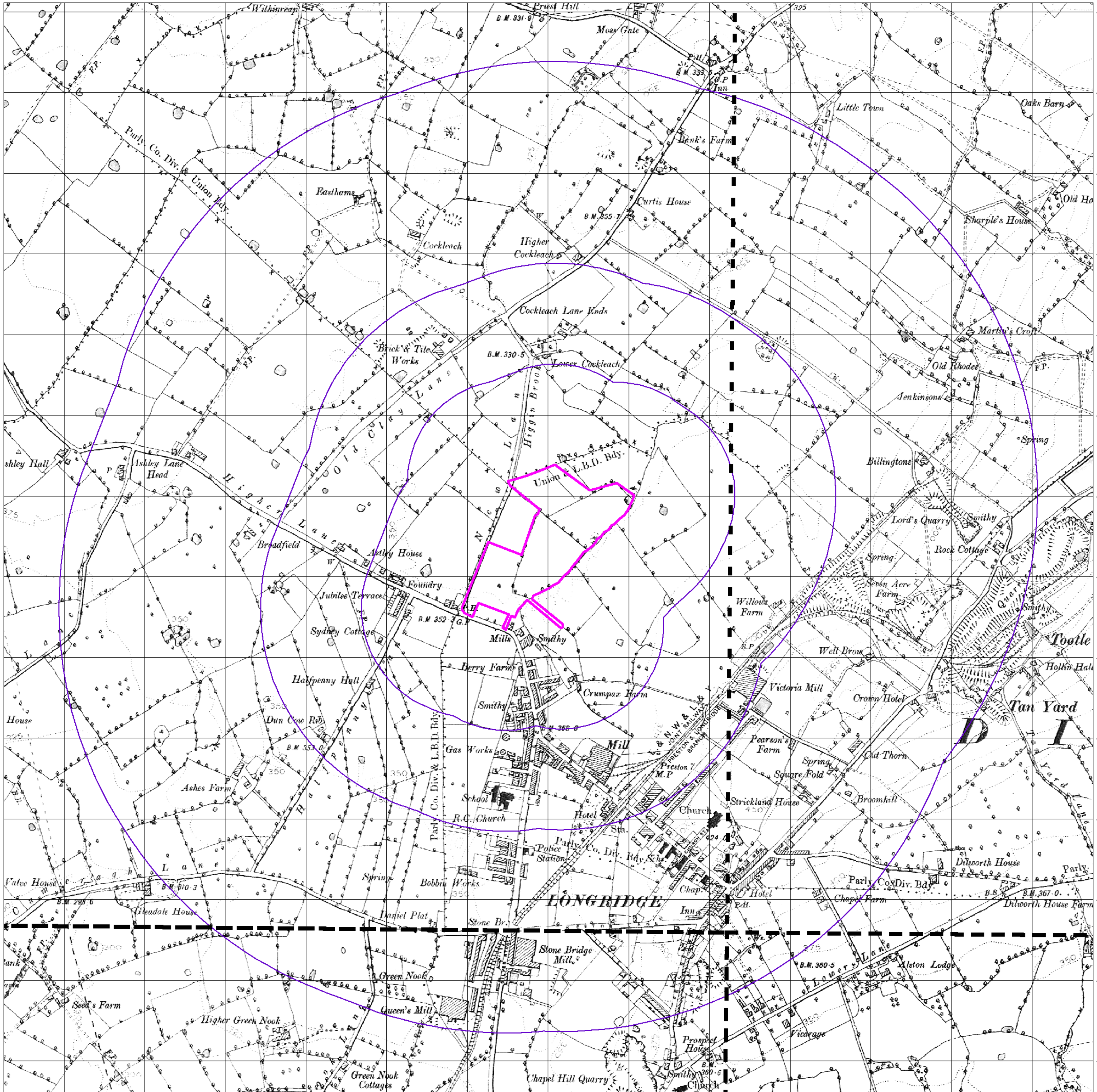

curtins

Lancashire And Furness

Published 1895

Source map scale - 1:10,560

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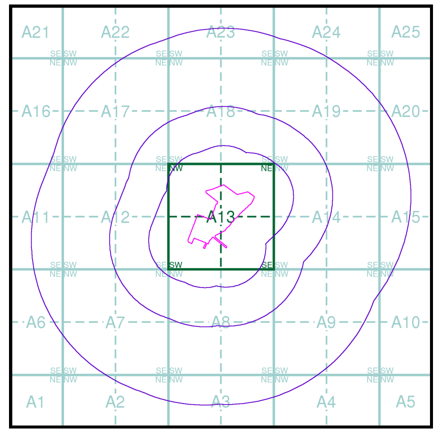
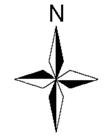
Map Name(s) and Date(s)

053NE 1895 1:10,560	054NW 1895 1:10,560
053SE 1895 1:10,560	054SW 1895 1:10,560

Historical Map - Slice A





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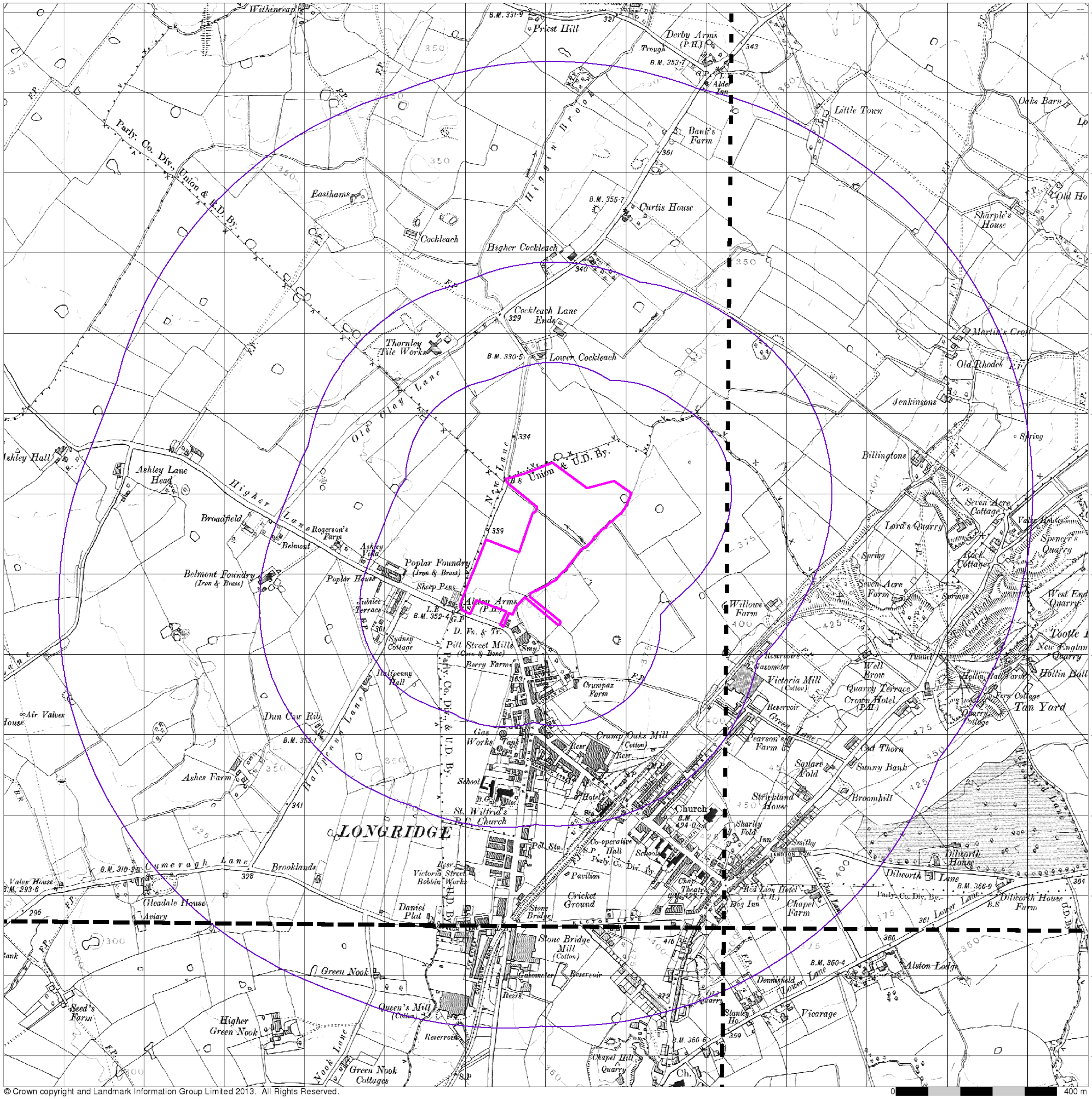

Lancashire And Furness

Published 1913 - 1914

Source map scale - 1:10,560

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

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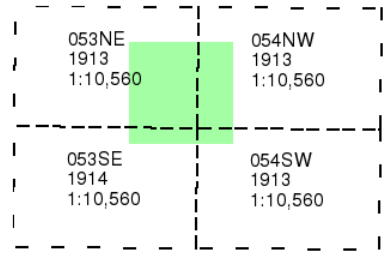
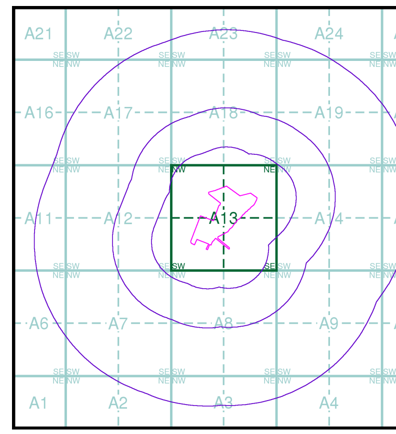


Historical Map - Slice A



N

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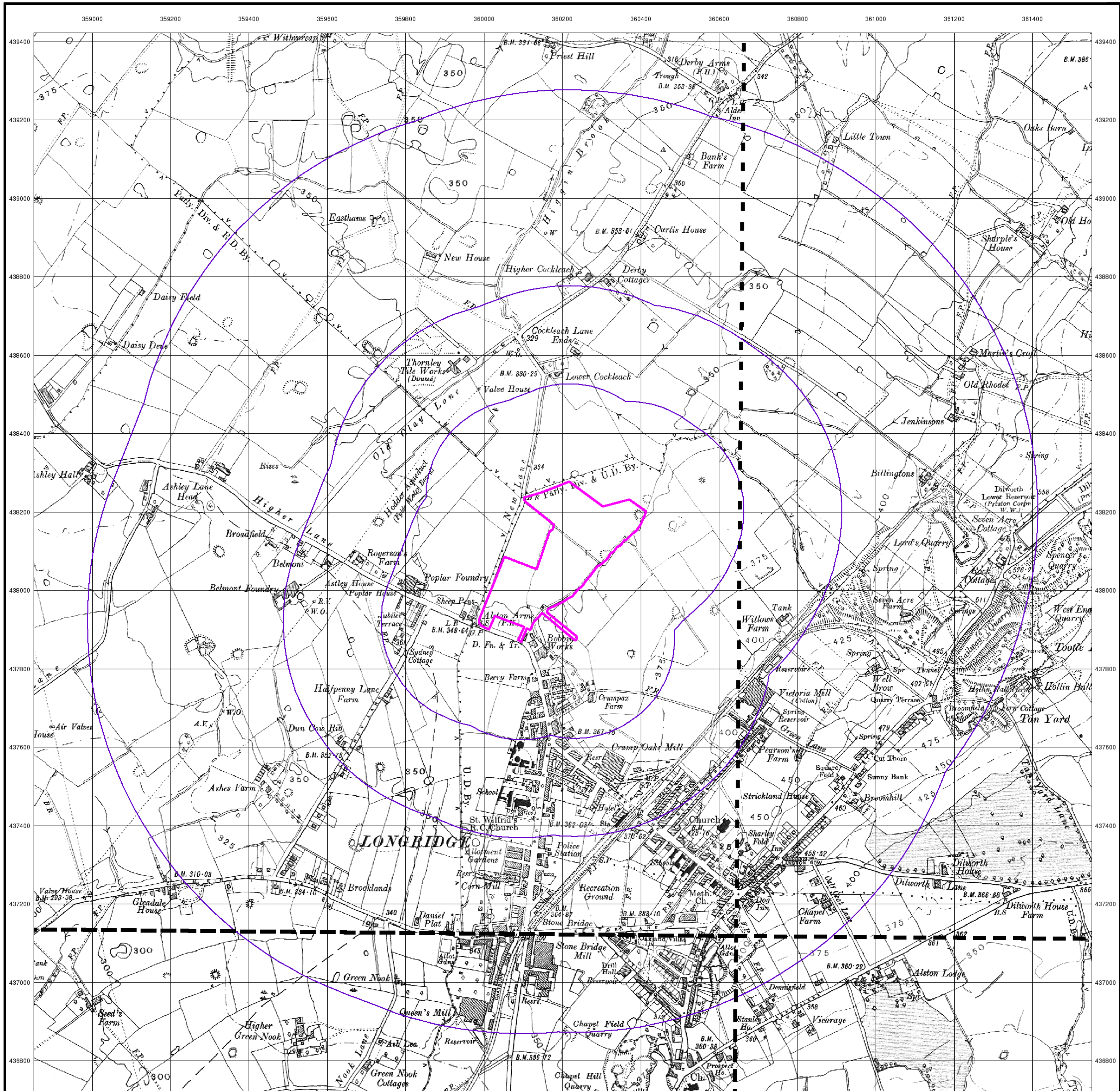

curtins

Lancashire And Furness

Published 1932

Source map scale - 1:10,560

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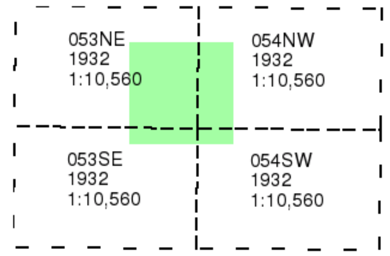
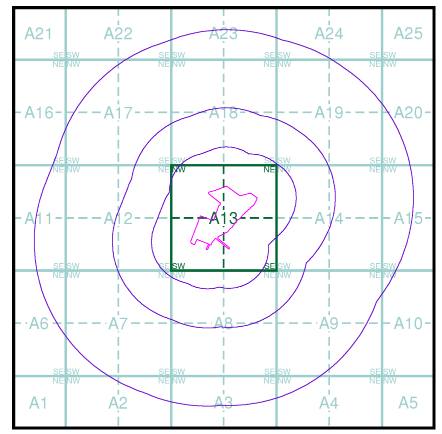


Historical Map - Slice A



N

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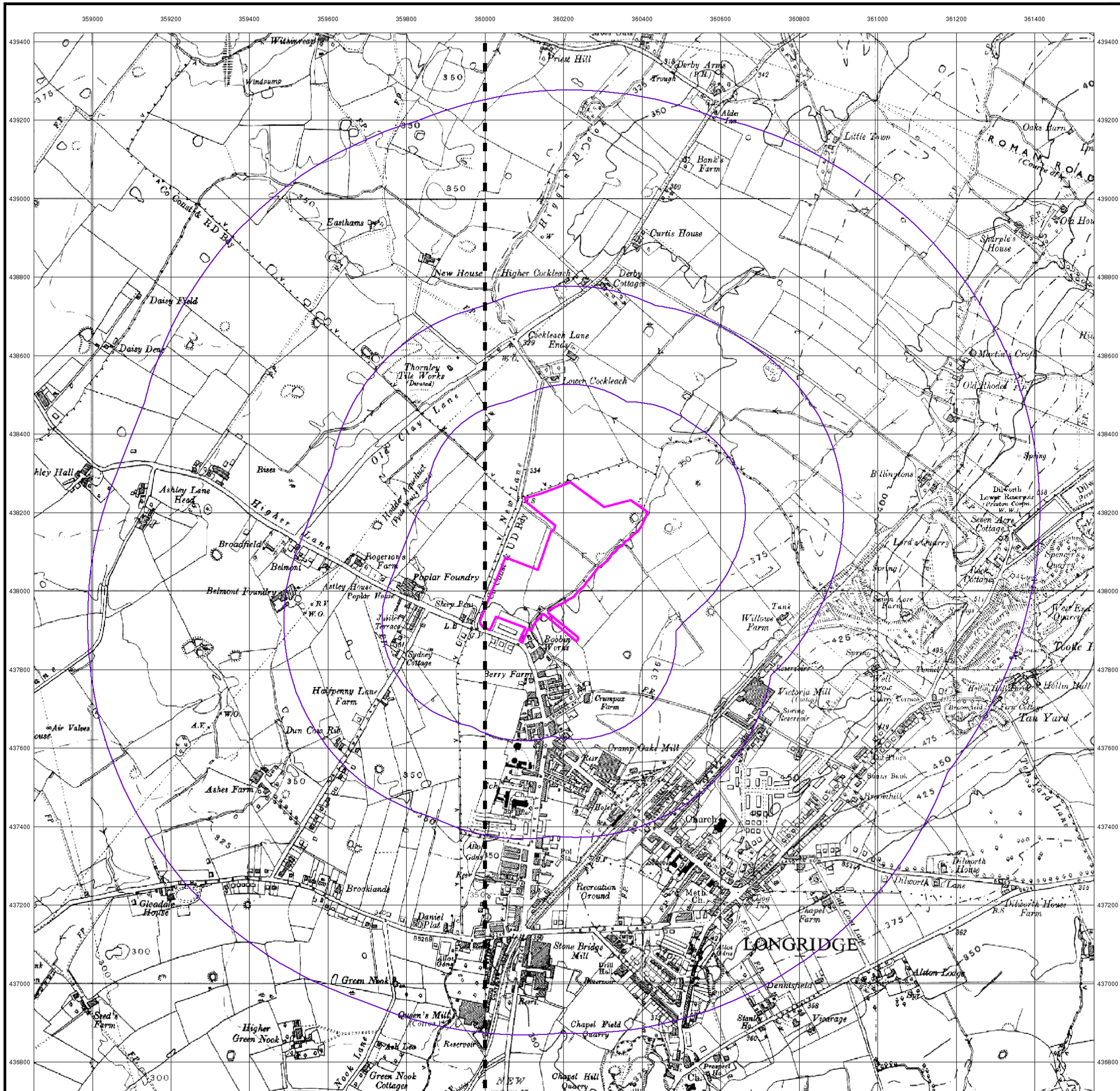

0 400 m

Ordnance Survey Plan

Published 1956

Source map scale - 1:10,000

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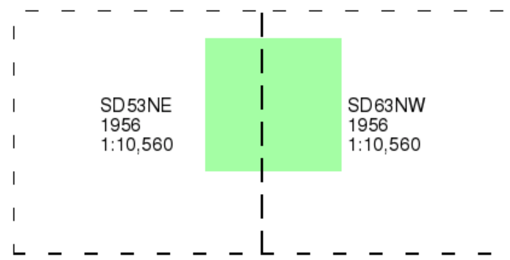
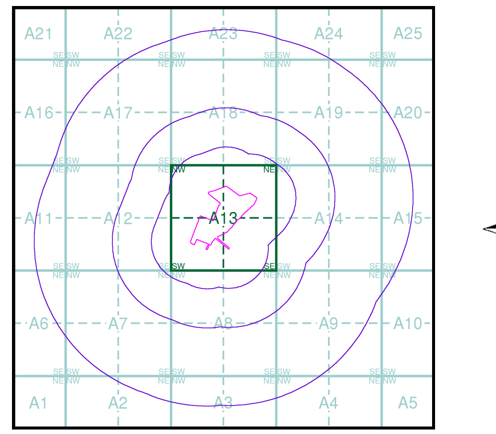
Map Name(s) and Date(s)



Historical Map - Slice A



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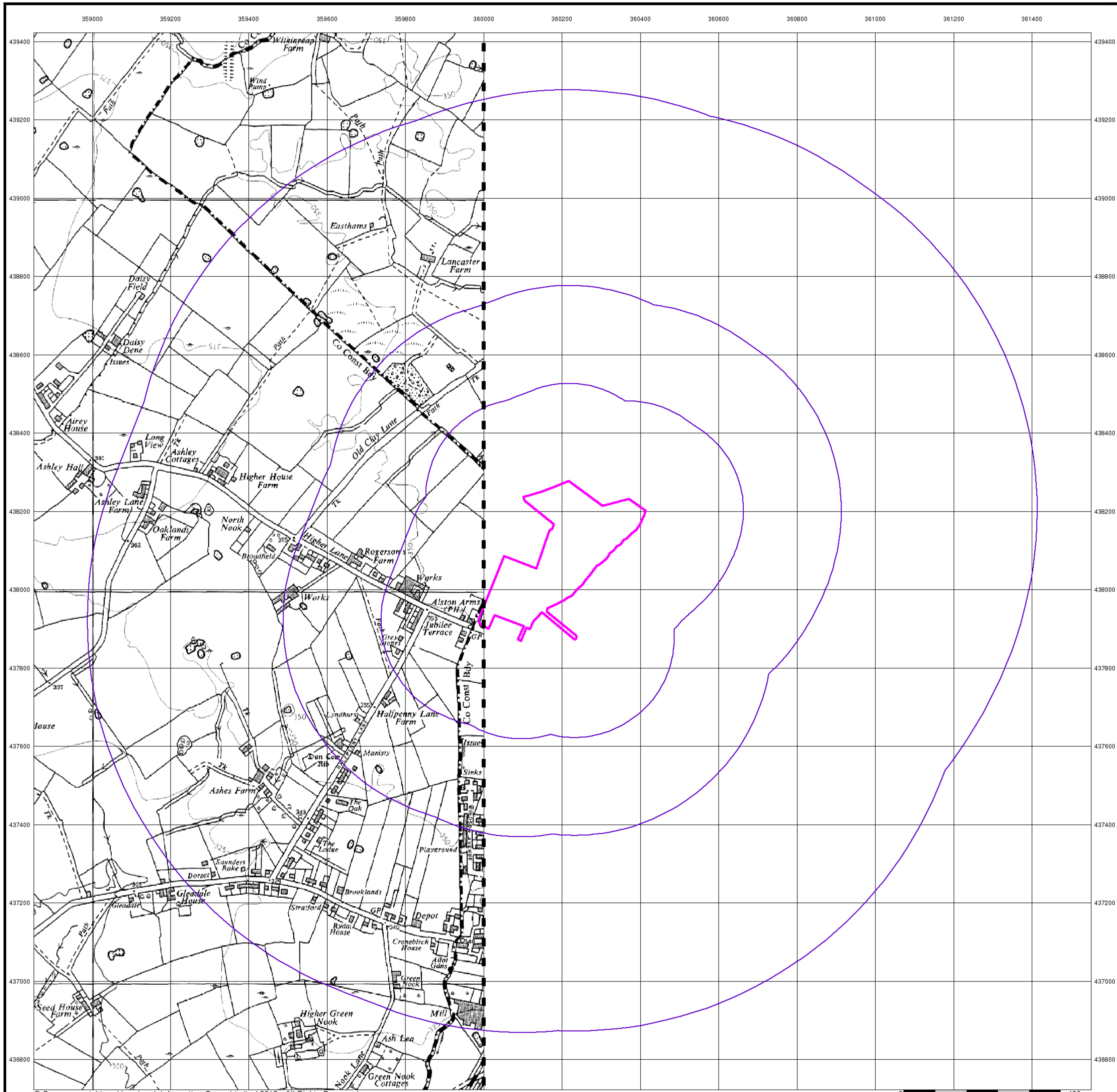

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Ordnance Survey Plan

Published 1968

Source map scale - 1:10,000

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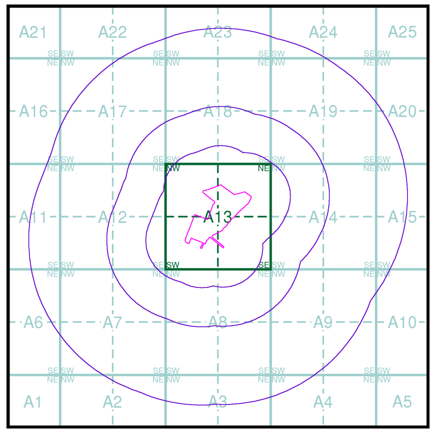
Map Name(s) and Date(s)

SD53NE
1968
1:10,560

Historical Map - Slice A



Order Details

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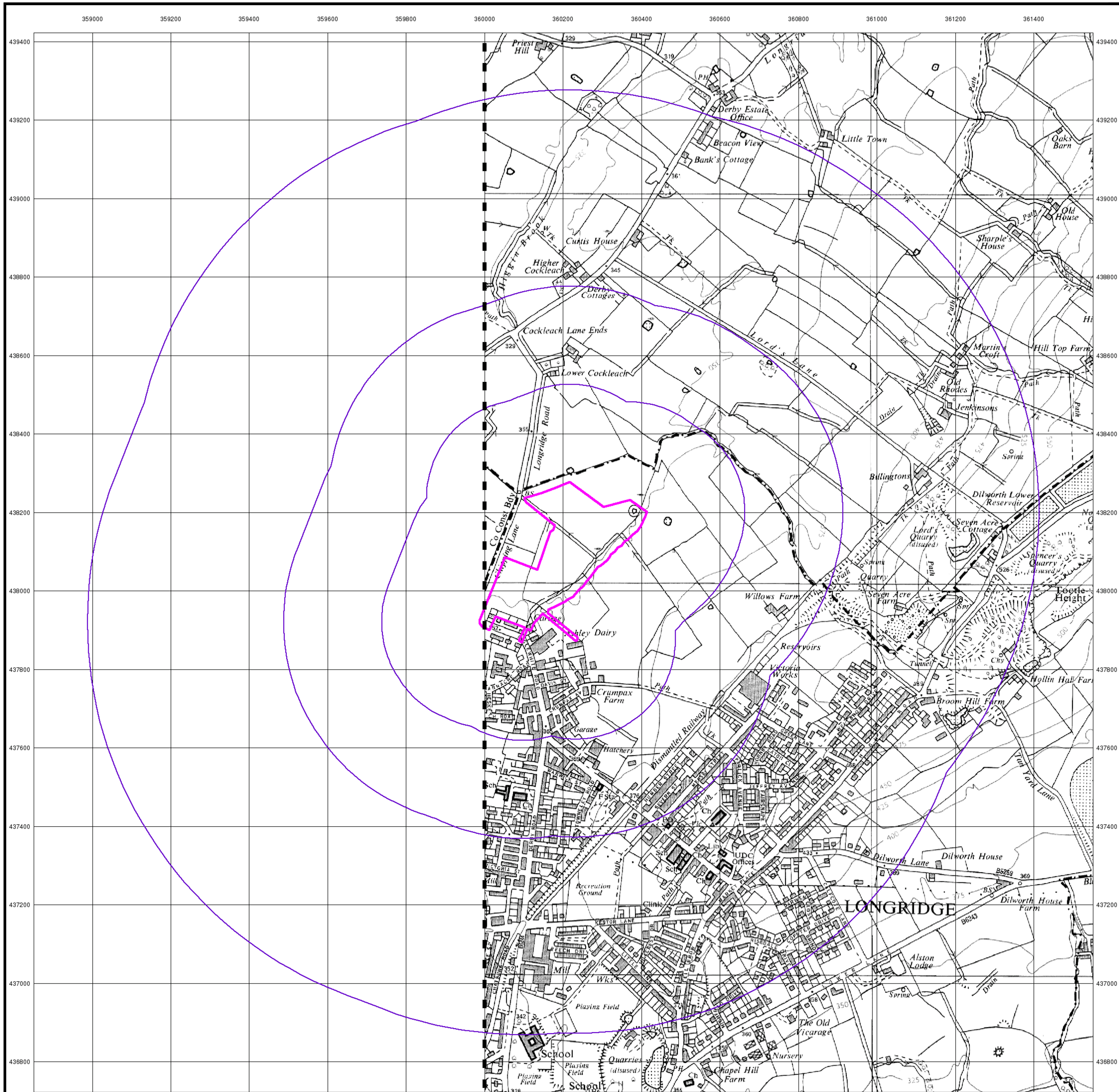

curtins

Ordnance Survey Plan

Published 1970

Source map scale - 1:10,000

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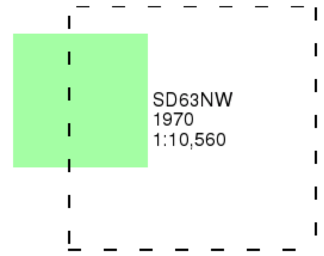
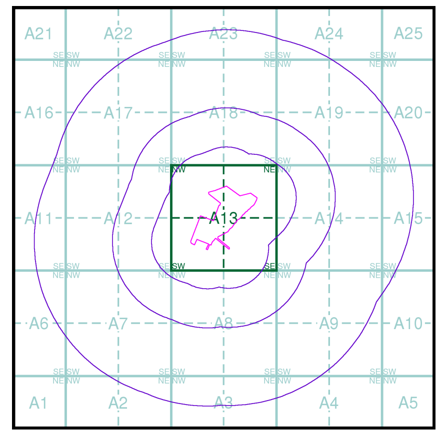


Historical Map - Slice A



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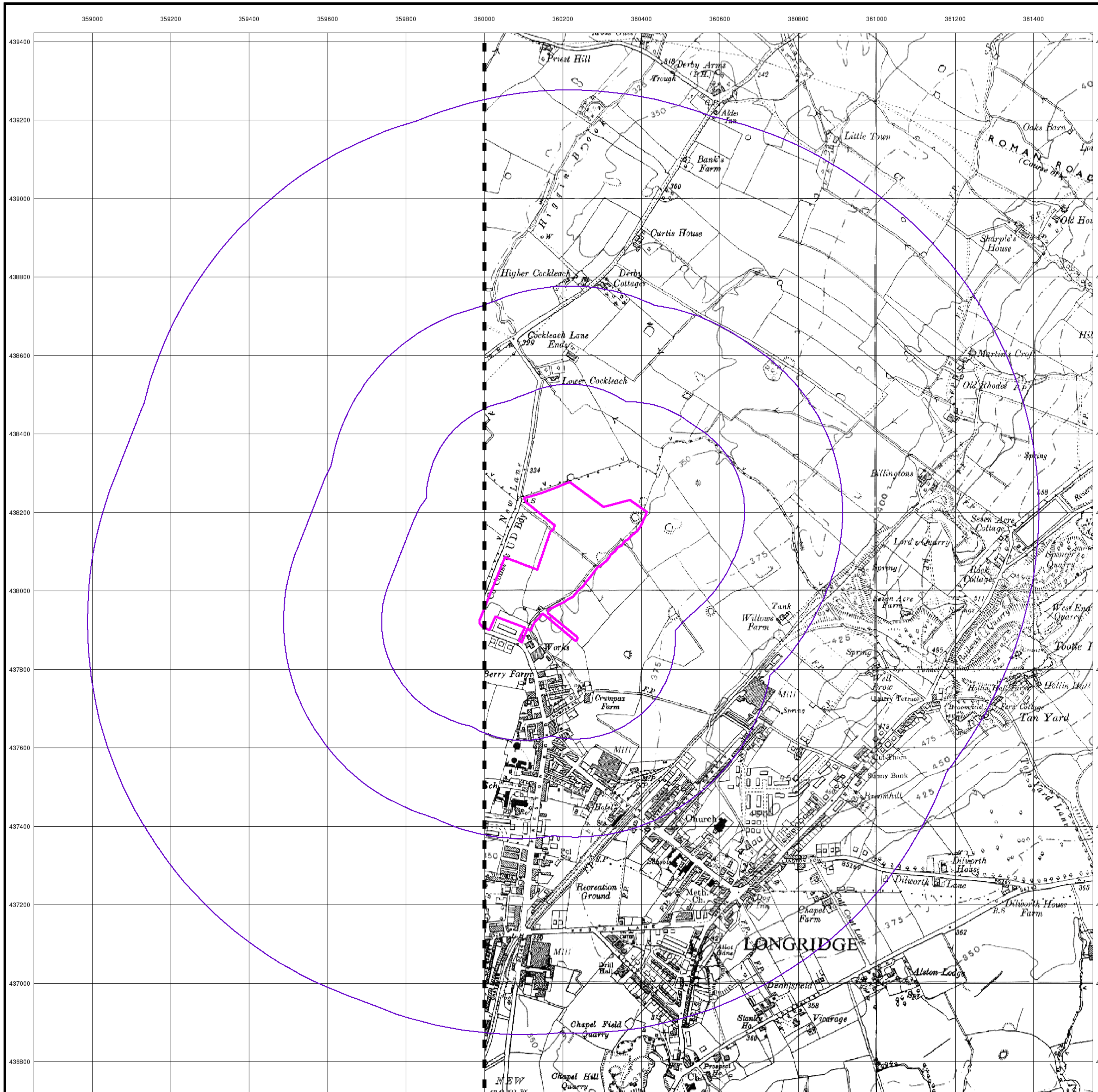

0 400 m

Ordnance Survey Plan

Published 1970

Source map scale - 1:10,000

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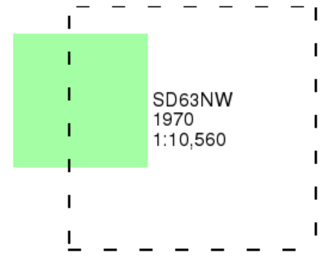
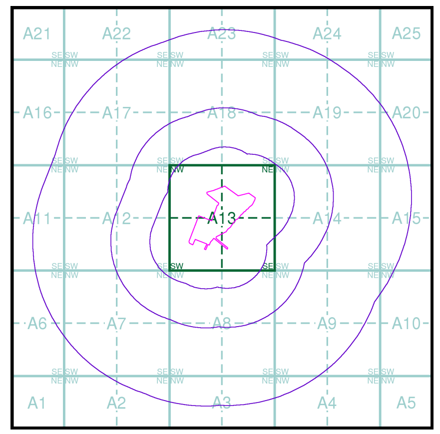


Historical Map - Slice A



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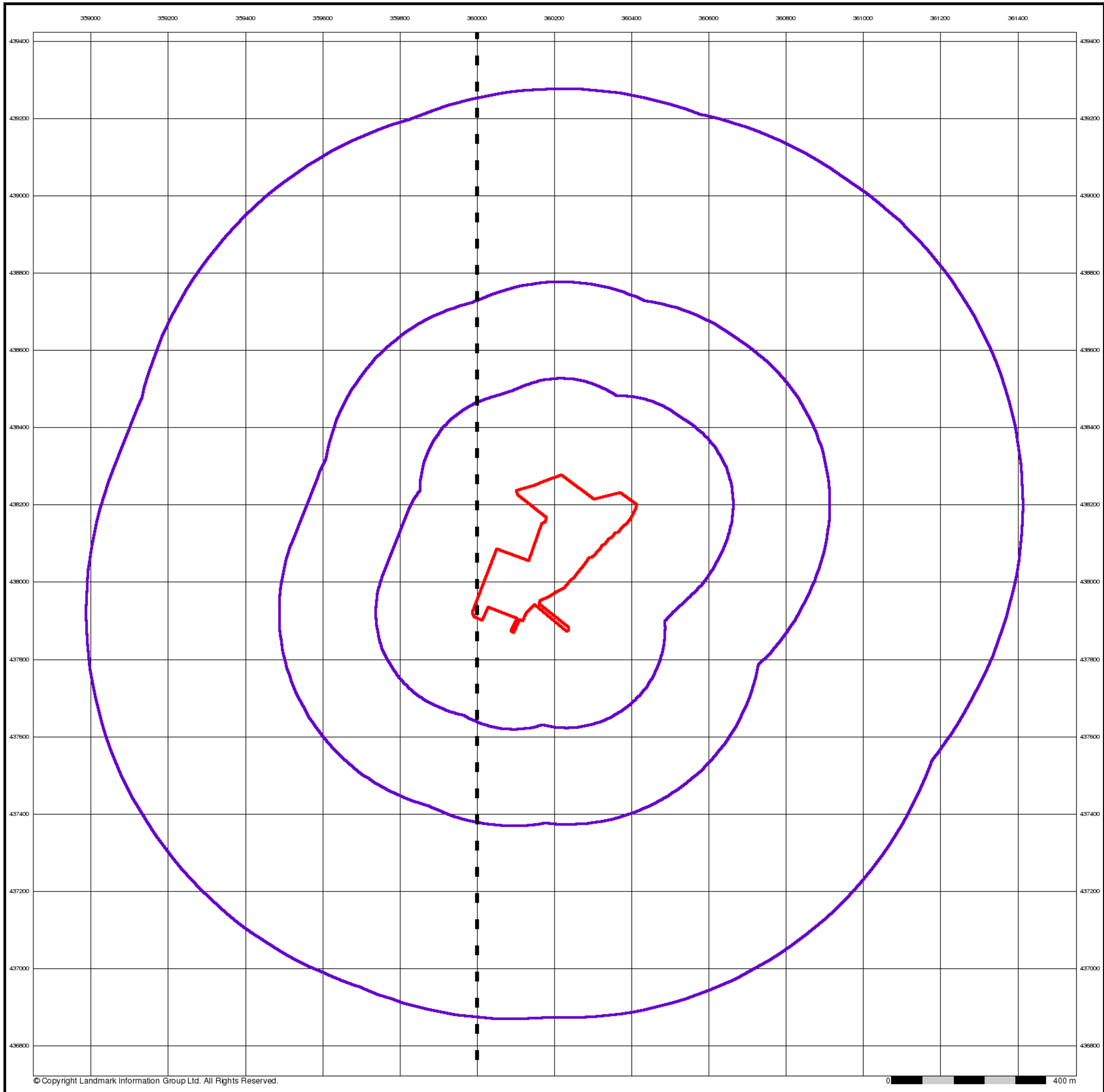


curtins

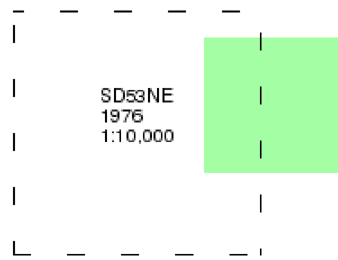
Preston

Published 1976

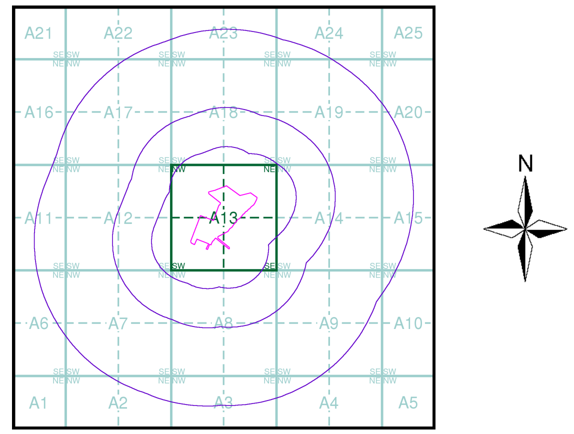
Source map scale - 1:10,000

These maps were produced by the Russian military during the Cold War between 1950 and 1997, and cover 103 towns and cities throughout the U.K. The maps are produced at 1:25,000, 1:10,000 and 1:5,000 scale, and show detailed land use, with colour-coded areas for development, green areas, and non-developed areas. Buildings are coloured black and important building uses (such as hospitals, post offices, factories etc.) are numbered, with a numbered key describing their use.
They were produced by the Russians for the benefit of navigation, as well as strategic military sites and transport hubs, for use if they were to have invaded the U.K. The detailed information provided indicates that the areas were surveyed using land-based personnel, on the ground, in the cities that are mapped.

Map Name(s) and Date(s)



Russian Map - Slice A



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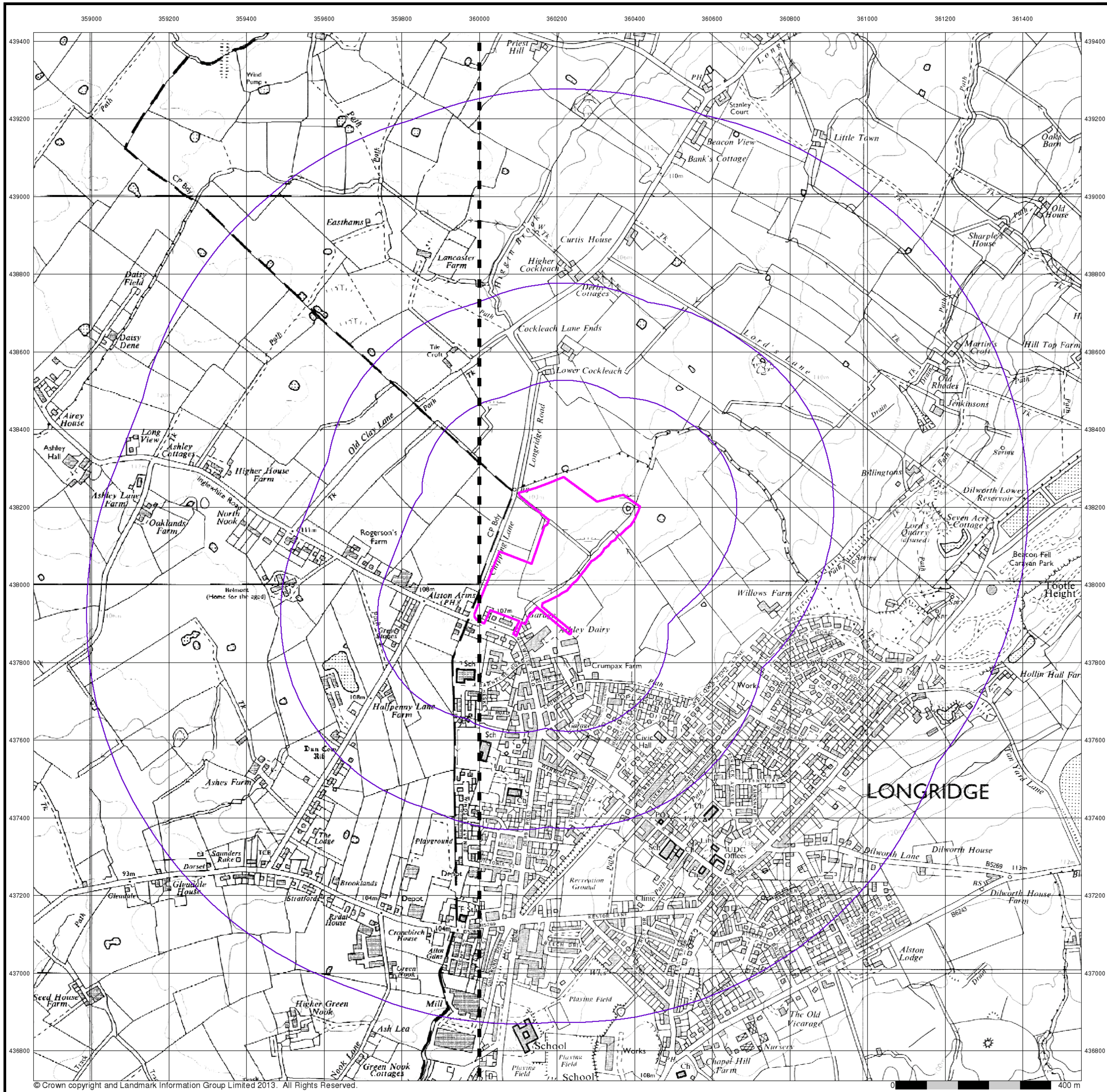


curtins

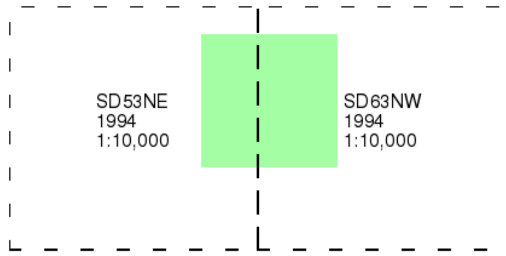
Ordnance Survey Plan

Published 1994

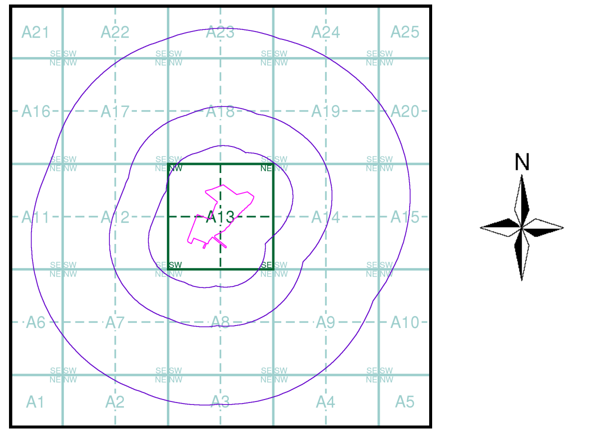
Source map scale - 1:10,000

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840`s. In 1854 the 1:2,500 scale was adopted for mapping urban areas; these maps were used to update the 1:10,560 maps. The published date given therefore is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas. In the late 1940`s, a Provisional Edition was produced, which updated the 1:10,560 mapping from a number of sources. The maps appear unfinished - with all military camps and other strategic sites removed. These maps were initially overprinted with the National Grid. In 1970, the first 1:10,000 maps were produced using the Transverse Mercator Projection. The revision process continued until recently, with new editions appearing every 10 years or so for urban areas.

Map Name(s) and Date(s)



Historical Map - Slice A



N

Order Details

Order Number:	55312619_1_1
Customer Ref:	EB1355
National Grid Reference:	360190, 438070
Slice:	A
Site Area (Ha):	7.22
Search Buffer (m):	1000

Site Details

Site at 360130, 438020

Landmark Information Group

Tel: 0844 844 9952
Fax: 0844 844 9951
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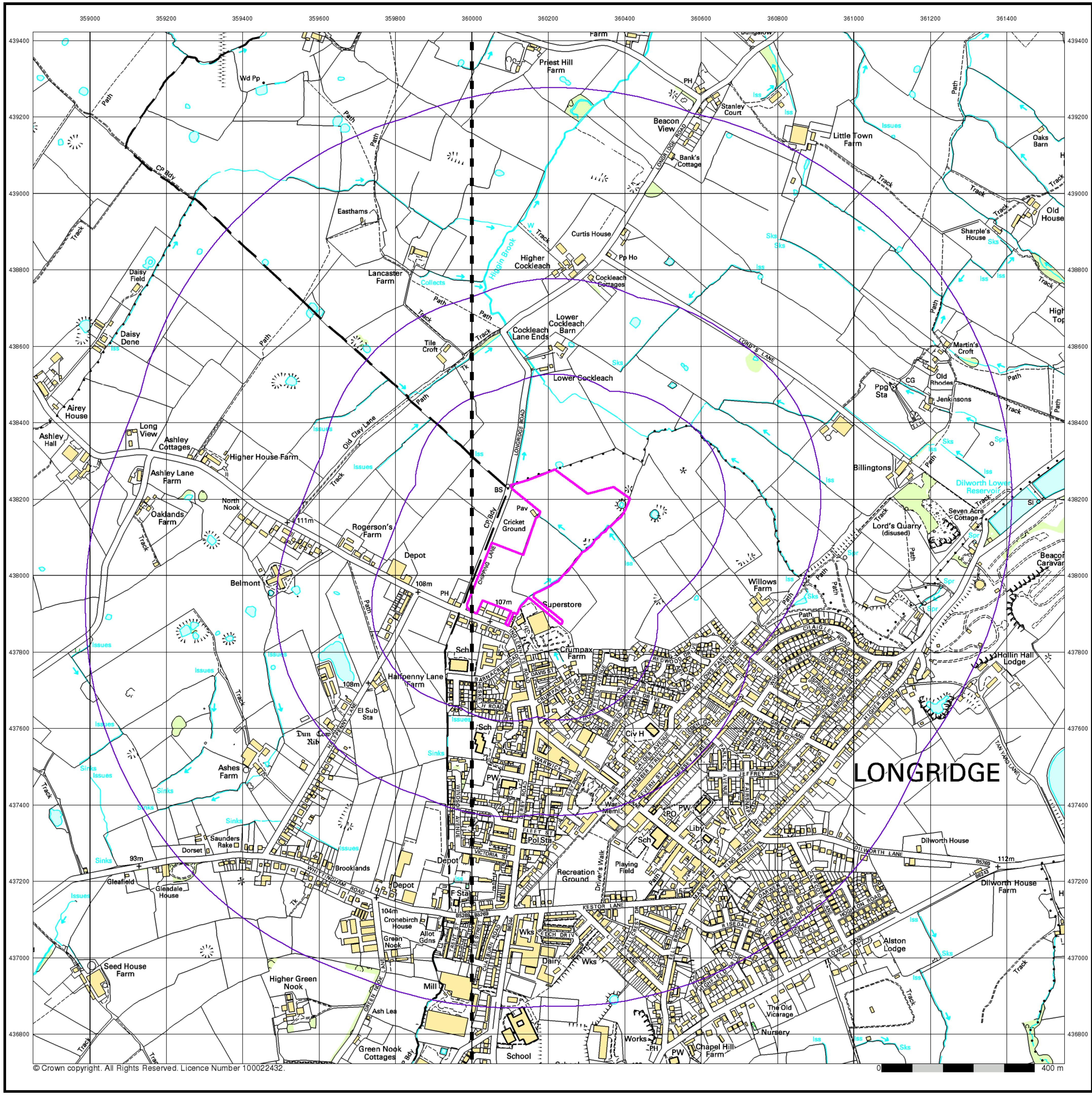


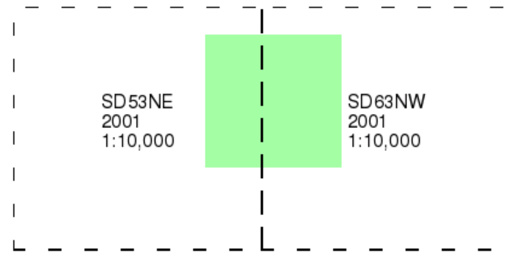
10k Raster Mapping

Published 2001

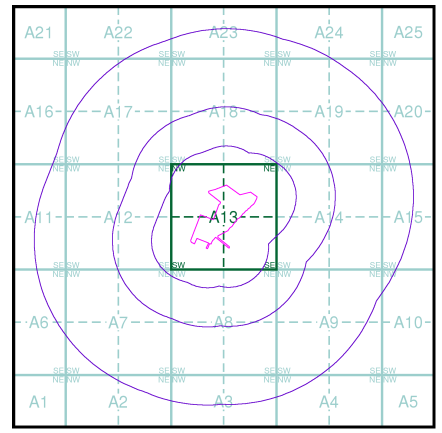
Source map scale - 1:10,000

The historical maps shown were produced from the Ordnance Survey`s 1:10,000 colour raster mapping. These maps are derived from Landplan which replaced the old 1:10,000 maps originally published in 1970. The data is highly detailed showing buildings, fences and field boundaries as well as all roads, tracks and paths. Road names are also included together with the relevant road number and classification. Boundary information depiction includes county, unitary authority, district, civil parish and constituency.

Map Name(s) and Date(s)



Historical Map - Slice A



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Site Details

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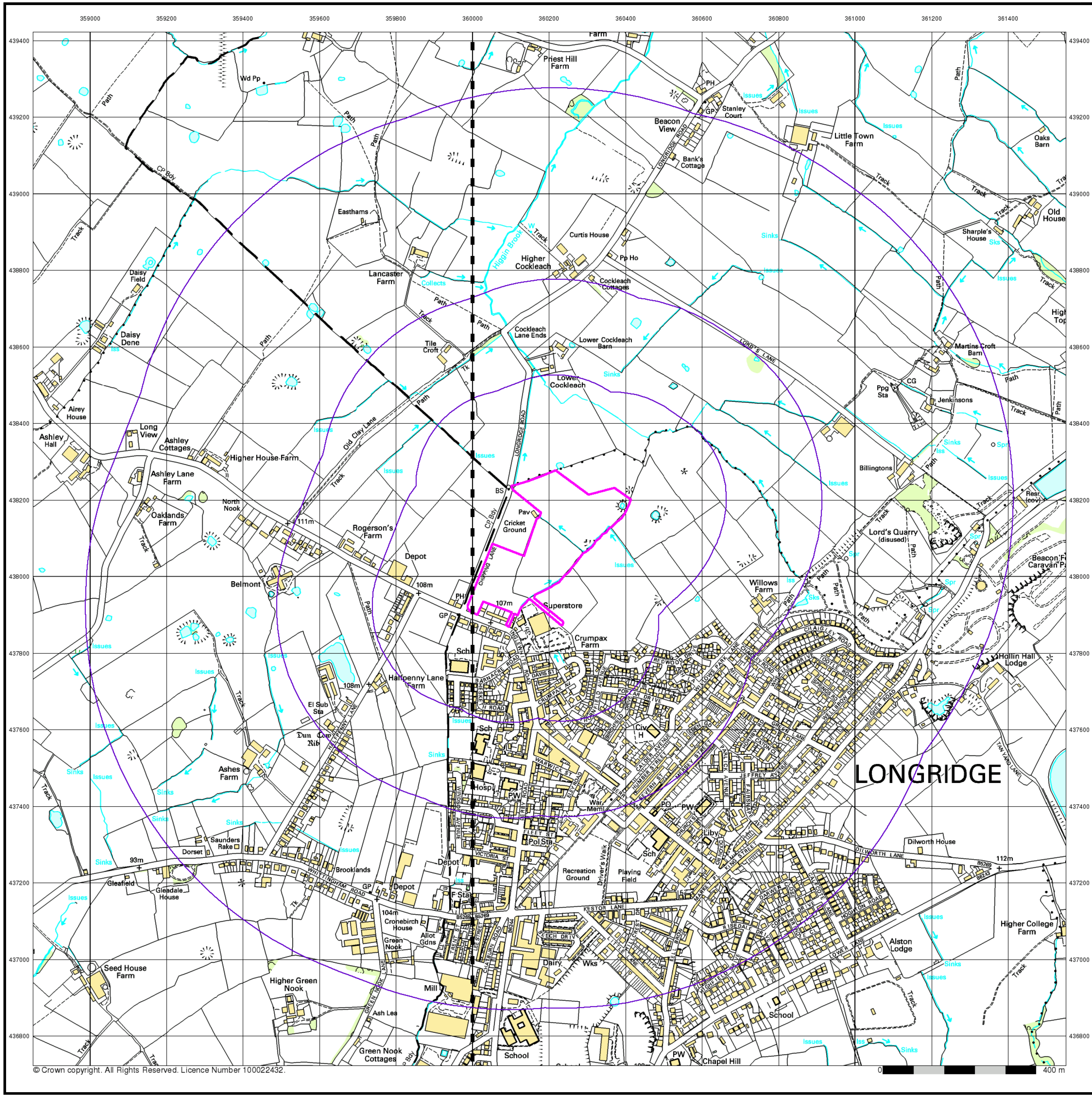

curtins

10k Raster Mapping

Published 2006

Source map scale - 1:10,000

The historical maps shown were produced from the Ordnance Survey`s 1:10,000 colour raster mapping. These maps are derived from Landplan which replaced the old 1:10,000 maps originally published in 1970. The data is highly detailed showing buildings, fences and field boundaries as well as all roads, tracks and paths. Road names are also included together with the relevant road number and classification. Boundary information depiction includes county, unitary authority, district, civil parish and constituency.

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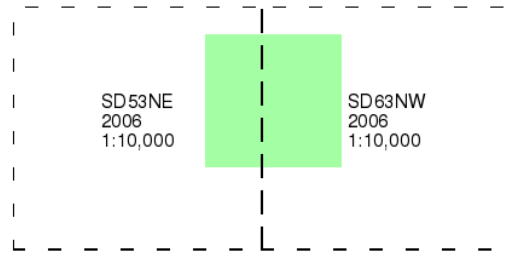
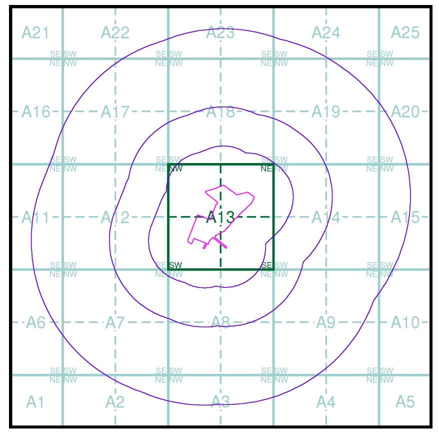


Historical Map - Slice A



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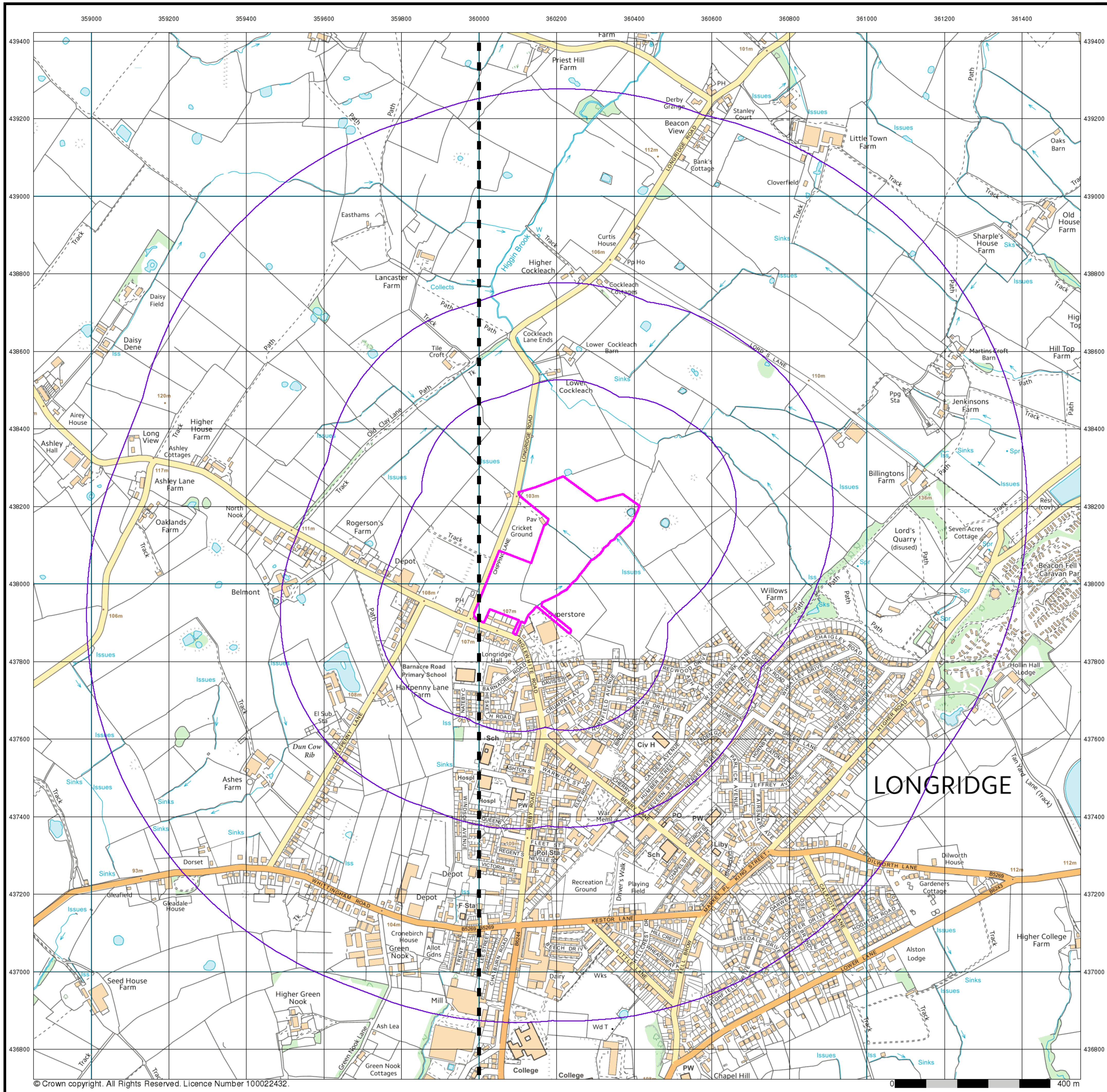


curtins

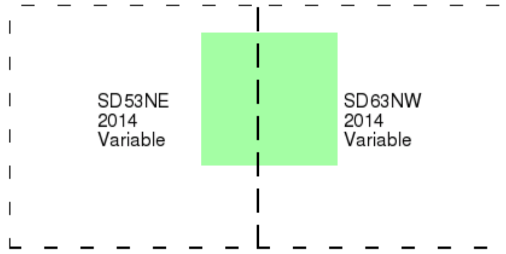
VectorMap Local

Published 2014

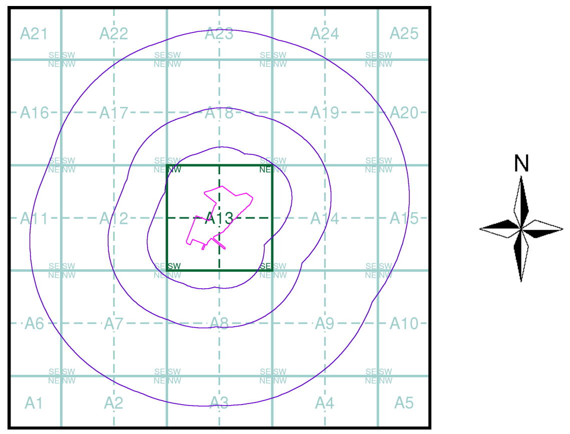
Source map scale - 1:10,000

VectorMap Local (Raster) is Ordnance Survey's highest detailed 'backdrop' mapping product. These maps are produced from OS's VectorMap Local, a simple vector dataset at a nominal scale of 1:10,000, covering the whole of Great Britain, that has been designed for creating graphical mapping. OS VectorMap Local is derived from large-scale information surveyed at 1:1250 scale (covering major towns and cities),1:2500 scale (smaller towns, villages and developed rural areas), and 1:10 000 scale (mountain, moorland and river estuary areas).

Map Name(s) and Date(s)



Historical Map - Slice A



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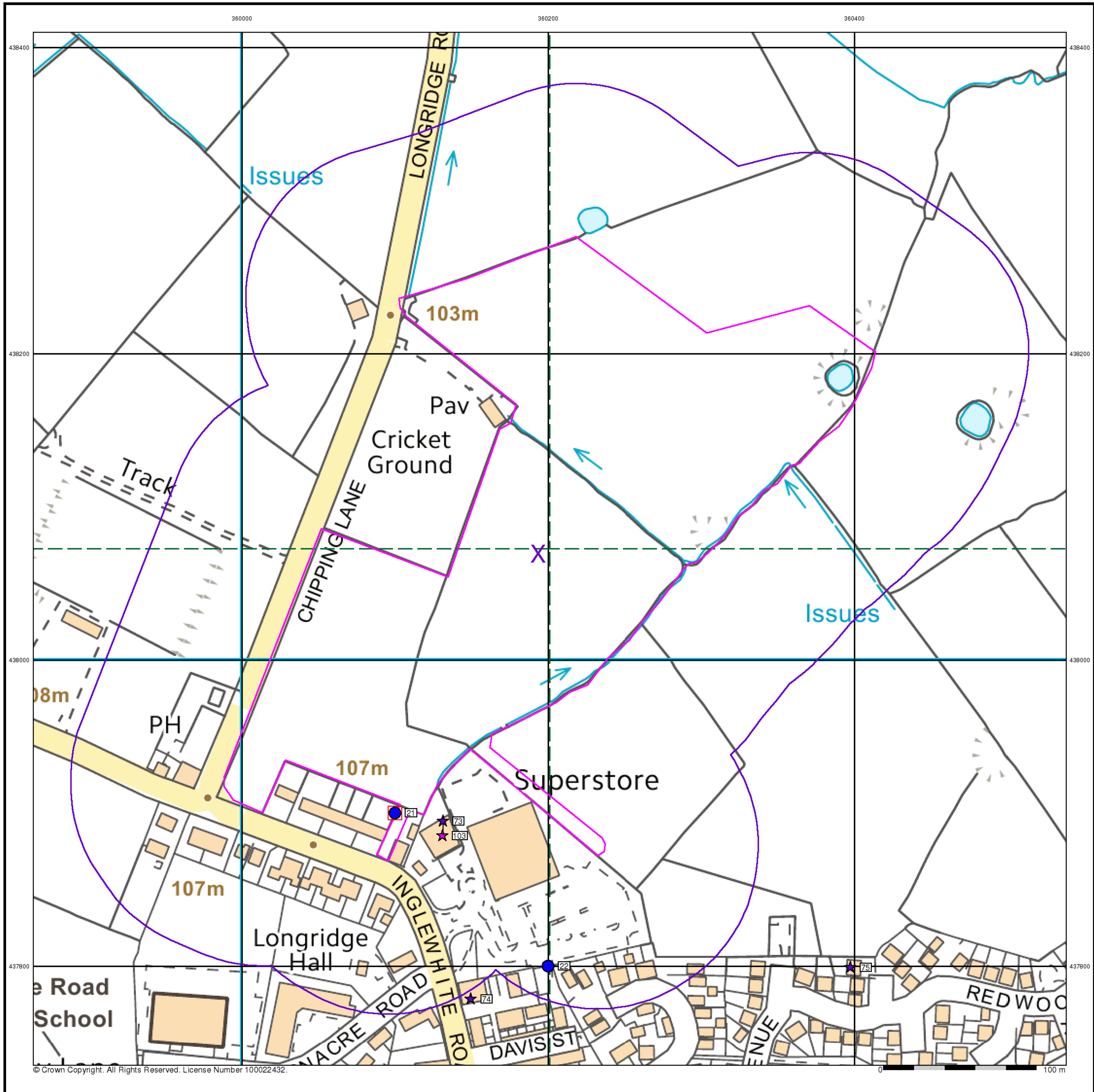


curtins

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Map ID
- Several of Type at Location

Agency and Hydrological

- Contaminated Land Register Entry or Notice (Location)
- Contaminated Land Register Entry or Notice
- Discharge Consent
- Enforcement or Prohibition Notice
- Integrated Pollution Control
- Integrated Pollution Prevention Control
- Local Authority Integrated Pollution Prevention and Control
- Local Authority Pollution Prevention and Control
- Local Authority Pollution Prevention and Control Enforcement
- Pollution Incident to Controlled Waters
- Prosecution Relating to Authorised Processes
- Prosecution Relating to Controlled Waters
- Registered Radioactive Substance
- River Network or Water Feature
- River Quality Sampling Point
- Substantiated Pollution Incident Register
- Water Abstraction
- Water Industry Act Referral

Geological

- BGS Recorded Mineral Site

Industrial Land Use

- Contemporary Trade Directory Entry
- Fuel Station Entry

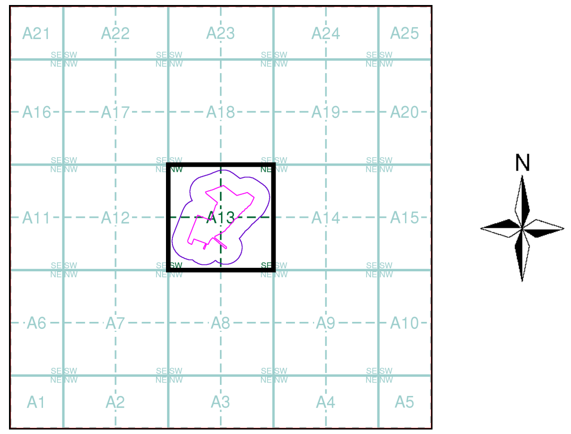
Waste

- BGS Recorded Landfill Site (Location)
- BGS Recorded Landfill Site
- EA Historic Landfill (Buffered Point)
- EA Historic Landfill (Polygon)
- Integrated Pollution Control Registered Waste Site
- Licensed Waste Management Facility (Landfill Boundary)
- Licensed Waste Management Facility (Location)
- Local Authority Recorded Landfill Site (Location)
- Local Authority Recorded Landfill Site
- Registered Landfill Site
- Registered Landfill Site (Location)
- Registered Landfill Site (Point Buffered to 100m)
- Registered Landfill Site (Point Buffered to 250m)
- Registered Waste Transfer Site (Location)
- Registered Waste Transfer Site
- Registered Waste Treatment or Disposal Site (Location)
- Registered Waste Treatment or Disposal Site

Hazardous Substances

- COMAH Site
- Explosive Site
- NIHHS Site
- Planning Hazardous Substance Consent
- Planning Hazardous Substance Enforcement

Site Sensitivity Map - Segment A13



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Customer Ref: EB1355
National Grid Reference: 360190, 438070
Slice: A
Site Area (Ha): 7.22

Site Details

Site at 360130, 438020

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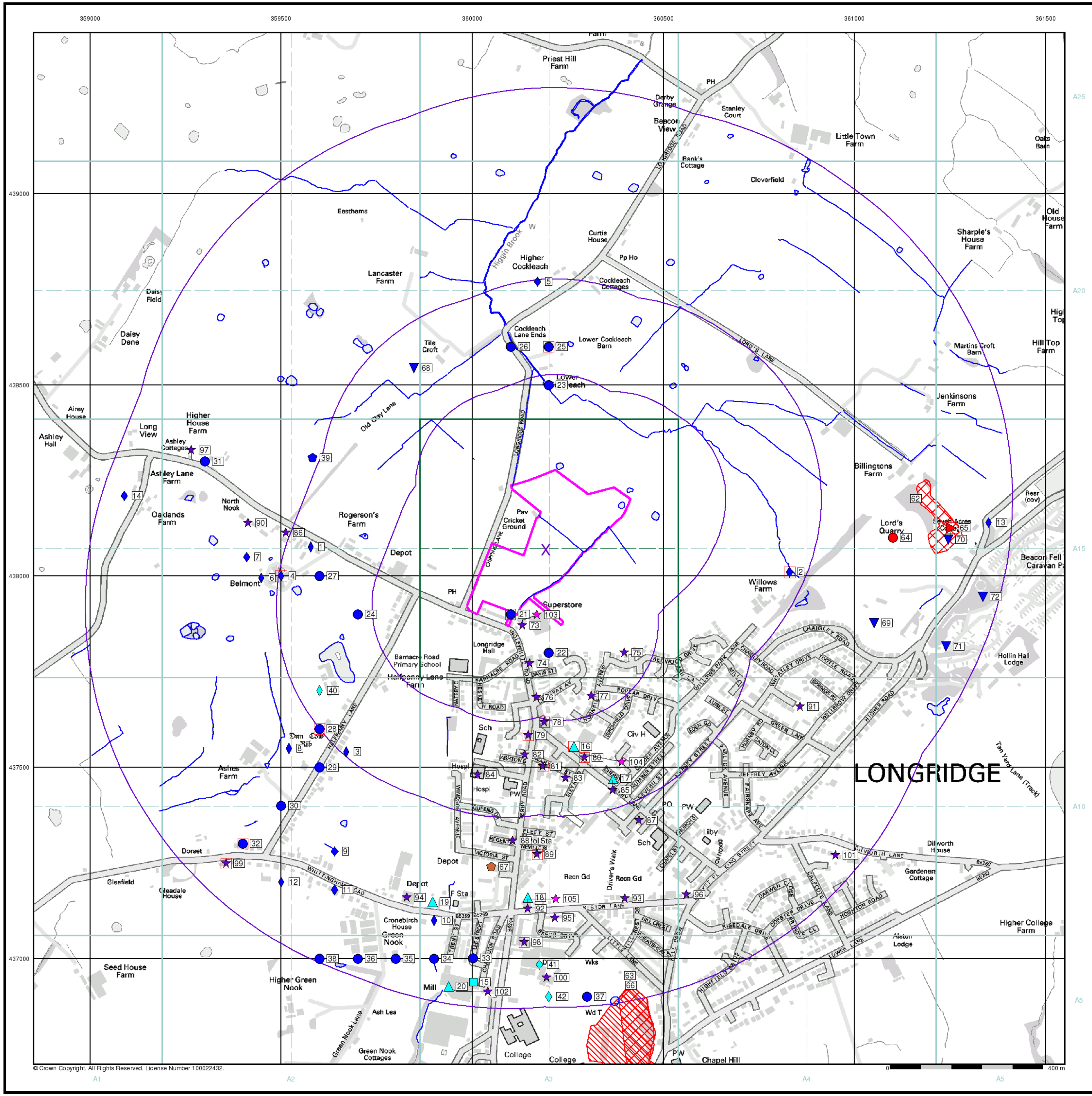

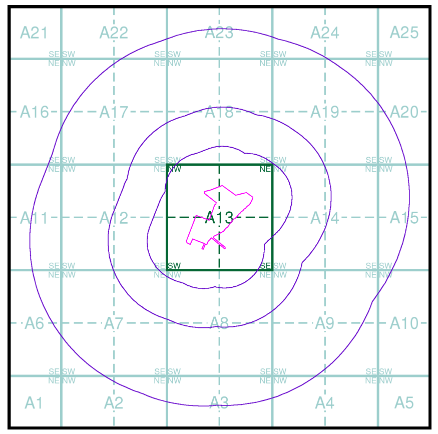

curtins

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Map ID
- Several of Type at Location

Agency and Hydrological

- Contaminated Land Register Entry or Notice (Location)
- Contaminated Land Register Entry or Notice
- Discharge Consent
- Enforcement or Prohibition Notice
- Integrated Pollution Control
- Integrated Pollution Prevention Control
- Local Authority Integrated Pollution Prevention and Control
- Local Authority Pollution Prevention and Control
- Local Authority Pollution Prevention and Control Enforcement
- Pollution Incident to Controlled Waters
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Geological

- BGS Recorded Mineral Site

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- Contemporary Trade Directory Entry
- Fuel Station Entry

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- Registered Waste Transfer Site (Location)
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- Registered Waste Treatment or Disposal Site (Location)
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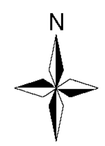
Hazardous Substances

- COMAH Site
- Explosive Site
- NIHHS Site
- Planning Hazardous Substance Consent
- Planning Hazardous Substance Enforcement

Site Sensitivity Map - Slice A



Order Details

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Search Buffer (m):	1000

Site Details

Site at 360130, 438020

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General

Specified Site

Specified Buffer(s)

X Bearing Reference Point

Agency and Hydrological (Flood)

Extreme Flooding from Rivers or Sea without Defences (Zone 2)

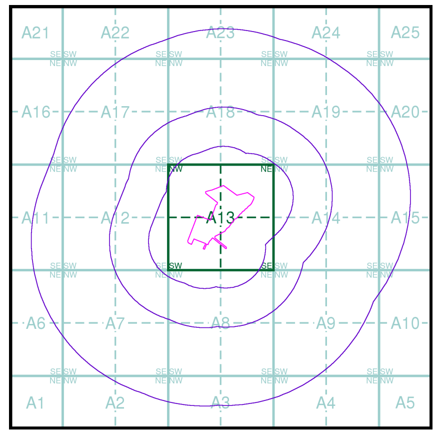
Flooding from Rivers or Sea without Defences (Zone 3)

Area Benefiting from Flood Defence

Flood Water Storage Areas

Flood Defence

Flood Map - Slice A



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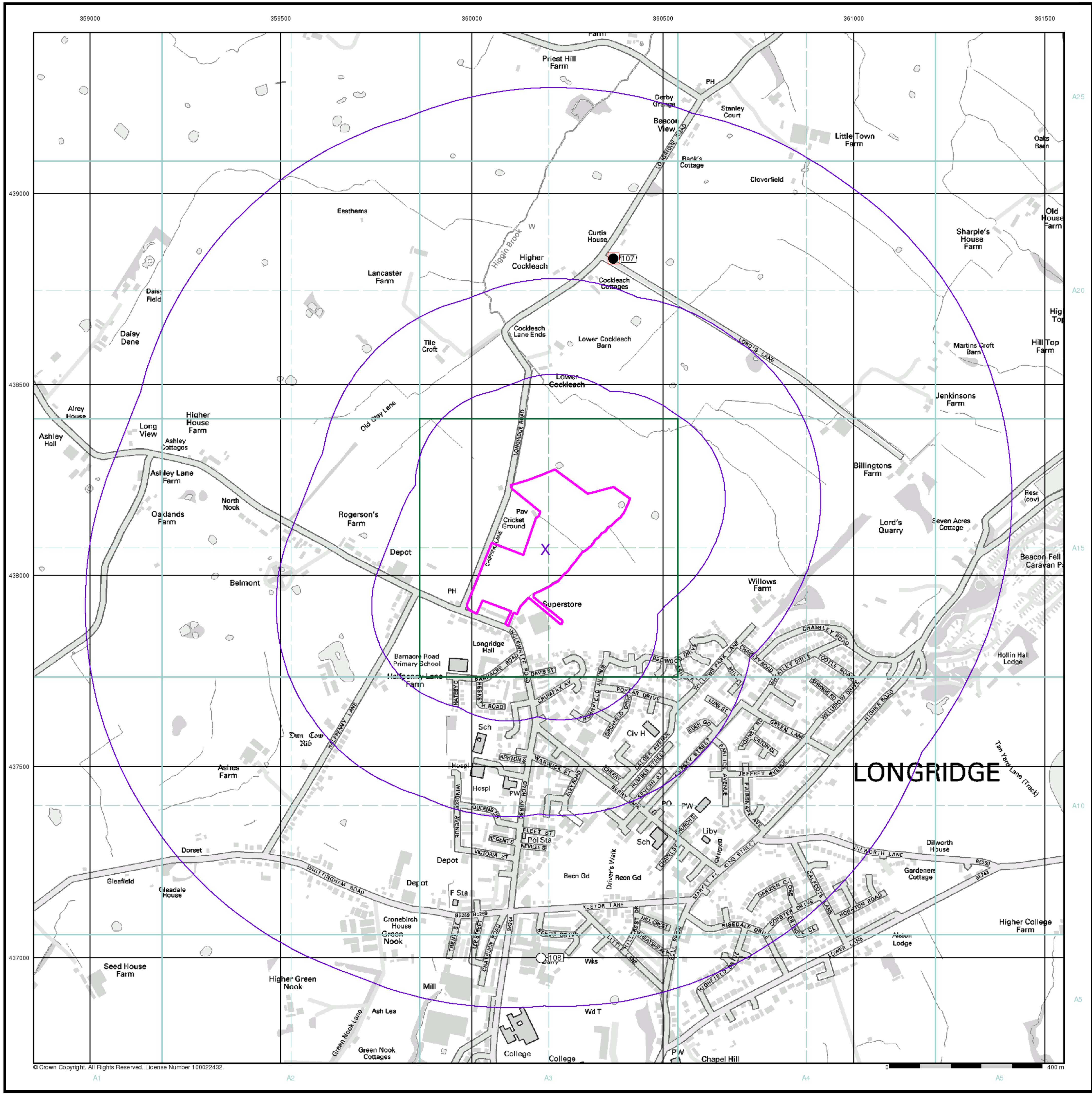


General

- Specified Site
- Specified Buffer(s)
- X Bearing Reference Point
- 8 Map ID
- Several of Type at Location

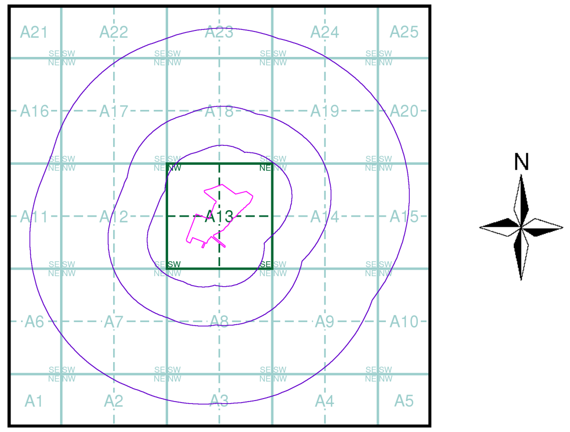
Agency and Hydrological (Boreholes)

- BGS Borehole Depth 0 - 10m
- BGS Borehole Depth 10 - 30m
- BGS Borehole Depth 30m +
- Confidential
- Other

For Borehole information please refer to the Borehole .csv file which accompanied this slice.

A copy of the BGS Borehole Ordering Form is available to download from the Support section of www.envirocheck.co.uk.

Borehole Map - Slice A



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Site Details

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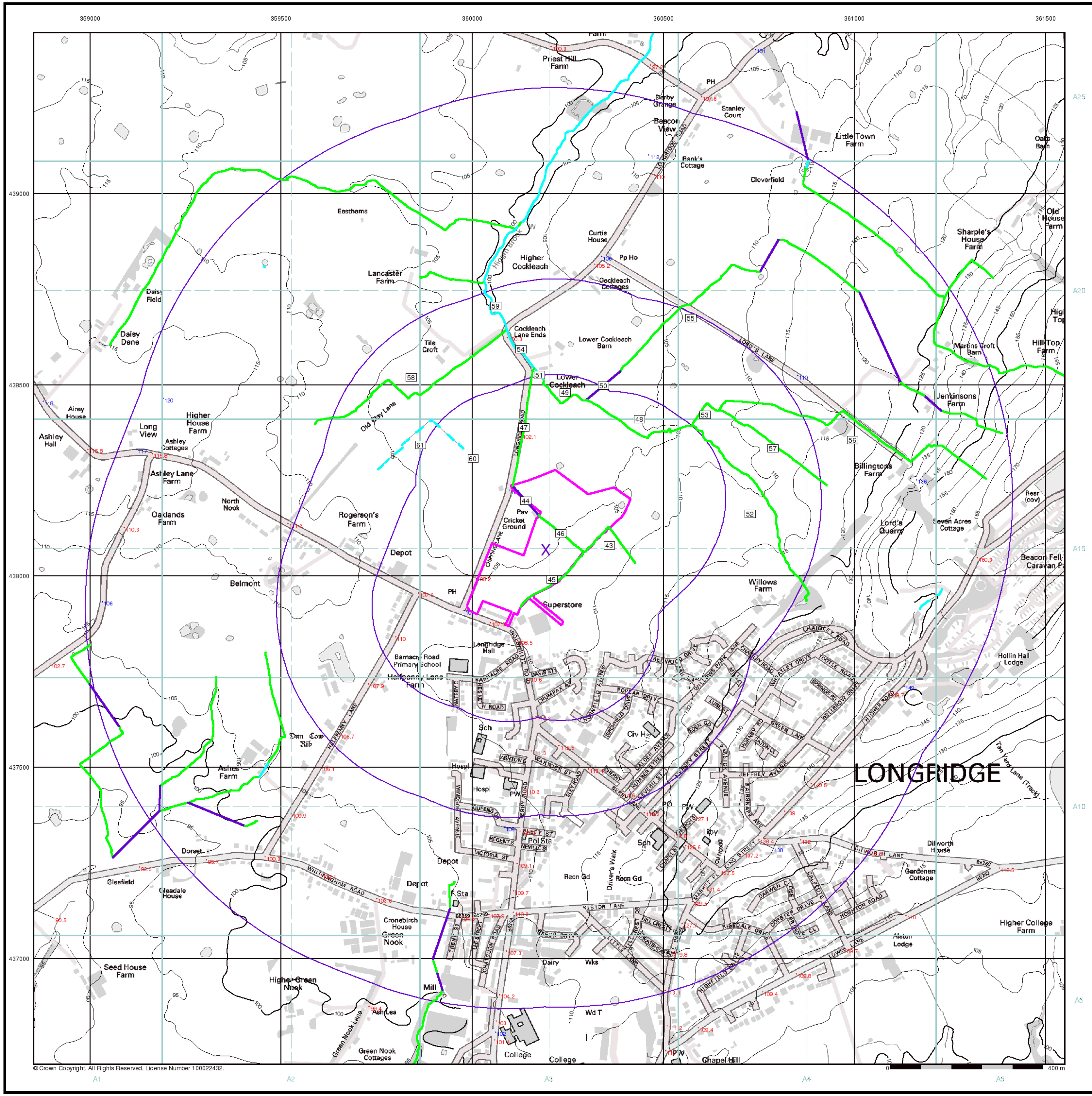


curtins

General

- Specified Site
- Specified Buffer(s)
- X Bearing Reference Point
- 8 Map ID

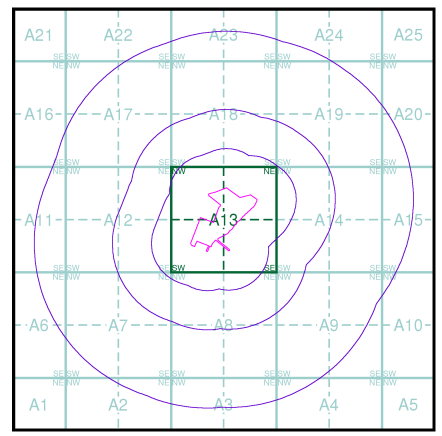
EA Detailed River Network Data

Primary River	Extended Culvert (greater than 50m)
Secondary River	Underground River (inferred)
Tertiary River	Underground River (local knowledge)
Canal	Downstream of High Water Mark
Canal Tunnel	Downstream of Seaward Extension
Undefined River	Not assigned River feature
Lake/Reservoir	
Offline Drainage Feature	

Contours (height in metres)

Standard Contour 105	167.3 Spot Height
Index Contour 100 95	45.8 Air Height

EA Detailed River Network Map - Slice A



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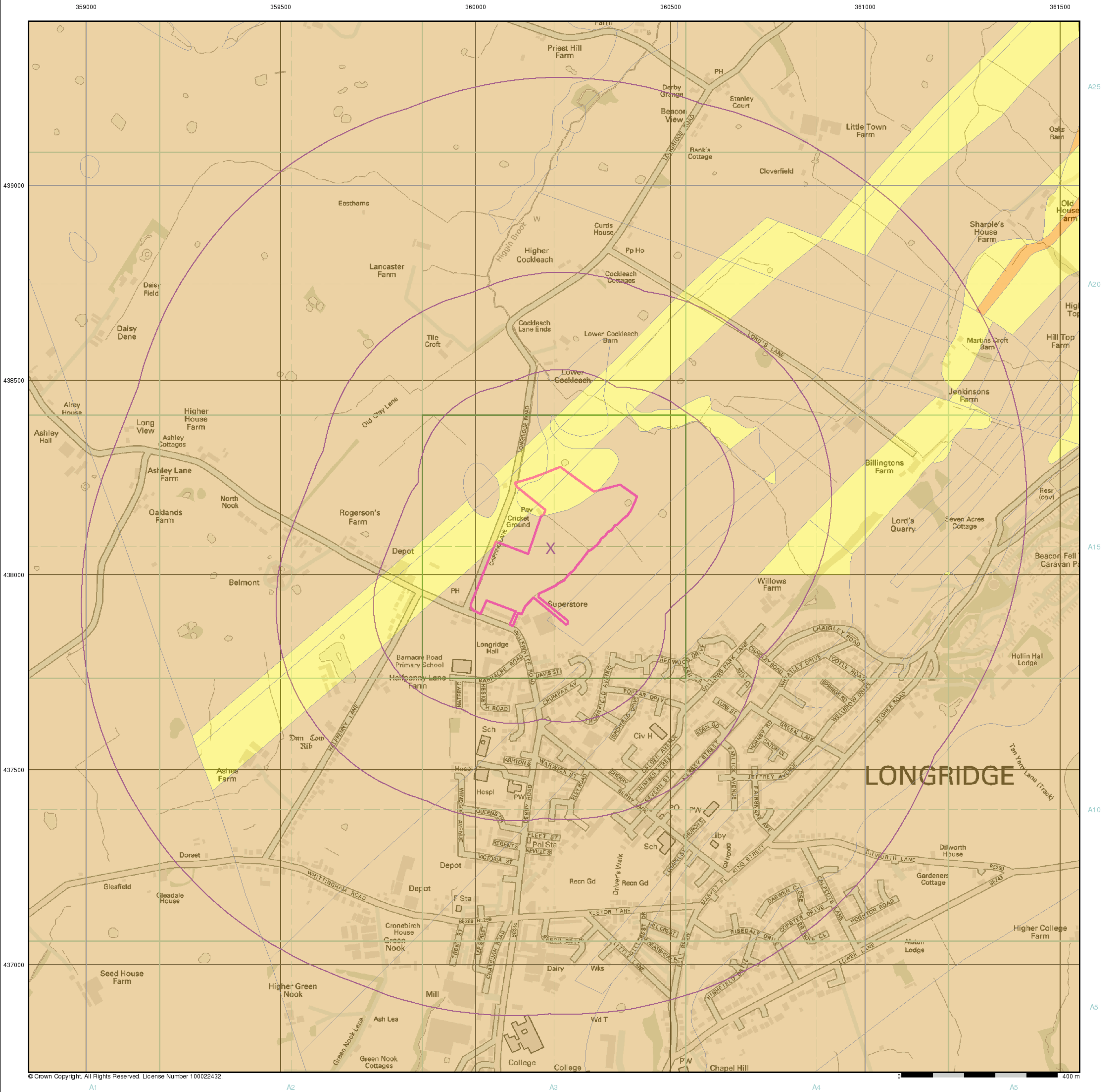


curtins

General

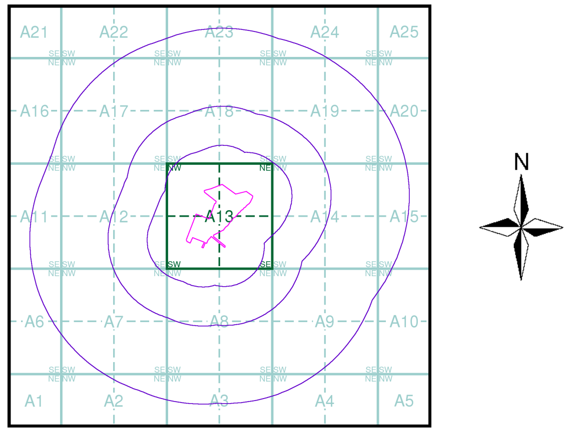
Specified Site
Specified Buffer(s)
X Bearing Reference Point

Estimated Soil Chemistry Arsenic

Arsenic Concentrations mg/kg

- < 15
- 15 - 25
- 25 - 35
- 35 - 45
- 45 - 60
- 60 - 120
- > 120

Estimated Soil Chemistry Arsenic - Slice A



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A Landmark Information Group Service v47.0 14-Apr-2014

General

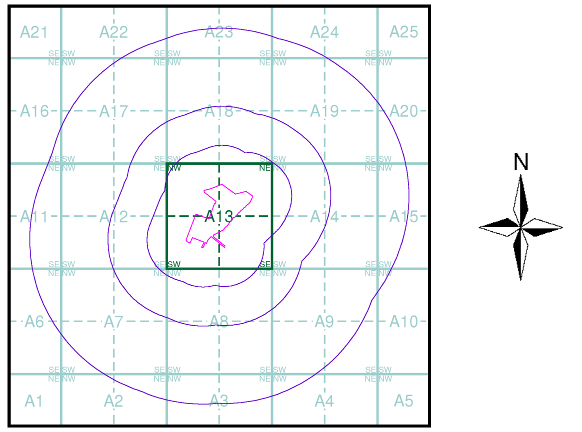
Specified Site
Specified Buffer(s)
X Bearing Reference Point

Estimated Soil Chemistry Cadmium

Cadmium Concentrations mg/kg

- < 1.8
- 1.8 - 2.2
- 2.2 - 3.0
- > 3.0

Estimated Soil Chemistry Cadmium - Slice A



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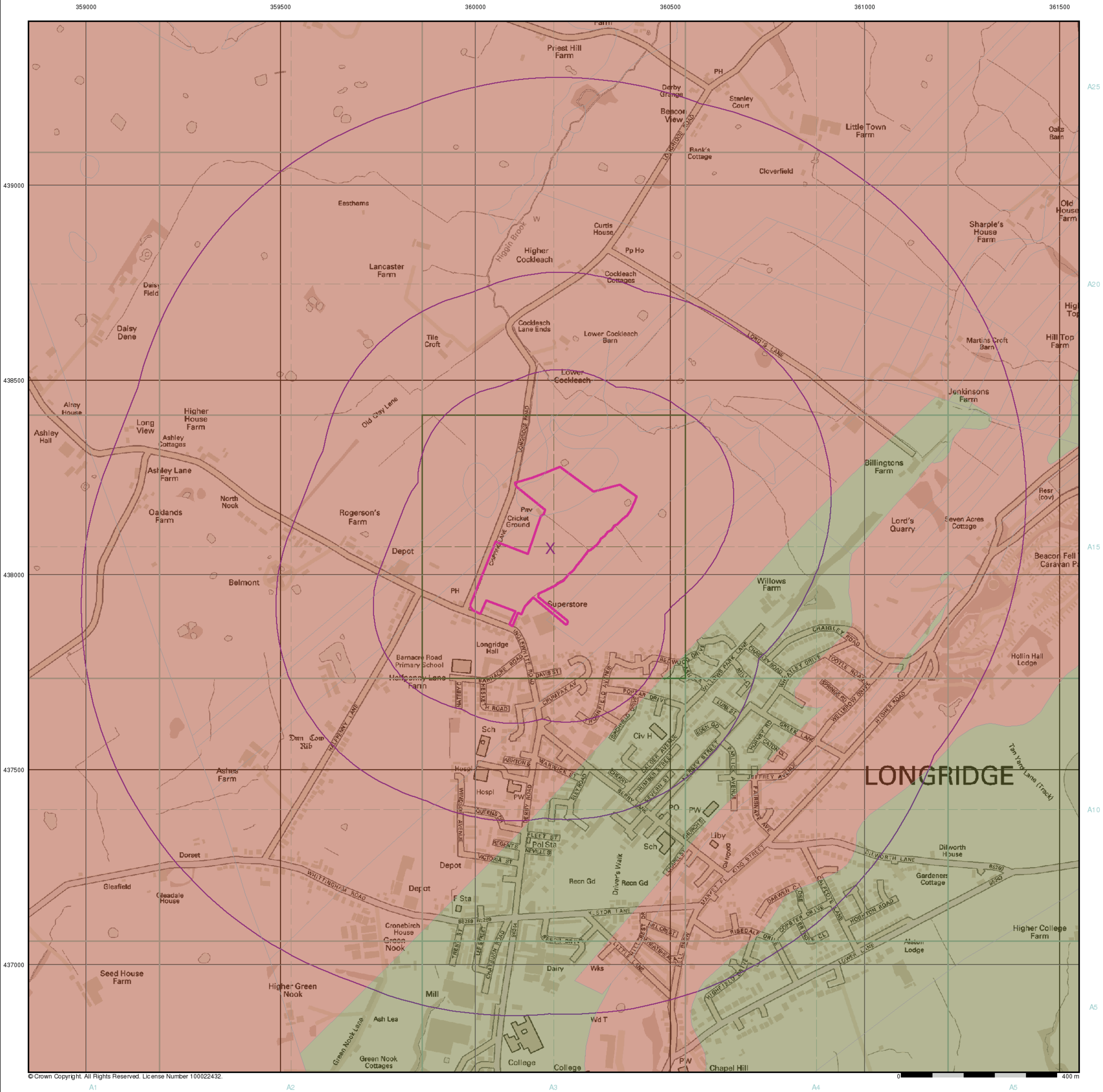


curtins

General

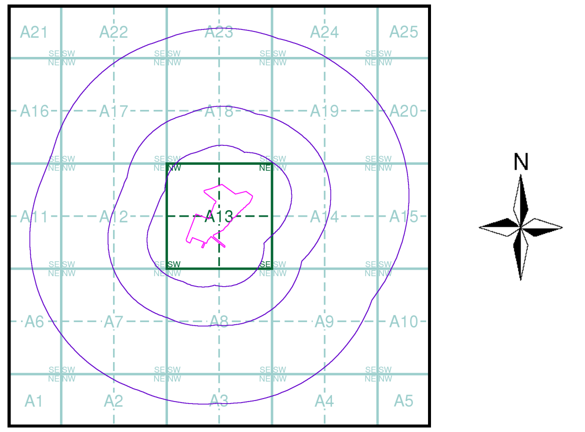
Specified Site   Specified Buffer(s)   X Bearing Reference Point

Estimated Soil Chemistry Chromium

Chromium Concentrations mg/kg

- < 20
- 20 - 40
- 40 - 60
- 60 - 90
- 90 - 120
- 120 - 180
- > 180

Estimated Soil Chemistry Chromium - Slice A



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Estimated Soil Chemistry Lead

General

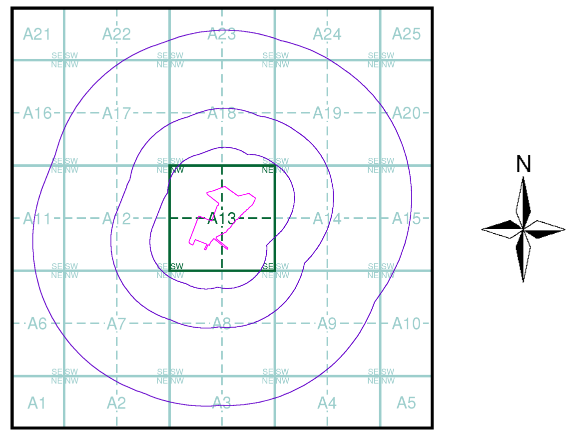
Specified Site
Specified Buffer(s)
X Bearing Reference Point

Estimated Soil Chemistry Lead

Lead Concentrations mg/kg

- < 150
- 150 - 300
- 300 - 600
- 600 - 900
- > 900

Estimated Soil Chemistry Lead - Slice A



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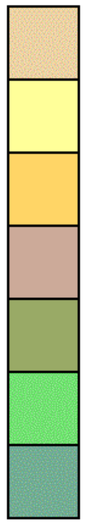


General

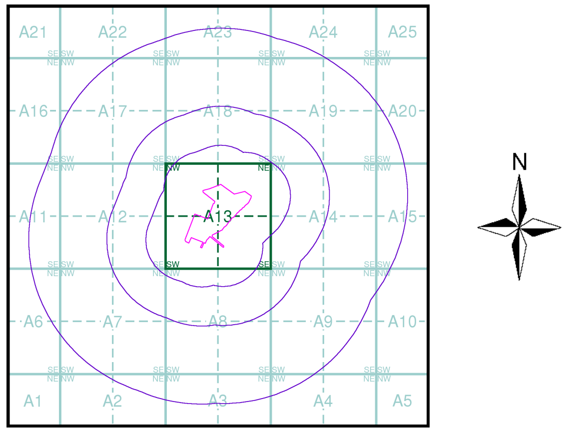
Specified Site
Specified Buffer(s)
X Bearing Reference Point

Estimated Soil Chemistry Nickel

Nickel Concentrations mg/kg

- < 15
- 15 - 30
- 30 - 45
- 45 - 60
- 60 - 80
- 80 - 100
- > 100

Estimated Soil Chemistry Nickel - Slice A



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Geology 1:50,000 Maps Legends

Artificial Ground and Landslip

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	MGR	Made Ground (Undivided)	Artificial Deposit	Holocene - Holocene
	SLIP	Landslide Deposit	Unknown/Unclassified Entry	Quaternary - Quaternary

Superficial Geology

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	ALV	Alluvium	Clay, Silt, Sand and Gravel	Flandrian - Flandrian
	TILLD	Till, Devensian	Diamicton	Devensian - Devensian
	GFDUD	Glaciofluvial Deposits, Devensian	Sand and Gravel	Devensian - Devensian
	PEAT	Peat	Peat [Unlithified Deposits Coding Scheme]	Quaternary - Quaternary
	RTDU	River Terrace Deposits (Undifferentiated)	Sand and Gravel	Quaternary - Quaternary

Bedrock and Faults

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	SDSH	Sabden Shales	Mudstone and Siltstone	Kinderscoutian - Arnsbergian
	PG	Pendle Grit Member	Sandstone and Siltstone, Interbedded	Pendleian - Pendleian
	PG	Pendle Grit Member	Sandstone, Silty	Pendleian - Pendleian
	PG	Pendle Grit Member	Mudstone	Pendleian - Pendleian
	WWG	Warley Wise Grit	Sandstone	Pendleian - Pendleian
	PNDS	Pendleside Sandstone Member	Sandstone	Brigantian - Brigantian
	BSG	Bowland Shale Formation	Mudstone and Siltstone	Yeadonian - Asbian
	BSG	Bowland Shale Formation	Mudstone	Yeadonian - Asbian
	PDL	Pendleside Limestone Formation	Limestone	Asbian - Holkerian
	BOH	Hodderense Limestone Formation	Limestone	Holkerian - Holkerian

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	RKM	Rad Brook Mudstone Member	Mudstone	Holkerian - Holkerian
	HOM	Hodder Mudstone Formation	Mudstone	Holkerian - Chadian
		Faults		

curtins

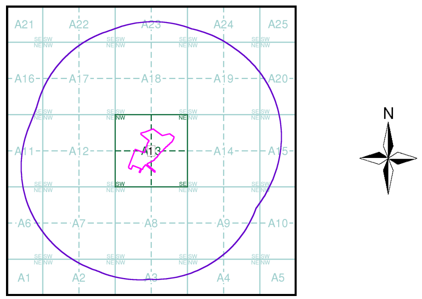
Geology 1:50,000 Maps

This report contains geological map extracts taken from the BGS Digital Geological map of Great Britain at 1:50,000 scale and is designed for users carrying out preliminary site assessments who require geological maps for the area around the site. This mapping may be more up to date than previously published paper maps.
The various geological layers - artificial and landslip deposits, superficial geology and solid (bedrock) geology are displayed in separate maps, but superimposed on the final 'Combined Surface Geology' map. All map legends feature on this page. Not all layers have complete nationwide coverage, so availability of data for relevant map sheets is indicated below.

Geology 1:50,000 Maps Coverage

Map ID:	1
Map Sheet No:	067
Map Name:	Garstang
Map Date:	1990
Bedrock Geology:	Available
Superficial Geology:	Available
Artificial Geology:	Available
Faults:	Not Supplied
Landslip:	Available
Rock Segments:	Not Supplied

Geology 1:50,000 Maps - Slice A



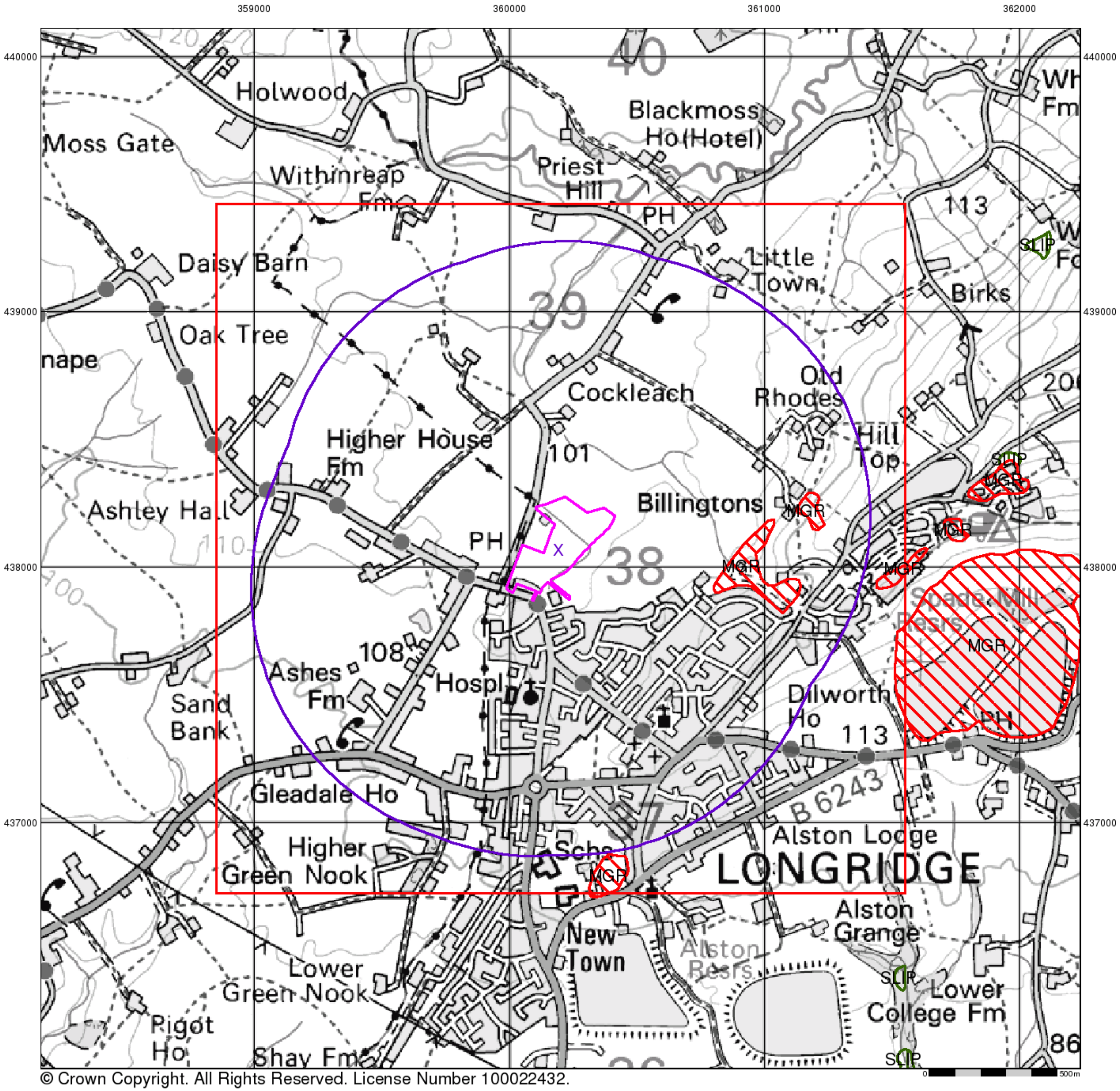
Order Details:

Order Number:	55312619_1_1
Customer Reference:	EB1355
National Grid Reference:	360190, 438070
Slice:	A
Site Area (Ha):	7.22
Search Buffer (m):	1000

Site Details:

Site at 360130, 438020

Landmark Information Group
Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



Artificial Ground and Landslip

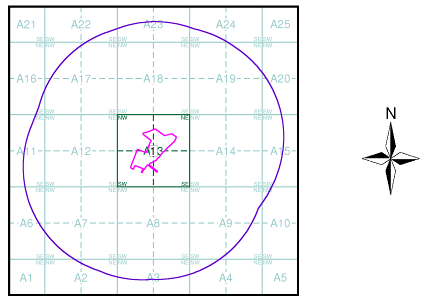
Artificial ground is a term used by BGS for those areas where the ground surface has been significantly modified by human activity. Information about previously developed ground is especially important, as it is often associated with potentially contaminated material, unpredictable engineering conditions and unstable ground.

Artificial ground includes:

- Made ground - man-made deposits such as embankments and spoil heaps on the natural ground surface.
- Worked ground - areas where the ground has been cut away such as quarries and road cuttings.
- Infilled ground - areas where the ground has been cut away then wholly or partially backfilled.
- Landscaped ground - areas where the surface has been reshaped.
- Disturbed ground - areas of ill-defined shallow or near surface mineral workings where it is impracticable to map made and worked ground separately.

Mass movement (landslip) deposits on BGS geological maps are primarily superficial deposits that have moved down slope under gravity to form landslips. These affect bedrock, other superficial deposits and artificial ground. The dataset also includes foundered strata, where the ground has collapsed due to subsidence.

Artificial Ground and Landslip Map - Slice A



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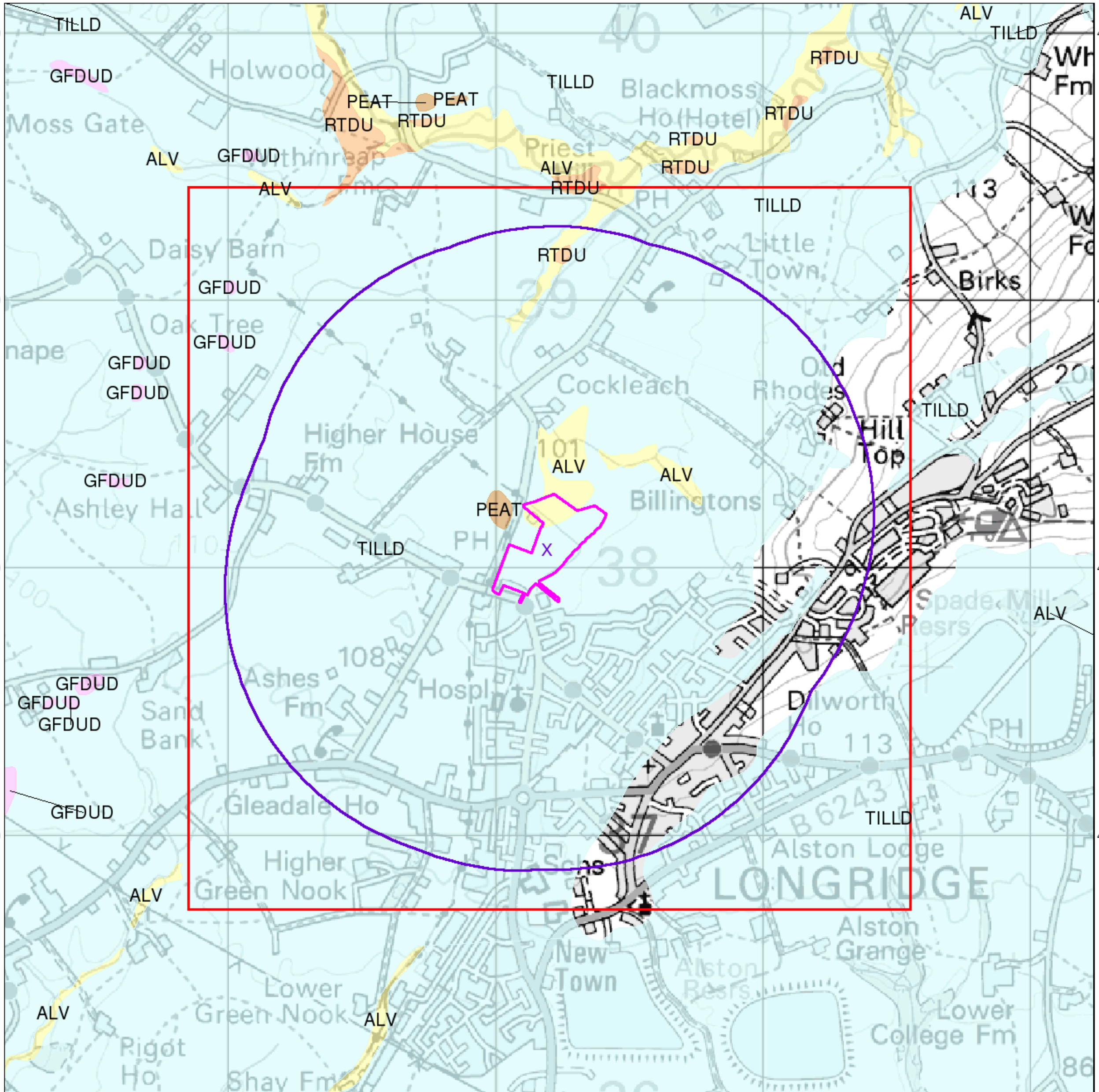

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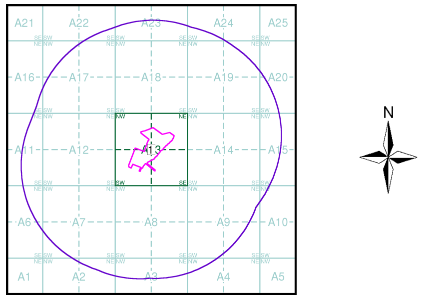
Superficial Geology

Superficial Deposits are the youngest geological deposits formed during the most recent period of geological time, the Quaternary, which extends back about 1.8 million years from the present.

They rest on older deposits or rocks referred to as Bedrock. This dataset contains Superficial deposits that are of natural origin and 'in place'. Other superficial strata may be held in the Mass Movement dataset where they have been moved, or in the Artificial Ground dataset where they are of man-made origin.

Most of these Superficial deposits are unconsolidated sediments such as gravel, sand, silt and clay, and onshore they form relatively thin, often discontinuous patches or larger spreads.

Superficial Geology Map - Slice A



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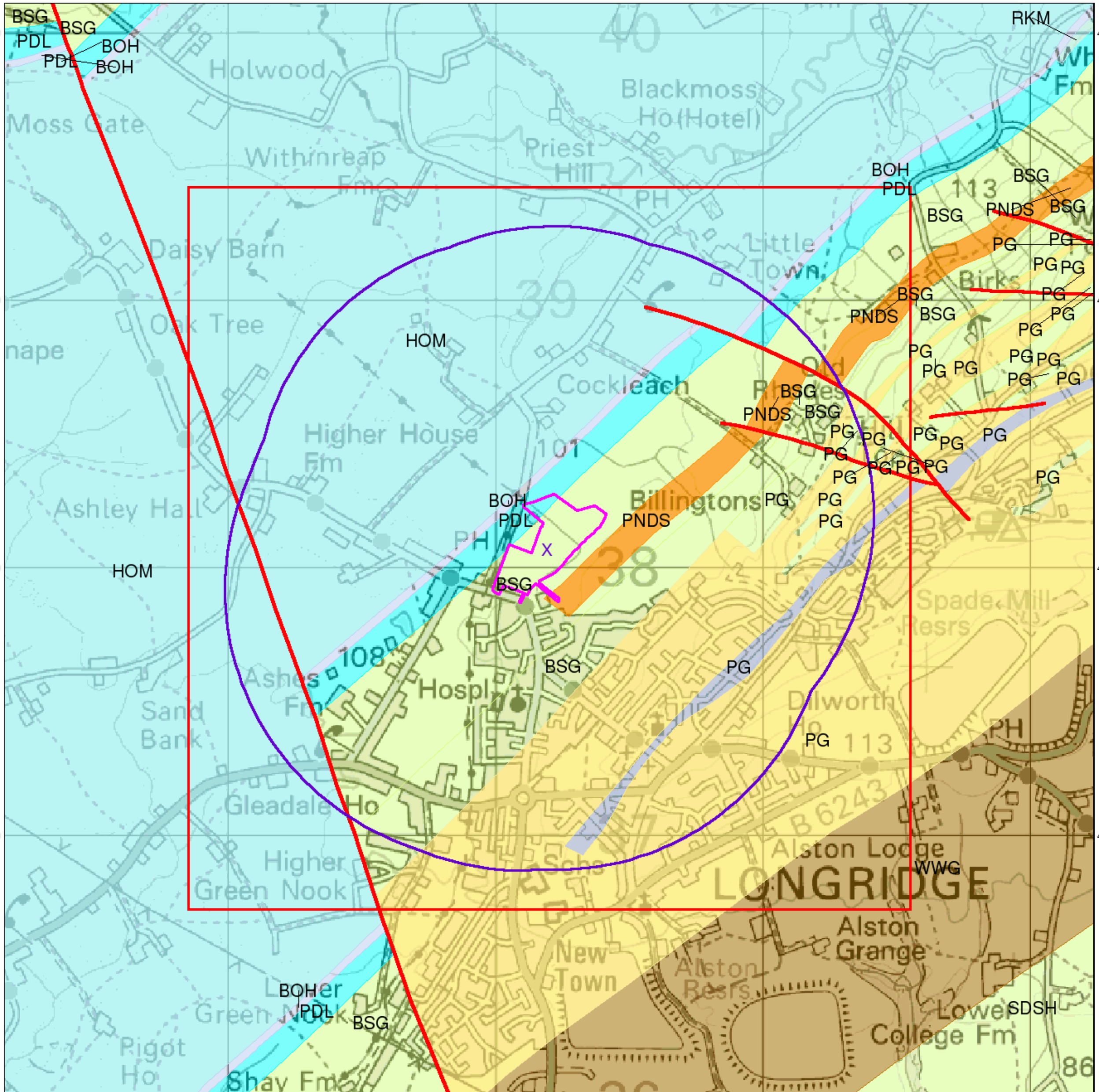

0 500m

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Bedrock and Faults

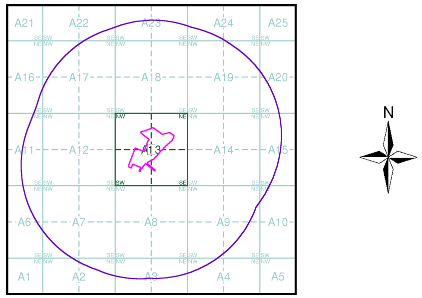
Bedrock geology is a term used for the main mass of rocks forming the Earth and are present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

The bedrock has formed over vast lengths of geological time ranging from ancient and highly altered rocks of the Proterozoic, some 2500 million years ago, or older, up to the relatively young Pliocene, 1.8 million years ago.

The bedrock geology includes many lithologies, often classified into three types based on origin: igneous, metamorphic and sedimentary.

The BGS Faults and Rock Segments dataset includes geological faults (e.g. normal, thrust), and thin beds mapped as lines (e.g. coal seam, gypsum bed). Some of these are linked to other particular 1:50,000 Geology datasets, for example, coal seams are part of the bedrock sequence, most faults and mineral veins primarily affect the bedrock but cut across the strata and post date its deposition.

Bedrock and Faults Map - Slice A



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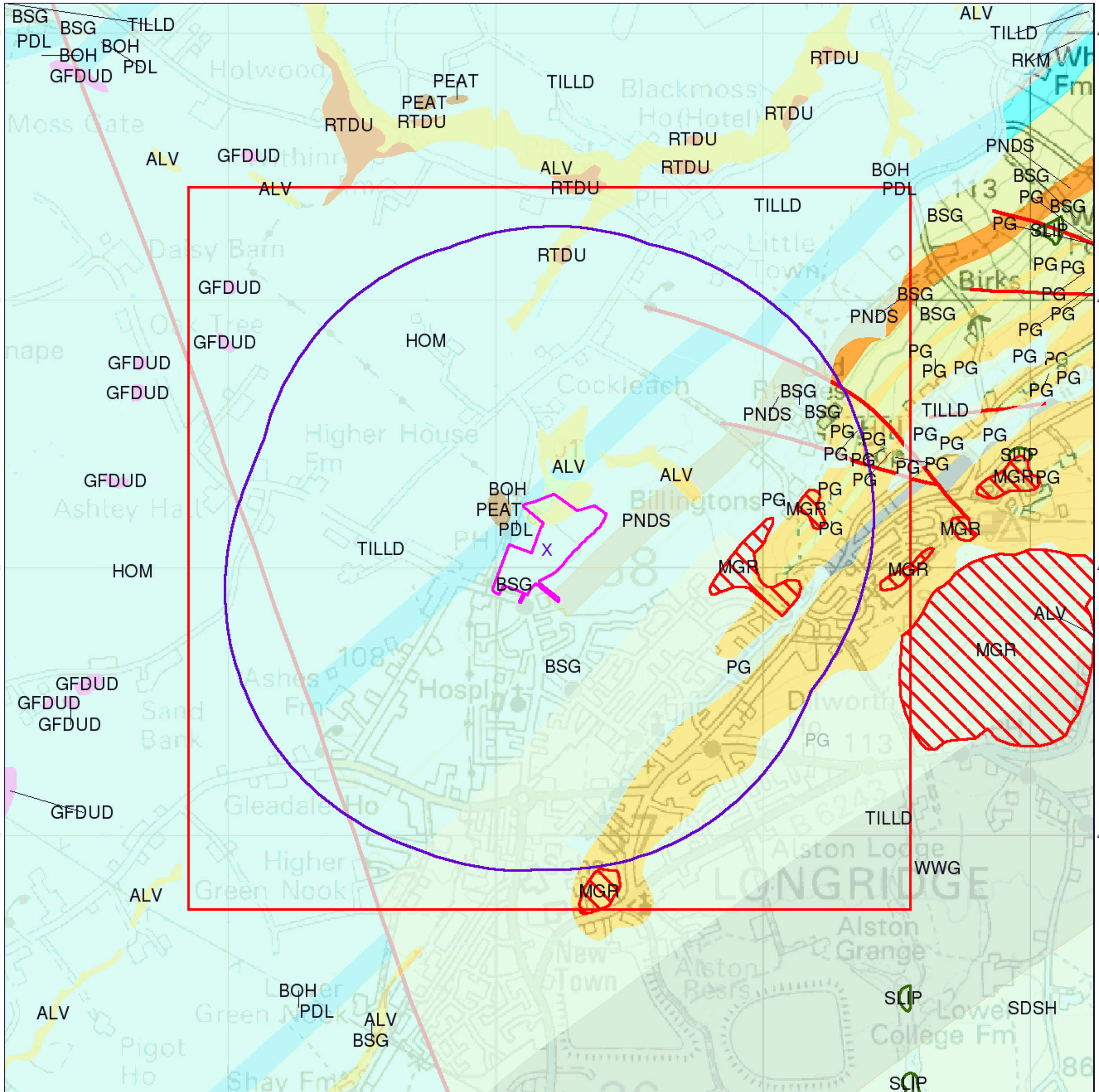

curtins

Combined Surface Geology

The Combined Surface Geology map combines all the previous maps into one combined geological overview of your site.

Please consult the legends to the previous maps to interpret the Combined "Surface Geology" map.

Additional Information

More information on 1:50,000 Geological mapping and explanations of rock classifications can be found on the BGS website. Using the LEX Codes in this report, further descriptions of rock types can be obtained by interrogating the 'BGS Lexicon of Named Rock Units'. This database can be accessed by following the 'Information and Data' link on the BGS website.

Contact

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Telephone: 0115 936 3143
Fax: 0115 936 3276
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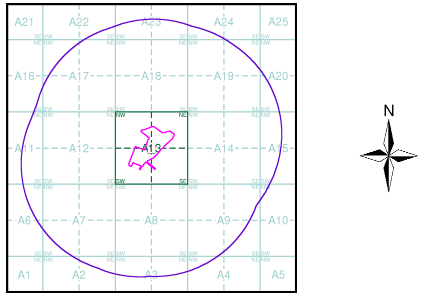
website: www.bgs.ac.uk

Combined Geology Map - Slice A



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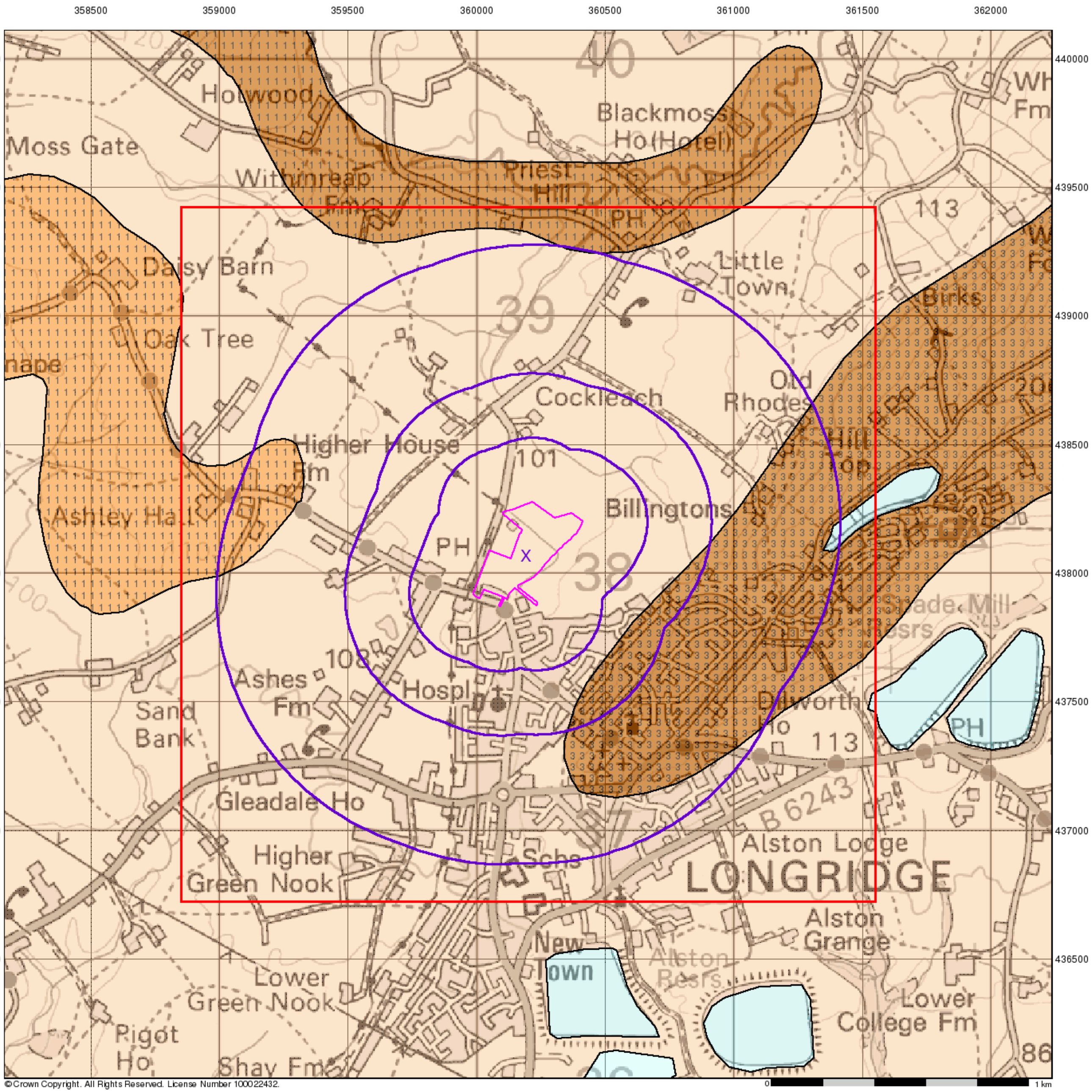


Groundwater Vulnerability

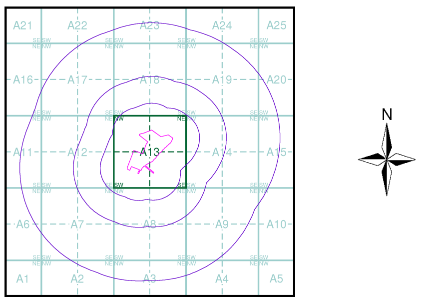
General

Specified Site
Specified Buffer(s)
Bearing Reference Point
Slice
Map ID

Agency and Hydrological

Geological Classes		Soil Classes
Major Aquifer (Highly Permeable)		High (H) 1, 2, 3, U
		Intermediate (I) 1, 2
		Low
Minor Aquifer (Variably Permeable)		High (H) 1, 2, 3, U
		Intermediate (I) 1, 2
		Low
Non Aquifer (Negligibly Permeable)		
Water or Sea		
Drift Deposit		

Site Sensitivity Context Map - Slice A



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National Grid Reference: 360190, 438070
Slice: A
Site Area (Ha): 7.22
Search Buffer (m): 1000

Site Details

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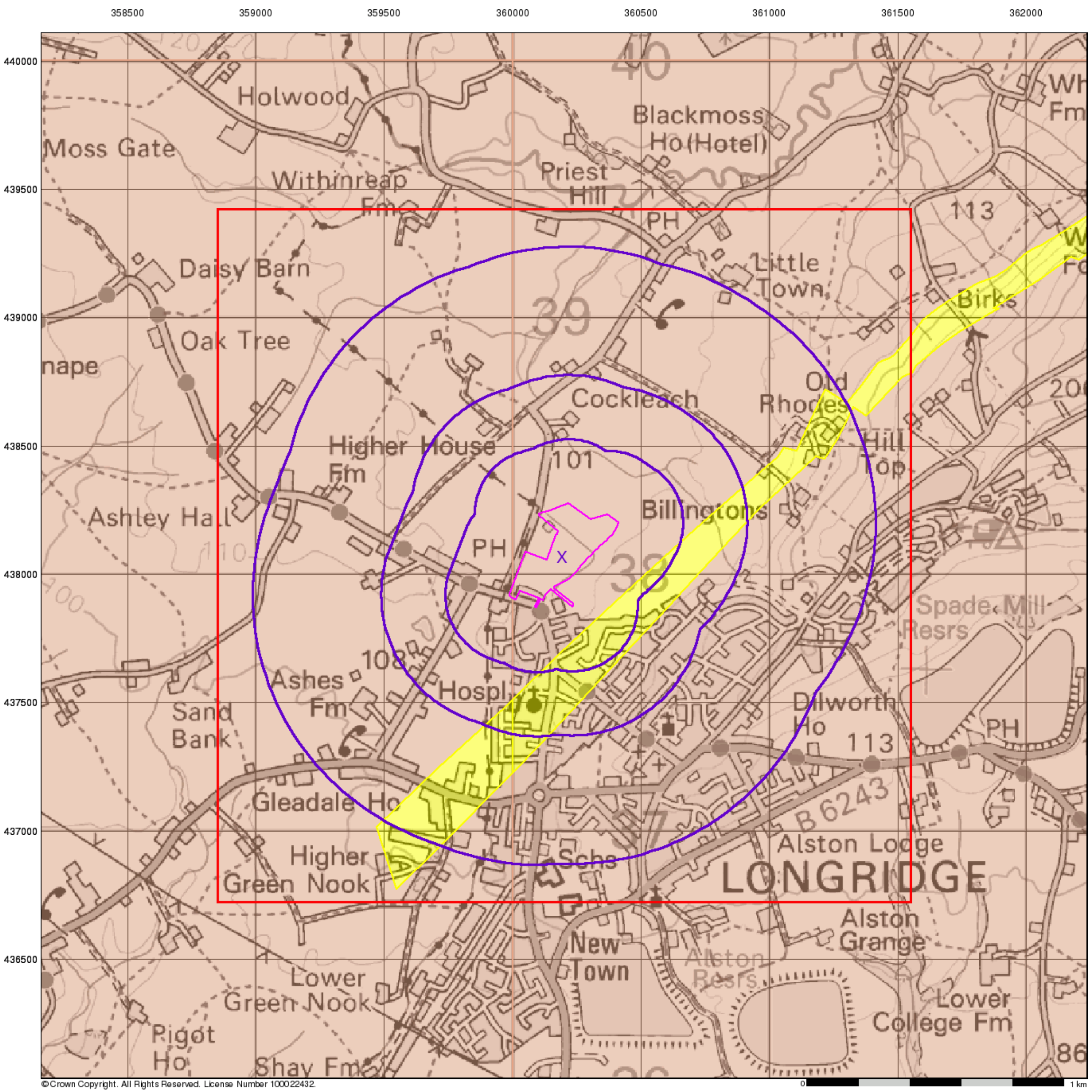

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Bedrock Aquifer Designation

General

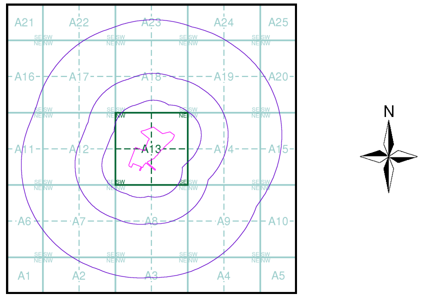
Specified Site
Specified Buffer(s)
Bearing Reference Point
Slice
Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown

Site Sensitivity Context Map - Slice A



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Slice:	A
Site Area (Ha):	7.22
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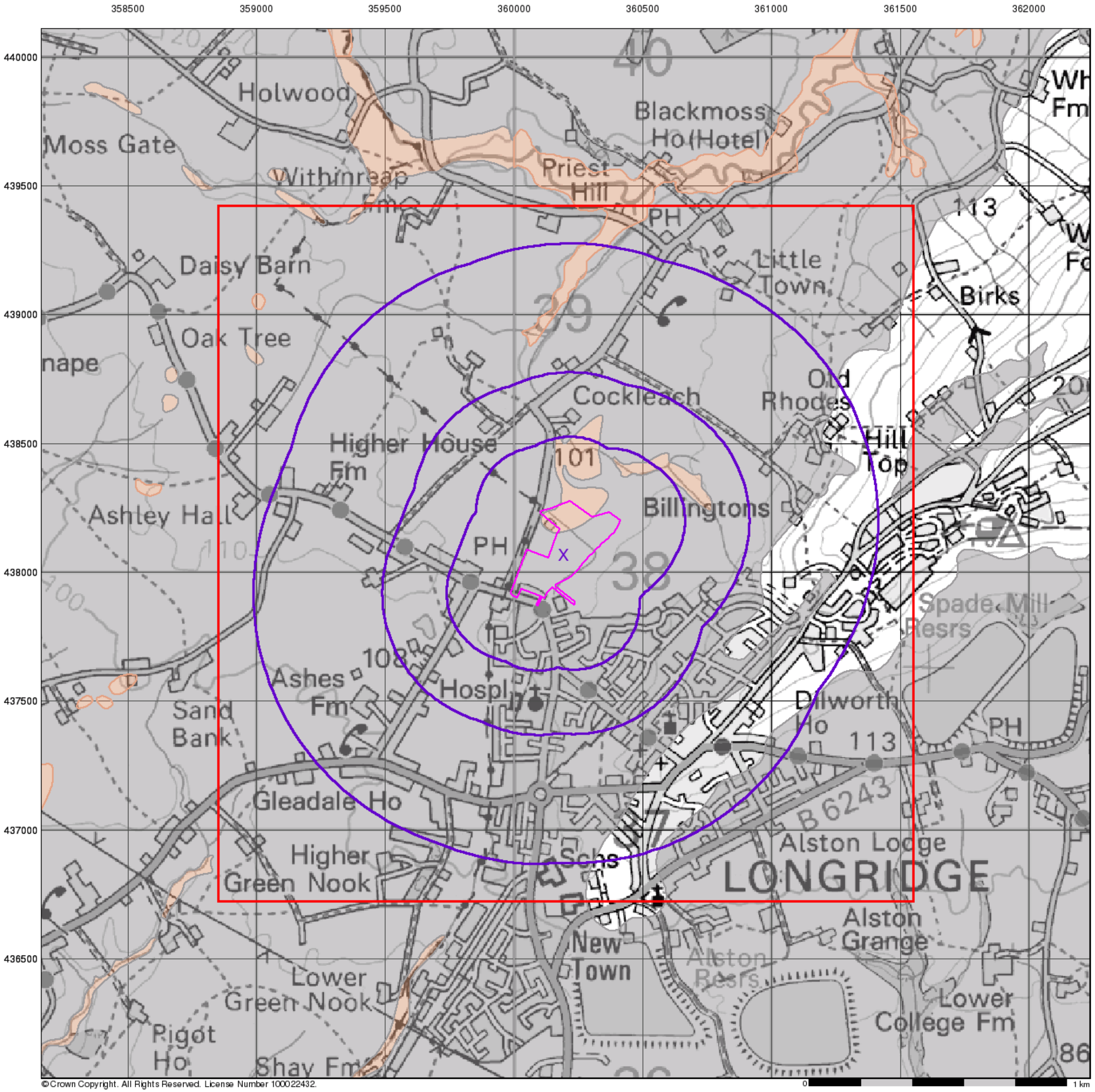

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Superficial Aquifer Designation

General

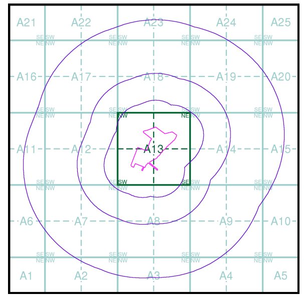
Specified Site
Specified Buffer(s)
Bearing Reference Point
Slice
Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown

Site Sensitivity Context Map - Slice A



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Order Details

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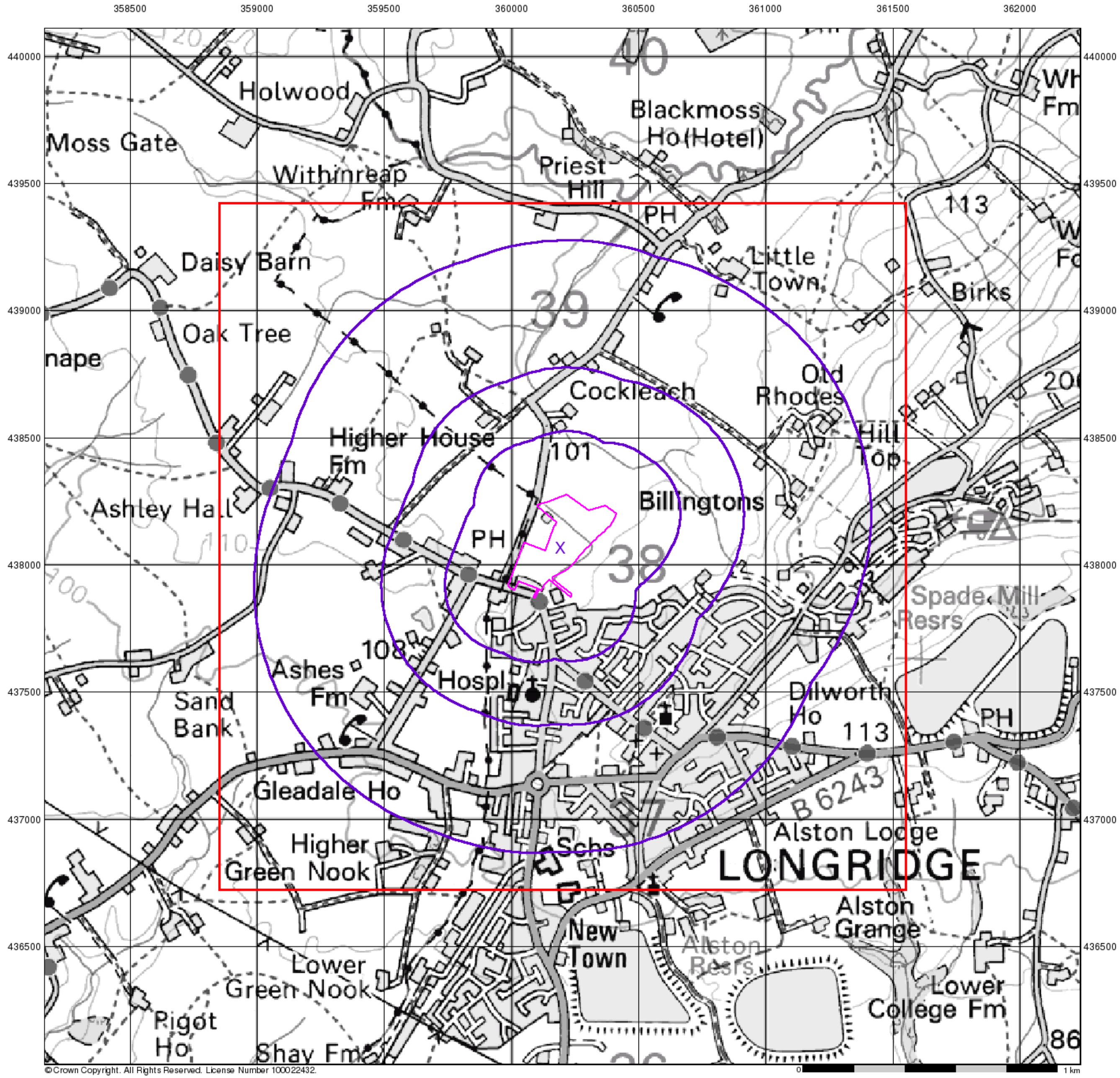


Source Protection Zones

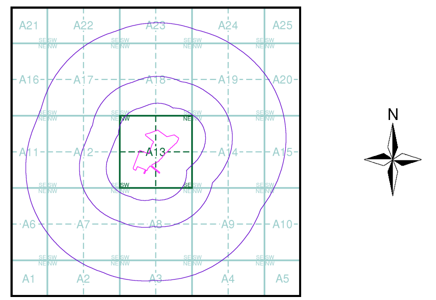
General

Specified Site
Specified Buffer(s)
Bearing Reference Point
Slice
Map ID

Agency and Hydrological

Source Protection Zone I
Source Protection Zone II
Source Protection Zone III
Zone of Special Interest
Source Protection Zone Borehole

Site Sensitivity Context Map - Slice A



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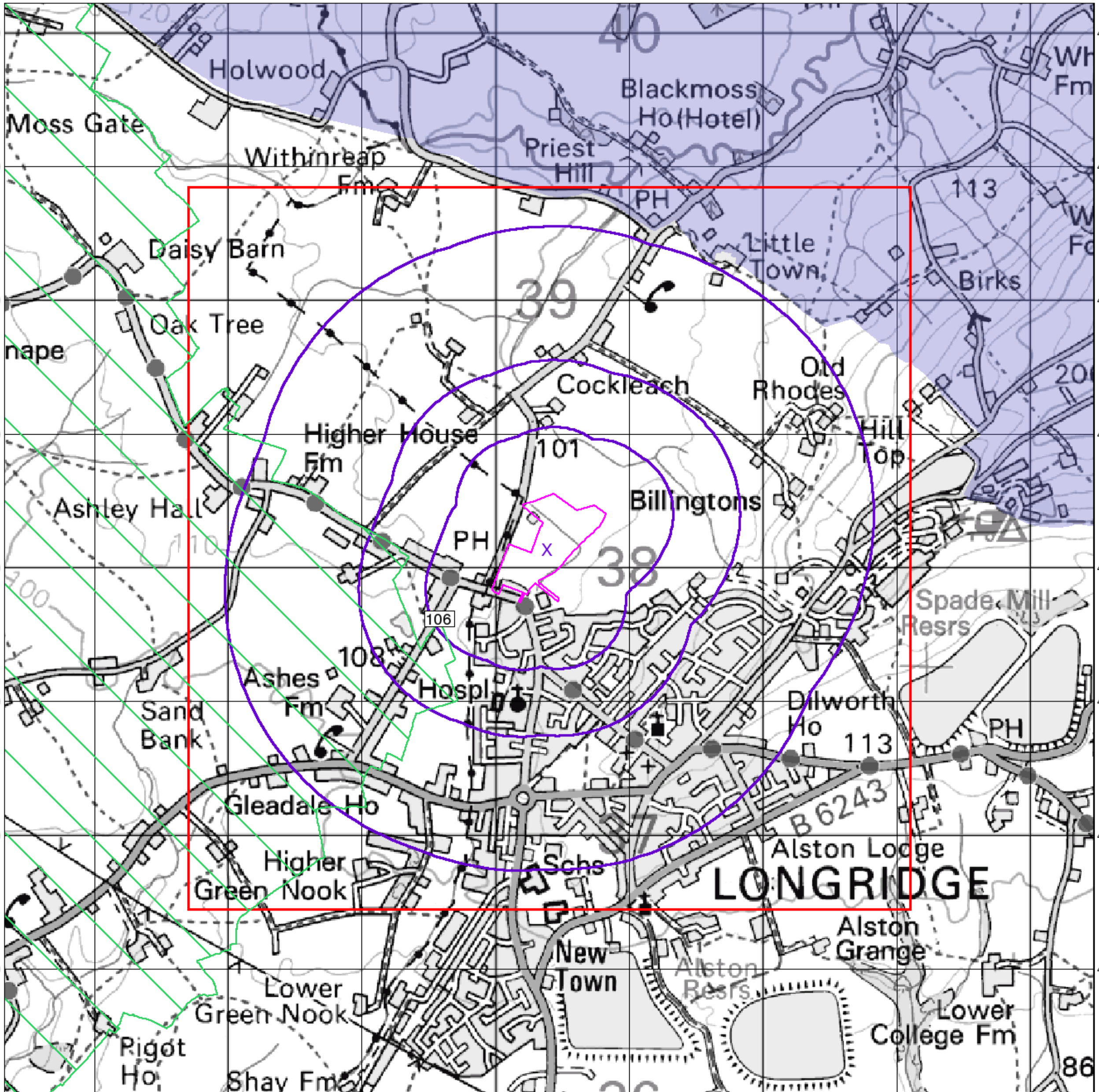

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Sensitive Land Uses

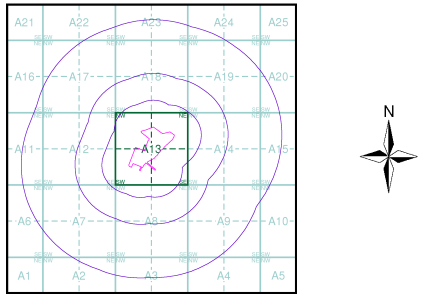
General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

Sensitive Land Uses

- Area of Adopted Green Belt
- Area of Unadopted Green Belt
- Area of Outstanding Natural Beauty
- Environmentally Sensitive Area
- Forest Park
- Local Nature Reserve
- Marine Nature Reserve
- National Nature Reserve
- National Park
- Nitrate Sensitive Area
- Nitrate Vulnerable Zone
- Ramsar Site
- Site of Special Scientific Interest
- Special Area of Conservation
- Special Protection Area

Site Sensitivity Context Map - Slice A



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Customer Ref:	EB1355
National Grid Reference:	360190, 438070
Slice:	A
Site Area (Ha):	7.22
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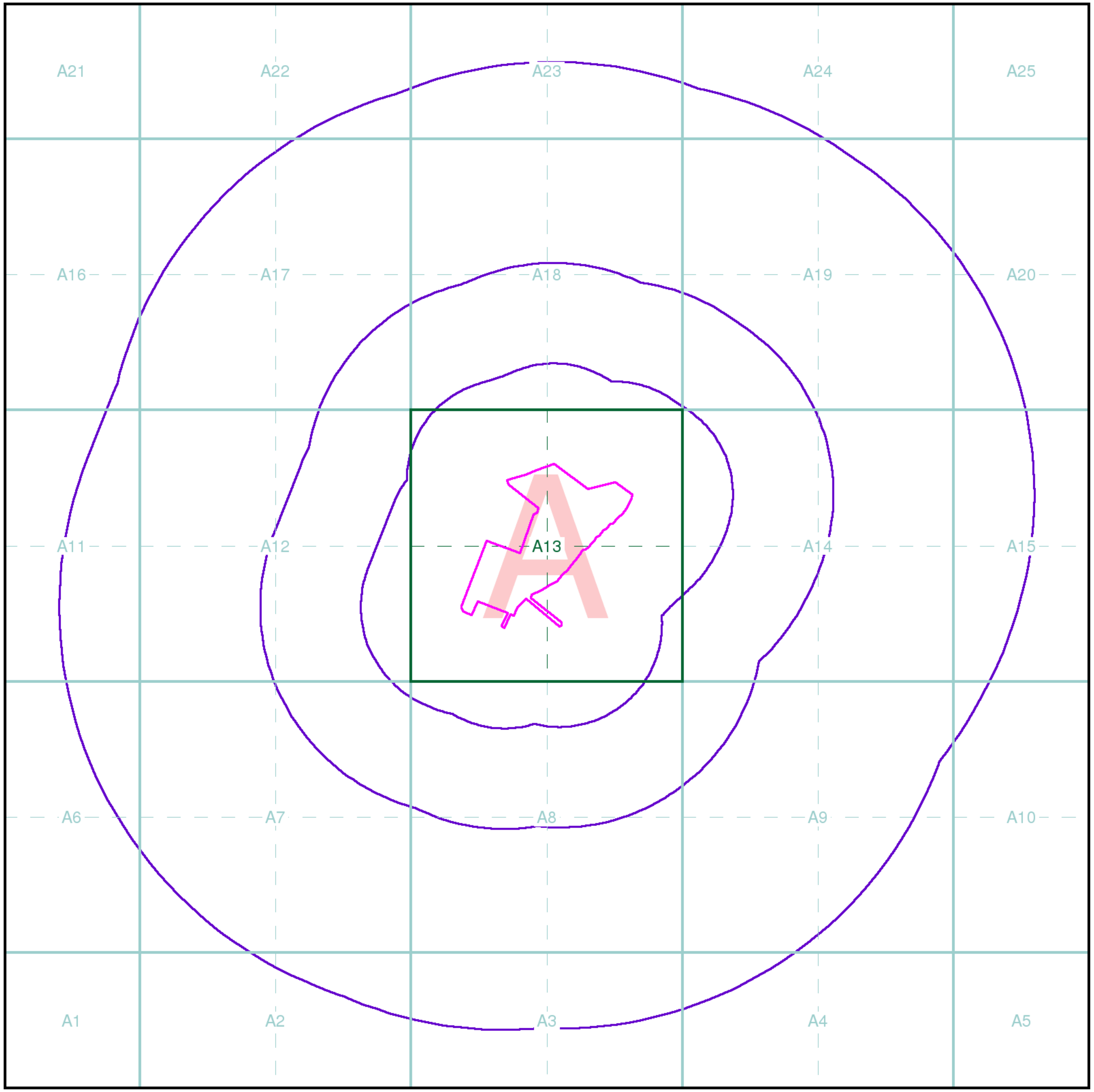

Index Map

For ease of identification, your site and buffer have been split into Slices, Segments and Quadrants. These are illustrated on the Index Map opposite and explained further below.

Slice
Each slice represents a 1:10,000 plot area (2.7km x 2.7km) for your site and buffer. A large site and buffer may be made up of several slices (represented by a red outline), that are referenced by letters of the alphabet, starting from the bottom left corner of the slice "grid". This grid does not relate to National Grid lines but is designed to give best fit over the site and buffer.

Segment
A segment represents a 1:2,500 plot area. Segments that have plot files associated with them are shown in dark green, others in light blue. These are numbered from the bottom left hand corner within each slice.

Quadrant
A quadrant is a quarter of a segment. These are labelled as NW, NE, SW, SE and are referenced in the datasheet to allow features to be quickly located on plots. Therefore a feature that has a quadrant reference of A7NW will be in Slice A, Segment 7 and the NW Quadrant.

A selection of organisations who provide data within this report:

Licensed Partner

Envirocheck reports are compiled from 136 different sources of data.

Client Details
Ms G Lownsbrough, Curtins Consulting Ltd, 10 Oxford Court, Bishopsgate, Manchester, M2 3WQ

Order Details

Order Number:	55312619_1_1
Customer Ref:	EB1355
National Grid Reference:	360200, 438090
Site Area (Ha):	7.22
Search Buffer (m):	1000

Site Details
Site at 360130, 438020

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http://www.landmarkinfo.co.uk/Terms/Show/515

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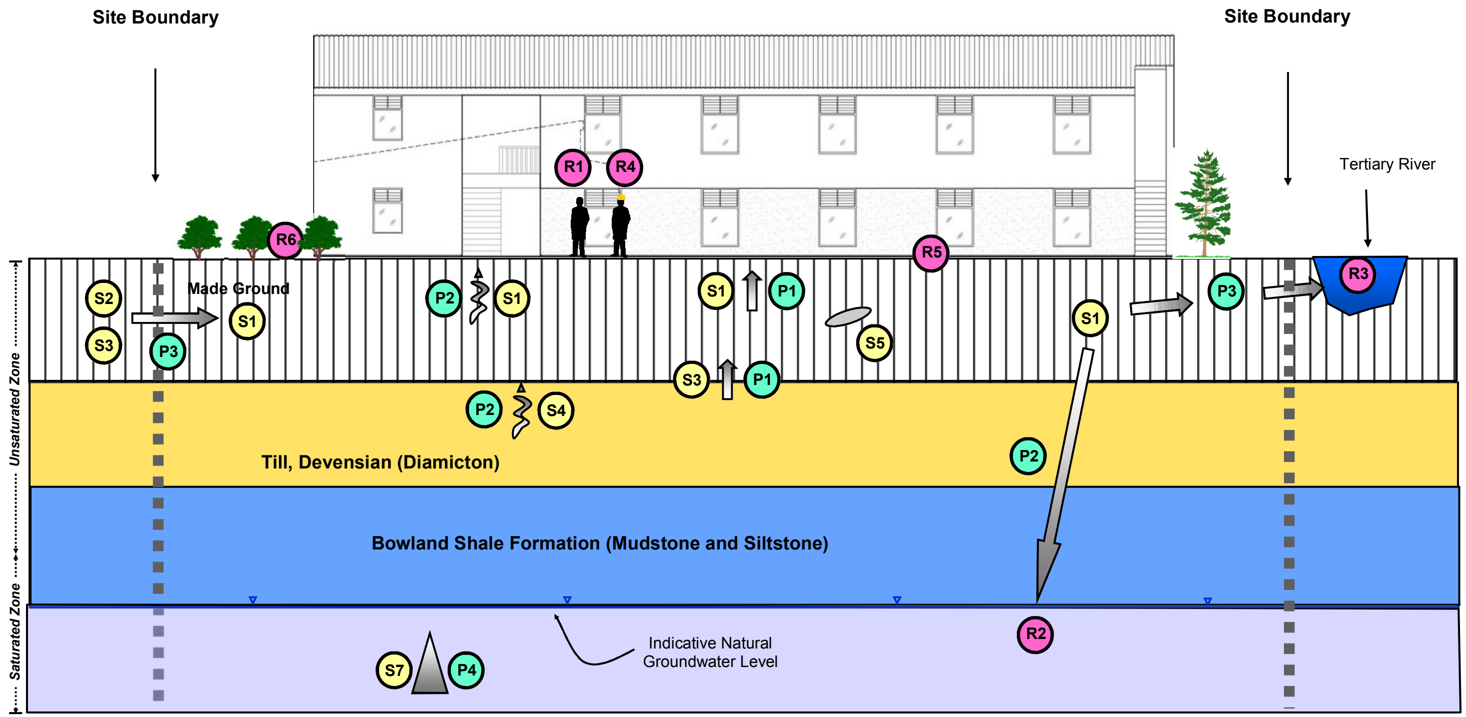
Appendix A3 – Diagrammatic Conceptual Model

Boland Meadow, Higgin Brook



Sources

- S1 Made-ground (On site)
- S2 Made-ground (Off site)
- S3 Natural soils (On & off site)
- S4 Ground gas sources
- S5 Unexploded ordnance
- S6 Radon geology
- S7 Mine workings

Pathways

- P1 Direct contact, ingestion and or inhalation
- P2 Vertical migration
- P3 Horizontal migration
- P4 Collapse

Receptors

- R1 End users
- R2 Groundwater
- R3 Surface water
- R4 Construction workers
- R5 Construction materials
- R6 Local ecology

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Project	**Job Reference**	**Author**	**Client**
Boland Meadow, Higgin Brook	EB1355	GL	Barratt Homes
Drawing Title	**Date**	**Checked**	**Scale**
Diagrammatic Conceptual Model	28.03.2014	AW	Not to scale

Appendix A4 – Qualitative Risk Assessment Rationale

The site-specific qualitative risk assessment of environmental harm, as detailed in Section 3.0 of this reporting, is summarised in Table A4.1 hereafter; the principle being to establish connecting links between a hazardous source to a potential receptor via an exposure pathway.

The qualitative risk assessment corresponds with the **total** site area.

Risk assessment is the process of collating known information on a hazard or set of hazards in order to estimate actual or potential risk to receptors. The receptor may be humans, a water resource, a sensitive local ecosystem or future construction materials. Receptors can be connected to the hazardous source by one or several exposure pathways such as direct contact for example. Risks are generally managed by isolating the receptor or intercepting the exposure pathway or by isolating or removing the hazard.

Without the three essential components of a source, pathway and receptor there can be no risk. Therefore the presence of hazard on a site does not necessarily mean there is a risk.

By considering where a viable pathway exists which connects a source with a receptor the risk assessment in Section 3.0 and Table A4.1 identifies where pollutant linkage exists. If there is no pollutant linkage there is no risk and only where a pollutant linkage is established does the risk assessment consider the level of risk.

The risk assessment considers the likelihood of a particular event taking place (accounting for the presence of the hazard and receptor and the integrity of the exposure pathway) in conjunction with the severity of the potential consequence (accounting for the potential severity of the hazard and the sensitivity of the receptor).

In the risk assessment the consequence of the hazard has been classified as severe or medium or mild or minor and the probability (likelihood) of the circumstances actually occurring classified as high likelihood or likely or low likelihood or unlikely.

The consequences and probabilities are subsequently cross-correlated to give a qualitative estimation of the risk using Department of the Environment risk classifications as detailed in the table below and as referenced in CIRIA C552.

		Consequence			
		Severe	**Medium**	**Mild**	**Minor**
Probability (Likelihood)	**High Likelihood**	Very High Risk	High Risk	Moderate Risk	Negligible Risk
	Likely	High Risk	Moderate Risk	Moderate/Low Risk	Negligible Risk
	Low Likelihood	High/Moderate Risk	Moderate/Low Risk	Low Risk	Negligible Risk
	Unlikely	Moderate/Low Risk	Low Risk	Negligible Risk	Negligible Risk

In accordance with DoE guidance, the following categorisation of **consequence** has been developed.

Classification	Definition	Examples
Severe	Short-term (acute) risk to human health likely to result in "significant harm" as defined by the Environment Protection Act 1990, Part IIA. Short-term risk of pollution of sensitive water resource. Catastrophic damage to buildings/property. A short-term risk to a particular ecosystem or organisation forming part of such ecosystem.	High concentrations of cyanide on the surface of an informal recreation area. Major spillage of contaminants from site into controlled water. Explosion, causing building collapse (can also equate to a short-term human health risk if buildings are occupied).
Medium	Chronic damage to Human Health. Pollution of sensitive water resources. A significant change in a particular ecosystem or organism forming part of such ecosystem.	Concentration of a contaminant from site exceeds the generic or site-specific assessment criteria. Leaching of contaminants from a site to a Principal or Secondary A aquifer. Death of a species within a designated nature reserve. Lesser toxic and asphyxiate effects
Mild	Pollution of non-sensitive water resources. Significant damage to crops, buildings, structures and services. Damage to sensitive buildings/structures/services or the environment.	Pollution of non-classified groundwater (inc. Secondary B aquifers). Damage to building rendering it unsafe to occupy (e.g. foundation damage resulting in instability).
Minor	Harm, although not necessarily significant harm, which may result in a financial loss or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing, etc). Easily repairable effects of damage to buildings, structures and services.	The presence of contaminants at such concentrations that protective equipment is required during site works. The loss of plants in a landscaping scheme. Discoloration of concrete.

In accordance with DoE guidance, the following categorisation of **probability** has been developed.

Classification	Definition
High Likelihood	There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term or there is evidence at the receptor of harm or pollution.
Likely	There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low Likelihood	There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term.
Unlikely	There is a pollution linkage but circumstances are such that it is improbable that an event would occur even in the very long term.

In accordance with DoE guidance, the following categorisation of **risk** has been developed.

Classification	Definition
Very High Risk	There is a *high probability* that *severe harm* could arise to a designated receptor from an identified hazard at the site without appropriate further action.
High Risk	*Harm* is *likely to arise* to a designated receptor from an identified hazard at the site without appropriate further action.
Moderate Risk	*It is possible* that without appropriate further action *harm could arise* to a designated receptor. It is relatively *unlikely* that any such harm would be *severe,* and if any harm were to occur it is *more likely* that such harm would be *relatively mild.*
Low Risk	*It is possible* that *harm could arise* to a designated receptor from an identified hazard. It is *likely* that, at worst, if any harm was realised any effects would be *mild.*
Negligible Risk	The presence of an identified hazard does not give rise to the potential to cause harm to a designated receptor.

The term 'risk' in this instance refers to the risk that the source, pathway, receptor linkage for a given source of contamination is complete. It does not refer to immediate risk to individuals or features present on the site from potential contaminants and is intended to be used as a tool to assess the necessity of further investigation.

Appendix A4.1 – Table and Summary of Potential Risks, Sheet 1

Conceptual Site Model			Qualitative Risk Assessment		
Source	Pathway(s)	Receptor(s)	Consequence (Potential Severity)	Likelihood of Occurrence	Risk*
S1: Made ground soils on site	**P2**: Vertical migration	**R2:** Controlled waters (Groundwater)	Medium	Low Likelihood	Moderate/Low
	P3: Horizontal migration	**R3:** Controlled waters (Surface Waters)	Medium	Low Likelihood	Moderate/Low
	P1: Direct contact, ingestion, inhalation (dust and vapours)	**R1:** End user of site	Medium	Low Likelihood	Moderate/Low
	P1: Direct contact, ingestion, inhalation (dust and vapours)	**R4:** Construction workers	Minor	Low Likelihood	Negligible
	P1 & P3: Direct contact, ingestion, inhalation (dust and vapours) and horizontal migration	**R5:** Construction materials	Mild	Low Likelihood	Low
	P1 & P3: Direct contact, ingestion, inhalation (dust and vapours) and horizontal migration	**R6:** Local ecology	Minor	Low Likelihood	Negligible
S2: Made ground soils off site	**P3 & P1**: Horizontal migration and direct contact, ingestion, inhalation (dust and vapours)	**R1:** End user of site	Medium	Likely	Moderate
	P3 & P1: Horizontal migration and direct contact, ingestion, inhalation (dust and vapours)	**R4:** Construction workers	Minor	Likely	Negligible

Appendix A4.1 – Table and Summary of Potential Risks, Sheet 2

Conceptual Site Model			Qualitative Risk Assessment		
Source	Pathway	Receptor	Consequence (Potential Severity)	Likelihood of Occurrence	Risk*
S3: Natural soils on or off site	**P1 & P3**: Direct contact, ingestion, inhalation (dust and vapours) and horizontal migration	**R1:** End user of site	Medium	Unlikely	Moderate/Low
	P1 & P3: Direct contact, ingestion, inhalation (dust and vapours) and horizontal migration	**R4:** Construction workers	Minor	Unlikely	Negligible
S4: Ground gases	**P2 & P3**: Vertical and horizontal migration	**R1:** End user of site	Severe	Low Likelihood	High/Moderate
S5: Radon	**P2 & P3**: Vertical and horizontal migration	**R1:** End user of site	Medium	Unlikely	Low
S6: Unexploded ordnance	**P1**: Direct contact	**R1:** End user of site	Severe	Unlikely	Moderate/Low
	P1: Direct contact	**R4:** Construction workers	Severe	Unlikely	Moderate/Low

****Risk refers to the potential risk that the Source, Pathway, Receptor linkage is complete and is used to determine if any further investigation is required. It does not indicate immediate emergency risk to any individual or feature present on the site unless specifically noted.***

Our Locations

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nottingham@curtins.com


Paddock
Pavilion
Car Park
Proposed
Cricket Pitch
Nets
Pond
Paddock
Primary School
Playing Fields
Primary
School
NEAP
Mews
Square
Square
LEAP
Park
Pond
Mews
Circus
Crescent
Land
Retained in
Agriculture
Mews
Square
Mews
Park
Superstore
Garage
Play Area
Chipping Lane
Willows Farm
Alston Arms (PH)
Barnacre Road
Primary School
Key
Application Site Boundary
Homes
Avenue
Village Streets
Village Lanes
Squares & Mews
Footpath/Cycleway
Existing Trees (Retained)
Existing Hedgerows (Retained & enhanced)
Proposed Trees & Hedgerows
Sustainable Urban Drainage Network
Play Area - Locally Equiped Area for Play
Play Area - Neighbourhood Equiped Area for Play
e*SCAPE
urbanists
Project Title
Higgins Brook, Longridge
e*SCAPE Job No.
013-008
Client
Barratt Homes
Drawing Number
013-008-P008
Revision
REV F
Drawing Title
Illustrative Masterplan/
Indicative Layout
Scale
1:1,250 @ A1
Date
Feb'15
n*ORTH
0m 10m 20m 30m 40m 50m 60m
Scale 1:1250 (@ A1)
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Sam Dean

From:	Daniel Sutcliffe <Daniel.Sutcliffe@ribblevalley.gov.uk>
Sent:	15 February 2016 10:53
To:	Sam Dean; Linden Richardson
Cc:	Stephen Kilmartin
Subject:	RE: STN3505NM: Gas monitoring at Longridge Preston

Follow Up Flag:	Follow up
Flag Status:	Flagged

Good Morning,

Apologies for the delay in responding but I have been off sick recently and I'm still catching up. I am happy for you to forego the gas monitoring on this site as I agree the likelihood/risk is relatively minimal. Please report on the intrusive ground investigations that you carry out and ensure that your findings (and details of any remediation work carried out) are submitted with your verification statement.

I've copied in the relevant planning officer for your site so that he is kept up to date and can make any necessary comment.

Kind Regards

Daniel Sutcliffe
Engineering Assistant
Ribble Valley Borough Council

From: Sam Dean [mailto:Sam.Dean@soiltechnics.net]
Sent: 11 February 2016 12:21
To: Sam Dean; Daniel Sutcliffe; Linden Richardson
Subject: RE: STN3505NM: Gas monitoring at Longridge Preston

Afternoon Daniel

have you had a chance to review our comments as per below?

Any queries please give me a call

Kind regards

Sam Dean
B.Sc. (Hons)., MIEnvSc., FGS
Associate Director

m 07917 602346 t 0161 9470270
e sam.dean@soiltechnics.net
w www.soiltechnics.net

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Cedar Barn, White Lodge, Walgrave, Northamptonshire NN6 9PY **t** 01604 781877

Manchester Office
Ivy Mill Business Centre, Crown Street, Failsworth, Manchester M35 9BG **t** 0161 9470270

From: Sam Dean
Sent: 04 February 2016 12:37
To: Daniel Sutcliffe; Linden Richardson
Subject: RE: STN3505NM: Gas monitoring at Longridge Preston

Daniel

Ref is Application 3/2014/0764

Any queries please give me a call

Kind regards

Sam Dean
B.Sc. (Hons)., MIEnvSc., FGS
Associate Director

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e sam.dean@soiltechnics.net
w www.soiltechnics.net

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Manchester Office
Ivy Mill Business Centre, Crown Street, Failsworth, Manchester M35 9BG **t** 0161 9470270

From: Daniel Sutcliffe [mailto:Daniel.Sutcliffe@ribblevalley.gov.uk]
Sent: 04 February 2016 10:34
To: Sam Dean <Sam.Dean@soiltechnics.net>; Linden Richardson <Linden.Richardson@soiltechnics.net>
Subject: RE: STN3505NM: Gas monitoring at Longridge Preston

Morning,

Could you please send me the relevant planning application reference for this site so that I can look it up?

Regards

Daniel Sutcliffe
Engineering Assistant
Ribble Valley Borough Council

From: Sam Dean [mailto:Sam.Dean@soiltechnics.net]
Sent: 02 February 2016 13:43
To: Linden Richardson
Cc: Daniel Sutcliffe
Subject: Re: STN3505NM: Gas monitoring at Longridge Preston

Daniel

Just to add to what Linden outlined, the site has outline planning (phase 1 and phase 2 approx 350 dwellings) and I believe you would have been in receipt of a phase 1 desk study report for the site already undertaken by a third party. They have outlined that gas is a source of concern based on the presence of potential Made Ground offsite.

The site is greenfield and geology is glacial till (clays). Landfill sources and historic pits are limited and distant. In our opinion even if there was a source of gas in Made Ground soils offsite, there is no preferential migration pathway to the site and the source, unless it contained significant concentrations of degradable and putrescible material of significant thickness, is considered low risk.

As you can appreciate, this may cause some conflict and delays later in the planning process if the LA are expecting to see some gas monitoring based on he recommendations of the desk study report and we do not undertake based on our assessment. If the LA recommend that such monitoring is undertaken as a matter course on all sites within their remit the we would obviously have no objection to this.

We would appreciate any feedback at your earliest convenience, we are programmed to undertake intrusive ground investigations at the site Weds and Thursday this week in the phase 1 area, with phase 2 following next week.

Regards

Sam Dean
(Associate Director for Soiltechnics Ltd)

Sent from my iPhone

On 2 Feb 2016, at 12:50, Linden Richardson <Linden.Richardson@soiltechnics.net> wrote:

> Dear Mr Sutcliffe
>
> I am working on the ground investigation for a proposed residential development at the above address (postcode PR3 2NA, it is the land north of the village and east of Chipping Lane) and will shortly be undertaking the site investigation.
>
> It has been suggested to me that I get in touch with you to get your position on the requirements for gas monitoring at the site. Our desk study has revealed no clear sources of ground gas and we are of the opinion that gas monitoring is not required at the site. If you agree with this position it would be useful to receive confirmation of this so that gas monitoring can be discounted. This would allow the planning application to be completed more promptly and at lower expense. However, should you need more time to deliberate, or not be able to respond before the works are undertaken then we will happily proceed with installations and monitoring.
>
> Many thanks for any input you can provide.
>
> Regards

Linden Richardson
B.Eng. (Hons)., MSc., AIEMA
Geo-environmental Engineer

t 0161 9470270
m 0777 9417287
e linden.richardson@soiltechnics.net
www.soiltechnics.net

<image001.png>
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Cedar Barn, White Lodge, Walgrave, Northamptonshire NN6 9PY **t** 01604 781877

Manchester Office
Ivy Mill Business Centre, Crown Street, Failsworth, Manchester M35 9BG **t** 0161 9470270

soiltechnics
environmental and geotechnical consultants

Initial Conceptual Model

Current site use commercial/industrial
Proposed site use residential

Source	Pathway										Receptor		Risk assessment to CIRIA C552	
	Humans						Vegetation	Water					Consequence of risk occurring via most likely pathway	Risk
	Ingestion of air-borne dusts	Ingestion of soil	Ingestion of vegetables and soil attached to vegetables	Inhalation of air-borne dusts	Inhalation of vapours	Dermal contact with soil and dust	Root uptake, deposition to shoots and foliage contact	Percolation of water through contaminated soils	Near-surface water run-off through contaminated soils	Saturation of contaminated soils by flood waters				
Soils														
Historic land uses, pollution incidents and	Likely	Likely	Unlikely	Likely	Likely	Likely	-	-	-	-	Current site users	Adult	Minor	Low
landfills/restored quarries in local area -	Likely	Likely	Unlikely	Likely	Likely	Likely	-	-	-	-	Proposed site users	Child	Minor	Low
Metals, PAHS, TPHs, organic pathogens	Likely	Likely	Unlikely	Likely	Likely	Likely	-	-	-	-	Construction operatives	Adult	Minor	Low
and bacteria	-	-	-	-	-	-	Likely	-	-	-	Vegetation (current and proposed)	-	Minor	Low
	-	-	-	-	-	-	-	Unlikely	Likely	Unlikely	Water (current and proposed)	-	Minor	Low

Final Conceptual Model

Current site use commercial/industrial
Proposed site use residential

Source	Pathway										Receptor		Risk assessment to CIRIA C552	
	Humans						Vegetation	Water					Consequence of risk occurring via most likely pathway	Risk
	Ingestion of air-borne dusts	Ingestion of soil	Ingestion of vegetables and soil attached to vegetables	Inhalation of air-borne dusts	Inhalation of vapours	Dermal contact with soil and dust	Root uptake, deposition to shoots and foliage contact	Percolation of water through contaminated soils	Near-surface water run-off through contaminated soils	Saturation of contaminated soils by flood waters				
Soils														
Potential for leachable concentrations of	Likely	Likely	Unlikely	Likely	Likely	Likely	-	-	-	-	Current site users	Adult	Minor	Low
copper to exist in Topsoil as identified in	Likely	Likely	Unlikely	Likely	Likely	Likely	-	-	-	-	Proposed site users	Child	Minor	Low
Phase 1 and Phase 2 development areas	Likely	Likely	Unlikely	Likely	Likely	Likely	-	-	-	-	Construction operatives	Adult	Minor	Low
	-	-	-	-	-	-	Likely	-	-	-	Vegetation (current and proposed)	-	Minor	Low
	-	-	-	-	-	-	-	Unlikely	Likely	Unlikely	Water (current and proposed)	-	Minor	Low

Title	Table number
Conceptual Site Model	1

Appendix D
MicroDrainage Simulations

CONTENTS

Network 1 Foul Water Design

Foul Drainage Design

FW Manhole Schedules

Network 2 Foul Water Design

Foul Drainage Design

FW Manhole Schedules

Network 3 Foul Water Design

Foul Drainage Design

FW Manhole Schedules

DRAINAGE LAYOUT

Drainage Network Layout

Street Lighting Key

6M TUBULAR STEEL LIGHTING COLUMN WITH GLASS EPOXY ROOT TREATMENT.

COLUMN TO BE FITTED WITH 1NO. POST-MOUNTED URBIS SCHREDER AXIA 3.1 16LED OLSON SQUARE GIANT 160mA S5/R2 FITTED WITH LUCY ZODION CBFSS5DR 10/10 SWITCHING FACTORY SET TO DIM @ 50% FROM 19-00HRS TO 07-00HRS.

5M TUBULAR STEEL LIGHTING COLUMN WITH GLASS EPOXY ROOT TREATMENT.

COLUMN TO BE FITTED WITH 1NO. POST-MOUNTED URBIS SCHREDER AXIA 3.1 16LED OLSON SQUARE GIANT 160mA S5/R2 FITTED WITH LUCY ZODION CBFSS5DR 10/10 SWITCHING FACTORY SET TO DIM @ 50% FROM 19-00HRS TO 07-00HRS.

EXISTING COLUMN AS PER PHASE 1 DESIGN.

LC36 COLUMN IDENTIFICATION NUMBER.

WARNING TO HOUSE-PURCHASERS

Property Misdescriptions Act 1991

Buyers are warned that this is a working drawing and is not intended to be treated as descriptive material describing, in relation to any particular property or development, any of the Specified matters prescribed by any Order made under the above Act. The contents of this drawing may be subject to change at any time and alterations and variations can occur during the progress of the works without revision of the drawing. Consequently the layout, form, content and dimensions of the finished construction may differ materially fron those shown. Nor do the contents of this drawing constitute a contract, part of any contract or warranty.

ENGINEERING LAYOUT NOTES

1. All adoptable drainage works have been designed and are to be constructed in accordance with 'Sewers for Adoption, 6th Edition', and United Utilities 'Guidelines for Sewer for adoption 6th Edition'. Where specification conflicts, UU guidelines shall take presidence.

United Utilities Standard details to be used are:

STND/19/001A	Manhole Type 1
STND/19/002A	Manhole Type 2 and Invert Access Detail
STND/19/003A	Shallow Manhole Detail for Small Diameter Pipes (Type 4)
STND/19/004A	Shallow Surface Water Manhole Detail – Restricted Headroom (less than 2.0m) – For Pipe Sizes 450Dia and Above
STND/19/005A	Flow Control Manhole Detail
STND/19/007A	External Backdrop Detail
STND/19/008A	Pipe Bedding Detail
STND/19/010A	Variable Manhole – Guidance Notes
STND/19/011A	Headwall Type 1 and Typical Outlet Grille Detail
STND/19/012A	Typical Outfall Details Type 2 & Type 3

2. All clay pipe work shall be Extra Strength Clayware to BS 295 and BS 65 (SW pipes only).

3. All precast concrete pipework shall be to Class 120 in accordance with BS5911 Part 1, BS EN 1916 and bear the BS kitemark.

4. All adoptable drainage to be bedded in Class S granular surround unless otherwise stated.

5. All Concrete manholes and Soakaways rings, Concrete cover slabs and Con to be manufactured to BS EN 1917 and BS 5911:Part 3.

6. Rising Mains to be Black Polyethylene Pipes complying to BS EN 13244-2. Polyethylene fittings, including fusion joints, and electro-fusion fittings shall comply with BS EN 13244-2.

7. All levels relate to Ordnance Datum. Contractor to ensure that this drawing is read in conjuction with the site specific Topographical Survey provided by Barratt Manchester and the Benchmark information provided.

8. This drawing is to be read in accordance with all other relevant drawings.

9. The contractor shall be responsible for ensuring that any existing invert levels indicated on the drawings are correct before work commences.

10. All proposed connections to the sewer shall be 150ø unless stated otherwise.

11. All private house drainage shall be 100ø and all drag-out connections shall be 150ø at a minimum gradient of 1:80 unless otherwise stated and laid in accordance with Part H of the the Building Regulations.

12. Runoff from private surfaces shall not discharge across the highway. Gullies or channels shall be provided as appropriate to prevent this.

13. Pram crossings shall be provided at the inner tangent points of all junctions.

14. Pipes shall be protected from concentrated loading by construction traffic during the construction period when insufficient cover to the pipe may make them vulnerable to damage.

15. Insitu CBR tests of the road formation level are to be carried out to determine the depth of pavement construction required. This is to be approved by the adopting authority prior to construction of the road pavements.

16. Groundworker to ensure that plot drainage be within the curtilage of the plot they serve where possible and inspection covers kept within hardstandings where possible.

17. Contractor to provide United Utilities with sufficient notice prior to commencement of Sewer works on their Inspections telephone number. Tel 0845 602 0406.

18. Contractor to obtain all necessary Highway opening notices from the relevant Local Authority, obtain approval to work on United Utilities Sewerage System, obtain approval to method statement from the Environment Agency for any works affecting a watercourse.

ENGINEERING KEY

S1 Adoptable S.W. Sewer & Manhole

F1 Adoptable F.W. Sewer & Manhole

Silt Trap Manhole at Overflow Basins

S1 Adoptable S.W. Sewer Headwall

(10.25) S. Water Drag-Out and Invert

10.25 Foul Drag-Out and Invert

Adoptable Road Gully

Street Name Plate

FLOW CONTROL DETAILS

MH Ref.	Specification
S110	ACO Orifice Plate to be Supplied by ACO Technologies. Tel 01462 816666. Ref: SL20190923 1No. 247mm Q-Plate-RW
S324	Crown Flow Control Device to be Supplied by Crown Water Systems. Tel 01344 886 996. Ref: 4280619 1No. 230mm QR5 Type Vortex Flow Control Unit. Head=3.20m, Flow=42.4 l/s.
S414	Crown Flow Control Device to be Supplied by Crown Water Systems. Tel 01344 886 996. Ref: 4280619 1No. 192mm QR5 Type Vortex Flow Control Unit. Head=2.6m, Flow=26.6 l/s.

REV	DESCRIPTION	DATE	DRAWN
G	Easement from S201-S49 & F321-F23 added; Flow control units updated to Crown spec. & S110 revised to orifice plate; Pond water levels revised to suit new calcs; Existing sewer in Road 19 revised; S109 & F104 revised	06.09.19	CD
F	Street lighting and plot drainage added	25.06.19	CD
E	Gradients of SW network 2 revised; S403, S406 & F304 removed	17.04.19	CD
D	Updated to planning layout revision 5	04.03.19	CD
C	Full drainage and level designs revised	11.02.19	CD
B	–	–	–
A	Revised from Proposed FFL dwg to Engineering Layout	–	–

BARRATT
HOMES

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Barratt Homes Manchester
(A division of BDW Trading Ltd)
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M16 9HQ
Tel: 0161 872 0161
Fax: 0161 855 2828

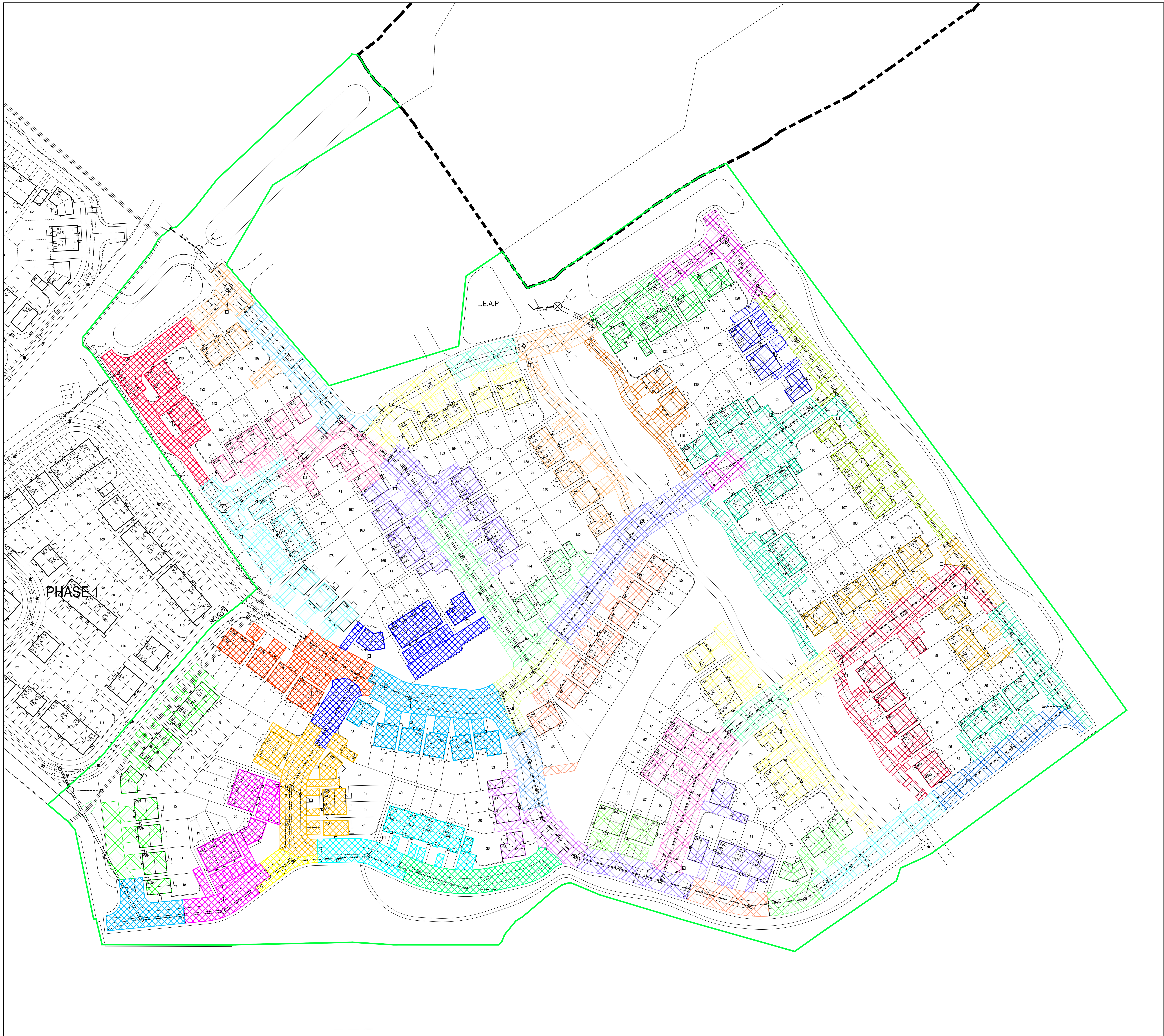
Job
Chipping Lane
Longridge
Phases 2 & 3

Title
Engineering Layout

Design By	Date	Drawing Number	Rev
FB	15.10.18	459/ED/102	G
C.A.D By	Scale @ A0		
FB	1:500		

DRAINAGE LAYOUT

SW Impermeable Areas Layout



	Inc. 10% Urban Creep
1−1.000 = 0.075 Ha	1−1.000 = 0.083 Ha
1−1.001 = 0.081 Ha	1−1.001 = 0.089 Ha
1−1.002 = 0.091 Ha	1−1.002 = 0.100 Ha
1−1.003 = 0.013 Ha	1−1.003 = 0.014 Ha
1−1.004 = 0.084 Ha	1−1.004 = 0.092 Ha
1−1.005 = 0.031 Ha	1−1.005 = 0.034 Ha
1−1.006 = 0.098 Ha	1−1.006 = 0.108 Ha
1−2.000 = 0.110 Ha	1−2.000 = 0.121 Ha
1−3.000 = 0.049 Ha	1−3.000 = 0.054 Ha
1−3.001 = 0.062 Ha	1−3.001 = 0.068 Ha
2−1.000 = 0.076 Ha	2−1.000 = 0.084 Ha
3−1.000 = 0.120 Ha	3−1.000 = 0.132 Ha
3−1.001 = 0.023 Ha	3−1.001 = 0.025 Ha
3−1.002 = 0.079 Ha	3−1.002 = 0.087 Ha
3−1.003 = 0.075 Ha	3−1.003 = 0.083 Ha
3−1.004 = 0.028 Ha	3−1.004 = 0.031 Ha
3−1.005 = 0.051 Ha	3−1.005 = 0.056 Ha
3−1.006 = 0.026 Ha	3−1.006 = 0.029 Ha
3−1.007 = 0.034 Ha	3−1.007 = 0.037 Ha
3−1.008 = 0.081 Ha	3−1.008 = 0.089 Ha
3−1.009 = 0.102 Ha	3−1.009 = 0.112 Ha
3−1.010 = 0.110 Ha	3−1.010 = 0.121 Ha
3−1.011 = 0 Ha	3−1.011 = 0 Ha
3−1.012 = 0.051 Ha	3−1.012 = 0.056 Ha
3−1.013 = 0.047 Ha	3−1.013 = 0.052 Ha
3−1.014 = 0 Ha	3−1.014 = 0 Ha
3−2.000 = 0.046 Ha	3−2.000 = 0.051 Ha
3−2.001 = 0.042 Ha	3−2.001 = 0.046 Ha
3−2.002 = 0.024 Ha	3−2.002 = 0.026 Ha
3−3.000 = 0.081 Ha	3−3.000 = 0.089 Ha
3−4.000 = 0.093 Ha	3−4.000 = 0.102 Ha
3−4.001 = 0.021 Ha	3−4.001 = 0.023 Ha
3−4.002 = 0.081 Ha	3−4.002 = 0.089 Ha
3−5.000 = 0.109 Ha	3−5.000 = 0.120 Ha
3−5.001 = 0.090 Ha	3−5.001 = 0.099 Ha
4−1.000 = 0.046 Ha	4−1.000 = 0.051 Ha
4−1.001 = 0.071 Ha	4−1.001 = 0.078 Ha
4−1.002 = 0.090 Ha	4−1.002 = 0.099 Ha
4−1.003 = 0.099 Ha	4−1.003 = 0.109 Ha
4−1.004 = 0.041 Ha	4−1.004 = 0.045 Ha
4−1.005 = 0.045 Ha	4−1.005 = 0.050 Ha
4−1.006 = 0.068 Ha	4−1.006 = 0.075 Ha
4−1.007 = 0.046 Ha	4−1.007 = 0.051 Ha
4−1.008 = 0 Ha	4−1.008 = 0 Ha
4−2.000 = 0.143 Ha	4−2.000 = 0.157 Ha
4−3.000 = 0.015 Ha	4−3.000 = 0.017 Ha
4−3.001 = 0.157 Ha	4−3.001 = 0.173 Ha

WARNING TO HOUSE-PURCHASERS
Property Misdescriptions Act 1991

REV	DESCRIPTION	DATE	DRAWN

BARRATT
HOMES

MANCHESTER

Barratt Homes Manchester
(A division of BDW Trading Ltd)
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Manchester
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Tel: 0161 872 0161
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Job
Chipping Lane
Longridge
Phases 2 & 3

Title
Surface Water Drainage Areas

Design By	Date	Drawing Number	Rev
CD	April 2019	459/ED/103	-
C.A.D By: CD	Scale @ A0: 1:500		

Storm Water Network 1

STORM SEWER DESIGN

Network Design Details (1 in 2 yr) & Online Controls

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 1

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	18.800	Add Flow / Climate Change (%)	0
Ratio R	0.281	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Surface Network 1

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	39.386	0.394	100.0	0.083	5.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	20.526	1.069	19.2	0.121	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	47.242	0.304	155.4	0.089	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	26.364	0.195	135.2	0.100	0.00	0.0	0.600	o	750	Pipe/Conduit	
3.000	37.767	1.511	25.0	0.054	5.00	0.0	0.600	o	225	Pipe/Conduit	
3.001	27.458	1.016	27.0	0.068	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	29.942	0.222	134.9	0.014	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.004	33.120	0.224	147.9	0.092	0.00	0.0	0.600	o	750	Pipe/Conduit	
1.005	51.952	0.391	132.9	0.034	0.00	0.0	0.600	o	750	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.50	108.550	0.083	0.0	0.0	0.0	1.31	52.0	11.2
2.000	50.00	5.11	110.650	0.121	0.0	0.0	0.0	3.00	119.3	16.4
1.001	50.00	6.13	108.081	0.293	0.0	0.0	0.0	1.26	89.0	39.7
1.002	50.00	6.31	107.327	0.393	0.0	0.0	0.0	2.41	1062.6	53.2
3.000	50.00	5.24	111.159	0.054	0.0	0.0	0.0	2.63	104.5	7.3
3.001	50.00	5.42	109.648	0.122	0.0	0.0	0.0	2.53	100.5	16.5
1.003	49.62	6.52	107.132	0.529	0.0	0.0	0.0	2.41	1063.9	71.1
1.004	48.87	6.76	106.910	0.621	0.0	0.0	0.0	2.30	1015.8	82.2
1.005	47.82	7.11	106.686	0.655	0.0	0.0	0.0	2.43	1071.9	84.8

Network Design Table for Surface Network 1

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.006	8.610	0.035	246.0	0.108	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.006	47.50	7.23	106.295	0.763	0.0	0.0	0.0	1.29	205.4	98.2

Online Controls for Surface Network 1

Orifice Manhole: S110, DS/PN: 1.006, Volume (m^3): 30.5

Diameter (m) 0.247 Discharge Coefficient 0.600 Invert Level (m) 106.295

STORM SEWER DESIGN

SW Manhole Schedules

Manhole Schedules for Surface Network 1

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S101	110.167	1.617	Open Manhole	1350	1.000	108.550	225				
S102	112.153	1.503	Open Manhole	1500	2.000	110.650	225				
S103	111.580	3.499	Open Manhole	2100	1.001	108.081	300	1.000	108.156	225	
								2.000	109.581	225	1425
S104	110.773	3.446	Open Manhole	2400	1.002	107.327	750	1.001	107.777	300	
S105	112.584	1.425	Open Manhole	1500	3.000	111.159	225				
S106	111.630	1.982	Open Manhole	1350	3.001	109.648	225	3.000	109.648	225	
S107	111.326	4.194	Open Manhole	2400	1.003	107.132	750	1.002	107.132	750	
								3.001	108.632	225	975
S108	110.854	3.944	Open Manhole	2400	1.004	106.910	750	1.003	106.910	750	
S109	110.433	3.747	Open Manhole	2400	1.005	106.686	750	1.004	106.686	750	
S110	108.200	1.905	Open Manhole	2400	1.006	106.295	450	1.005	106.295	750	
S27	107.938	1.678	Open Manhole	1500		OUTFALL		1.006	106.260	450	

STORM SEWER DESIGN

Rainfall Simulation

1:30 year event

Simulation Criteria for Surface Network 1

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.800	Storm Duration (mins)	30
Ratio R	0.281		

Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.281
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.800	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	ON
Analysis Timestep	Fine	Inertia Status	ON
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360
Return Period(s) (years)	30
Climate Change (%)	0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S101	15 Winter	30	+0%					108.660
2.000	S102	15 Winter	30	+0%					110.737
1.001	S103	15 Winter	30	+0%					108.327
1.002	S104	15 Winter	30	+0%					107.528
3.000	S105	15 Winter	30	+0%					111.218
3.001	S106	15 Winter	30	+0%					109.745
1.003	S107	30 Winter	30	+0%					107.452
1.004	S108	30 Winter	30	+0%					107.418
1.005	S109	30 Winter	30	+0%					107.361
1.006	S110	30 Winter	30	+0%	30/15 Summer				107.223

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S101	-0.115	0.000	0.47		23.1	OK	
2.000	S102	-0.138	0.000	0.32		34.3	OK	
1.001	S103	-0.054	0.000	1.00		83.4	OK	
1.002	S104	-0.549	0.000	0.16		109.9	OK	
3.000	S105	-0.166	0.000	0.15		15.3	OK	
3.001	S106	-0.128	0.000	0.38		35.8	OK	

Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.003	S107	-0.430	0.000	0.17		122.0	OK	
1.004	S108	-0.242	0.000	0.17		126.3	OK	
1.005	S109	-0.075	0.000	0.11		96.3	OK	
1.006	S110	0.478	0.000	0.69		94.5	SURCHARGED	

STORM SEWER DESIGN

Rainfall Simulation

1:30 year event with Surcharged Outfall

Surcharged Outfall Details for Surface Network 1

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.006	S27	107.938	106.260	106.260	1500	0

Datum (m) 106.723 Offset (mins) 0

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
1	1.000	42	1.000	83	1.000	124	1.000	165	1.000	206	1.000
2	1.000	43	1.000	84	1.000	125	1.000	166	1.000	207	1.000
3	1.000	44	1.000	85	1.000	126	1.000	167	1.000	208	1.000
4	1.000	45	1.000	86	1.000	127	1.000	168	1.000	209	1.000
5	1.000	46	1.000	87	1.000	128	1.000	169	1.000	210	1.000
6	1.000	47	1.000	88	1.000	129	1.000	170	1.000	211	1.000
7	1.000	48	1.000	89	1.000	130	1.000	171	1.000	212	1.000
8	1.000	49	1.000	90	1.000	131	1.000	172	1.000	213	1.000
9	1.000	50	1.000	91	1.000	132	1.000	173	1.000	214	1.000
10	1.000	51	1.000	92	1.000	133	1.000	174	1.000	215	1.000
11	1.000	52	1.000	93	1.000	134	1.000	175	1.000	216	1.000
12	1.000	53	1.000	94	1.000	135	1.000	176	1.000	217	1.000
13	1.000	54	1.000	95	1.000	136	1.000	177	1.000	218	1.000
14	1.000	55	1.000	96	1.000	137	1.000	178	1.000	219	1.000
15	1.000	56	1.000	97	1.000	138	1.000	179	1.000	220	1.000
16	1.000	57	1.000	98	1.000	139	1.000	180	1.000	221	1.000
17	1.000	58	1.000	99	1.000	140	1.000	181	1.000	222	1.000
18	1.000	59	1.000	100	1.000	141	1.000	182	1.000	223	1.000
19	1.000	60	1.000	101	1.000	142	1.000	183	1.000	224	1.000
20	1.000	61	1.000	102	1.000	143	1.000	184	1.000	225	1.000
21	1.000	62	1.000	103	1.000	144	1.000	185	1.000	226	1.000
22	1.000	63	1.000	104	1.000	145	1.000	186	1.000	227	1.000
23	1.000	64	1.000	105	1.000	146	1.000	187	1.000	228	1.000
24	1.000	65	1.000	106	1.000	147	1.000	188	1.000	229	1.000
25	1.000	66	1.000	107	1.000	148	1.000	189	1.000	230	1.000
26	1.000	67	1.000	108	1.000	149	1.000	190	1.000	231	1.000
27	1.000	68	1.000	109	1.000	150	1.000	191	1.000	232	1.000
28	1.000	69	1.000	110	1.000	151	1.000	192	1.000	233	1.000
29	1.000	70	1.000	111	1.000	152	1.000	193	1.000	234	1.000
30	1.000	71	1.000	112	1.000	153	1.000	194	1.000	235	1.000
31	1.000	72	1.000	113	1.000	154	1.000	195	1.000	236	1.000
32	1.000	73	1.000	114	1.000	155	1.000	196	1.000	237	1.000
33	1.000	74	1.000	115	1.000	156	1.000	197	1.000	238	1.000
34	1.000	75	1.000	116	1.000	157	1.000	198	1.000	239	1.000
35	1.000	76	1.000	117	1.000	158	1.000	199	1.000	240	1.000
36	1.000	77	1.000	118	1.000	159	1.000	200	1.000	241	1.000
37	1.000	78	1.000	119	1.000	160	1.000	201	1.000	242	1.000
38	1.000	79	1.000	120	1.000	161	1.000	202	1.000	243	1.000
39	1.000	80	1.000	121	1.000	162	1.000	203	1.000	244	1.000
40	1.000	81	1.000	122	1.000	163	1.000	204	1.000	245	1.000
41	1.000	82	1.000	123	1.000	164	1.000	205	1.000	246	1.000

Surcharged Outfall Details for Surface Network 1

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
247	1.000	266	1.000	285	1.000	304	1.000	323	1.000	342	1.000
248	1.000	267	1.000	286	1.000	305	1.000	324	1.000	343	1.000
249	1.000	268	1.000	287	1.000	306	1.000	325	1.000	344	1.000
250	1.000	269	1.000	288	1.000	307	1.000	326	1.000	345	1.000
251	1.000	270	1.000	289	1.000	308	1.000	327	1.000	346	1.000
252	1.000	271	1.000	290	1.000	309	1.000	328	1.000	347	1.000
253	1.000	272	1.000	291	1.000	310	1.000	329	1.000	348	1.000
254	1.000	273	1.000	292	1.000	311	1.000	330	1.000	349	1.000
255	1.000	274	1.000	293	1.000	312	1.000	331	1.000	350	1.000
256	1.000	275	1.000	294	1.000	313	1.000	332	1.000	351	1.000
257	1.000	276	1.000	295	1.000	314	1.000	333	1.000	352	1.000
258	1.000	277	1.000	296	1.000	315	1.000	334	1.000	353	1.000
259	1.000	278	1.000	297	1.000	316	1.000	335	1.000	354	1.000
260	1.000	279	1.000	298	1.000	317	1.000	336	1.000	355	1.000
261	1.000	280	1.000	299	1.000	318	1.000	337	1.000	356	1.000
262	1.000	281	1.000	300	1.000	319	1.000	338	1.000	357	1.000
263	1.000	282	1.000	301	1.000	320	1.000	339	1.000	358	1.000
264	1.000	283	1.000	302	1.000	321	1.000	340	1.000	359	1.000
265	1.000	284	1.000	303	1.000	322	1.000	341	1.000	360	1.000

Simulation Criteria for Surface Network 1

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.800	Storm Duration (mins)	30
Ratio R	0.281		

Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

Simulation Criteria

Areal Reduction Factor 1.000
Hot Start (mins) 0
Hot Start Level (mm) 0
Manhole Headloss Coeff (Global) 0.500
Foul Sewage per hectare (l/s) 0.000
Additional Flow - % of Total Flow 0.000
MADD Factor * 10m³/ha Storage 2.000
Inlet Coeffiecient 0.800
Flow per Person per Day (l/per/day) 0.000

Number of Input Hydrographs 0
Number of Online Controls 1
Number of Offline Controls 0
Number of Storage Structures 0
Number of Time/Area Diagrams 0
Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR
Region England and Wales
M5-60 (mm) 18.800
Ratio R 0.281
Cv (Summer) 0.750
Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep Fine
DTS Status ON
DVD Status ON
Inertia Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360
Return Period(s) (years) 30
Climate Change (%) 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S101	15 Winter	30	+0%					108.660
2.000	S102	15 Winter	30	+0%					110.737
1.001	S103	60 Winter	30	+0%	30/60 Summer				108.563
1.002	S104	60 Winter	30	+0%	30/30 Summer				108.490
3.000	S105	15 Winter	30	+0%					111.218
3.001	S106	15 Winter	30	+0%					109.745
1.003	S107	60 Winter	30	+0%	30/15 Winter				108.486
1.004	S108	60 Winter	30	+0%	30/15 Summer				108.460
1.005	S109	60 Winter	30	+0%	30/15 Summer				108.333
1.006	S110	60 Winter	30	+0%	30/15 Summer				108.138

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S101	-0.115	0.000	0.47		23.1	OK	
2.000	S102	-0.138	0.000	0.32		34.3	OK	
1.001	S103	0.182	0.000	0.56		47.1	SURCHARGED	
1.002	S104	0.413	0.000	0.07		48.1	SURCHARGED	
3.000	S105	-0.166	0.000	0.15		15.3	OK	
3.001	S106	-0.128	0.000	0.38		35.8	OK	

Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.003	S107	0.604	0.000	0.08		58.3	SURCHARGED	
1.004	S108	0.800	0.000	0.09		66.4	SURCHARGED	
1.005	S109	0.897	0.000	0.08		68.7	SURCHARGED	
1.006	S110	1.393	0.000	0.59		80.6	FLOOD RISK	

STORM SEWER DESIGN

Rainfall Simulation

1:100 year event +30% Climate Change

Simulation Criteria for Surface Network 1

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.800	Storm Duration (mins)	30
Ratio R	0.281		

Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	0
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.281
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.800	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	ON
Analysis Timestep	Fine	Inertia Status	ON
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360
Return Period(s) (years)	100
Climate Change (%)	30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S101	15 Winter	100	+30%	100/15 Summer				109.011
2.000	S102	15 Winter	100	+30%					110.768
1.001	S103	15 Winter	100	+30%	100/15 Summer				108.789
1.002	S104	30 Winter	100	+30%	100/15 Winter				108.494
3.000	S105	15 Winter	100	+30%					111.237
3.001	S106	15 Winter	100	+30%					109.780
1.003	S107	30 Winter	100	+30%	100/15 Summer				108.484
1.004	S108	30 Winter	100	+30%	100/15 Summer				108.449
1.005	S109	30 Winter	100	+30%	100/15 Summer				108.355
1.006	S110	30 Winter	100	+30%	100/15 Summer				108.156

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S101	0.236	0.000	0.75		36.9	SURCHARGED	
2.000	S102	-0.107	0.000	0.53		57.6	OK	
1.001	S103	0.408	0.000	1.52		127.0	SURCHARGED	
1.002	S104	0.417	0.000	0.19		134.2	SURCHARGED	
3.000	S105	-0.147	0.000	0.26		25.7	OK	
3.001	S106	-0.093	0.000	0.64		60.0	OK	

Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.003	S107	0.602	0.000	0.22		161.8	SURCHARGED	
1.004	S108	0.789	0.000	0.20		150.8	SURCHARGED	
1.005	S109	0.919	0.000	0.15		137.8	SURCHARGED	
1.006	S110	1.411	0.000	1.12		153.6	FLOOD RISK	

Storm Water Network 2

STORM SEWER DESIGN

Network Design Details (1 in 2 yr)

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 2

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	18.800	Add Flow / Climate Change (%)	0
Ratio R	0.281	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Surface Network 2

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	25.065	0.135	185.7	0.084	5.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.31	105.375	0.084	0.0	0.0	0.0	1.33	146.5	11.4

STORM SEWER DESIGN

SW Manhole Schedules

Manhole Schedules for Surface Network 2

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S201	106.855	1.480	Open Manhole	2100	1.000	105.375	375				
S49	106.894	1.654	Open Manhole	1350		OUTFALL		1.000	105.240	375	

Storm Water Network 3

STORM SEWER DESIGN

Network Design Details (1 in 2 yr), Online Controls & Storage Structures

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 3

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	18.800	Add Flow / Climate Change (%)	0
Ratio R	0.281	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Surface Network 3

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	18.574	0.113	164.4	0.132	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	21.020	0.127	165.5	0.025	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	38.591	0.234	164.9	0.087	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	20.496	0.637	32.2	0.051	5.00	0.0	0.600	o	225	Pipe/Conduit	
2.001	20.288	0.630	32.2	0.046	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.002	33.160	1.079	30.7	0.026	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	32.000	0.905	35.4	0.083	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.004	18.105	0.540	33.5	0.031	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.005	21.220	0.633	33.5	0.056	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.30	113.750	0.132	0.0	0.0	0.0	1.02	40.4	17.9
1.001	50.00	5.65	113.637	0.157	0.0	0.0	0.0	1.01	40.3	21.3
1.002	50.00	6.18	113.435	0.244	0.0	0.0	0.0	1.22	86.3	33.0
2.000	50.00	5.15	115.622	0.051	0.0	0.0	0.0	2.31	92.0	6.9
2.001	50.00	5.29	114.985	0.097	0.0	0.0	0.0	2.31	92.0	13.1
2.002	50.00	5.53	114.355	0.123	0.0	0.0	0.0	2.37	94.2	16.7
1.003	50.00	6.38	113.201	0.450	0.0	0.0	0.0	2.65	187.5	60.9
1.004	49.71	6.49	112.296	0.481	0.0	0.0	0.0	2.73	192.7	64.8
1.005	49.30	6.62	111.756	0.537	0.0	0.0	0.0	2.72	192.6	71.7

Network Design Table for Surface Network 3

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.006	26.149	0.972	26.9	0.029	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.007	14.101	0.463	30.5	0.037	0.00	0.0	0.600	o	450	Pipe/Conduit	
3.000	66.749	1.420	47.0	0.089	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.008	11.314	0.343	33.0	0.089	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.009	75.598	2.291	33.0	0.112	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.010	19.351	0.586	33.0	0.121	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.000	20.774	0.472	44.0	0.102	5.00	0.0	0.600	o	150	Pipe/Conduit	
4.001	31.984	0.727	44.0	0.023	0.00	0.0	0.600	o	150	Pipe/Conduit	
4.002	15.379	0.349	44.1	0.089	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.011	9.311	0.023	400.0	0.000	0.00	0.0	0.600	o	1500	Pipe/Conduit	
5.000	33.973	0.085	400.0	0.120	5.00	0.0	0.600	o	1500	Pipe/Conduit	
5.001	19.633	0.049	400.0	0.099	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.012	62.392	0.156	400.0	0.056	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.013	17.480	0.044	397.3	0.052	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.014	12.998	0.078	166.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.006	48.86	6.76	111.123	0.566	0.0	0.0	0.0	3.04	215.1	74.9
1.007	48.67	6.82	110.001	0.603	0.0	0.0	0.0	3.69	587.6	79.5
3.000	50.00	5.58	112.437	0.089	0.0	0.0	0.0	1.91	76.1	12.1
1.008	48.51	6.88	109.538	0.781	0.0	0.0	0.0	3.55	564.5	102.6
1.009	47.48	7.23	109.194	0.893	0.0	0.0	0.0	3.55	564.4	114.8
1.010	47.23	7.32	105.438	1.014	0.0	0.0	0.0	3.55	564.2	129.7
4.000	50.00	5.23	109.677	0.102	0.0	0.0	0.0	1.52	26.9	13.8
4.001	50.00	5.58	107.728	0.125	0.0	0.0	0.0	1.52	26.9	16.9
4.002	50.00	5.75	105.501	0.214	0.0	0.0	0.0	1.52	26.9«	29.0
1.011	47.03	7.40	103.802	1.228	0.0	0.0	0.0	2.14	3779.1	156.4
5.000	50.00	5.26	103.912	0.120	0.0	0.0	0.0	2.14	3779.1	16.2
5.001	50.00	5.42	103.827	0.219	0.0	0.0	0.0	2.14	3779.1	29.7
1.012	45.73	7.88	103.778	1.503	0.0	0.0	0.0	2.14	3779.1	186.2
1.013	45.39	8.02	103.622	1.555	0.0	0.0	0.0	2.15	3792.1	191.1
1.014	44.85	8.23	103.578	1.555	0.0	0.0	0.0	1.01	40.2«	191.1

Online Controls for Surface Network 3

Depth/Flow Relationship Manhole: S324, DS/PN: 1.014, Volume (m^3): 48.8

Invert Level (m) 103.578

Depth (m)	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**	**Depth (m)**	**Flow (l/s)**
0.100	7.9700	0.800	34.6400	2.000	33.5200	3.800	46.2000
0.200	17.9600	1.000	32.1700	2.200	35.1600	4.200	48.5800
0.300	26.1200	1.200	30.5300	2.400	36.7200	4.600	50.8400
0.400	31.6700	1.400	29.7200	2.600	38.2200	5.000	53.0000
0.500	34.7400	1.600	29.9800	3.000	41.0500		
0.600	35.8600	1.800	31.8000	3.400	43.7000		

Storage Structures for Surface Network 3

Tank or Pond Manhole: S324, DS/PN: 1.014

Invert Level (m) 106.350

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	451.4	0.800	1004.1

STORM SEWER DESIGN

SW Manhole Schedules

Manhole Schedules for Surface Network 3

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S301	115.811	2.061	Open Manhole	1800	1.000	113.750	225				
S302	115.507	1.870	Open Manhole	1800	1.001	113.637	225	1.000	113.637	225	
S303	115.248	1.813	Open Manhole	1800	1.002	113.435	300	1.001	113.510	225	
S304	117.047	1.425	Open Manhole	1350	2.000	115.622	225				
S305	116.571	1.586	Open Manhole	1350	2.001	114.985	225	2.000	114.985	225	
S306	115.934	1.579	Open Manhole	1350	2.002	114.355	225	2.001	114.355	225	
S307	114.902	1.701	Open Manhole	1800	1.003	113.201	300	1.002	113.201	300	
								2.002	113.276	225	
S308	113.882	1.586	Open Manhole	1350	1.004	112.296	300	1.003	112.296	300	
S309	113.493	1.737	Open Manhole	1350	1.005	111.756	300	1.004	111.756	300	
S310	113.205	2.082	Open Manhole	1350	1.006	111.123	300	1.005	111.123	300	
S311	112.851	2.850	Open Manhole	1500	1.007	110.001	450	1.006	110.151	300	
S312	113.862	1.425	Open Manhole	1500	3.000	112.437	225				
S313	113.033	3.495	Open Manhole	1800	1.008	109.538	450	1.007	109.538	450	
								3.000	111.017	225	1254
S314	112.751	3.557	Open Manhole	1800	1.009	109.194	450	1.008	109.195	450	1
S315	110.923	5.485	Open Manhole	1800	1.010	105.438	450	1.009	106.903	450	1465
S316	111.027	1.350	Open Manhole	1350	4.000	109.677	150				
S317	110.654	2.926	Open Manhole	1200	4.001	107.728	150	4.000	109.205	150	1477
S318	110.157	4.656	Open Manhole	1350	4.002	105.501	150	4.001	107.001	150	1500
S319	110.092	6.290	Open Manhole	3000	1.011	103.802	1500	1.010	104.852	450	
								4.002	105.152	150	
S320	109.196	5.284	Open Manhole	3000	5.000	103.912	1500				
S321	109.723	5.896	Open Manhole	3000	5.001	103.827	1500	5.000	103.827	1500	
S322	109.673	5.895	Open Manhole	3000	1.012	103.778	1500	1.011	103.779	1500	1
								5.001	103.778	1500	
S323	107.141	3.519	Open Manhole	3000	1.013	103.622	1500	1.012	103.622	1500	
S324	106.860	3.282	Open Manhole	3000	1.014	103.578	225	1.013	103.578	1500	
S325	103.900	0.400	Open Manhole	0		OUTFALL		1.014	103.500	225	

STORM SEWER DESIGN

Rainfall Simulation

1:30 year event

Simulation Criteria for Surface Network 3

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.800	Storm Duration (mins)	30
Ratio R	0.281		

Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 3

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.281
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360
Return Period(s) (years) 30
Climate Change (%) 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S301	15 Winter	30	+0%	30/15 Winter				113.994
1.001	S302	15 Winter	30	+0%	30/15 Summer				113.887
1.002	S303	15 Winter	30	+0%					113.640
2.000	S304	15 Winter	30	+0%					115.685
2.001	S305	15 Winter	30	+0%					115.076
2.002	S306	15 Winter	30	+0%					114.456
1.003	S307	15 Winter	30	+0%					113.390
1.004	S308	15 Winter	30	+0%					112.499
1.005	S309	15 Winter	30	+0%					111.973
1.006	S310	15 Winter	30	+0%					111.328
1.007	S311	15 Winter	30	+0%					110.207
3.000	S312	15 Winter	30	+0%					112.528
1.008	S313	15 Winter	30	+0%					109.803
1.009	S314	15 Winter	30	+0%					109.408
1.010	S315	15 Winter	30	+0%					105.699
4.000	S316	15 Winter	30	+0%	30/15 Summer				109.899
4.001	S317	15 Winter	30	+0%	30/15 Summer				108.269
4.002	S318	15 Winter	30	+0%	30/15 Summer				106.878
1.011	S319	120 Winter	30	+0%	30/120 Winter				105.336
5.000	S320	120 Winter	30	+0%					105.336
5.001	S321	120 Winter	30	+0%	30/120 Winter				105.336
1.012	S322	120 Winter	30	+0%	30/120 Winter				105.336

Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 3

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S301	0.019	0.000	0.97		35.2	SURCHARGED	
1.001	S302	0.025	0.000	1.11		40.8	SURCHARGED	
1.002	S303	-0.095	0.000	0.78		62.8	OK	
2.000	S304	-0.162	0.000	0.17		14.5	OK	
2.001	S305	-0.134	0.000	0.34		28.3	OK	
2.002	S306	-0.124	0.000	0.41		36.0	OK	
1.003	S307	-0.111	0.000	0.70		120.5	OK	
1.004	S308	-0.097	0.000	0.78		129.6	OK	
1.005	S309	-0.082	0.000	0.86		145.3	OK	
1.006	S310	-0.095	0.000	0.80		153.4	OK	
1.007	S311	-0.244	0.000	0.43		163.3	OK	
3.000	S312	-0.134	0.000	0.34		25.1	OK	
1.008	S313	-0.184	0.000	0.64		212.3	OK	
1.009	S314	-0.236	0.000	0.46		241.3	OK	
1.010	S315	-0.189	0.000	0.63		272.4	OK	
4.000	S316	0.072	0.000	1.07		27.1	SURCHARGED	
4.001	S317	0.391	0.000	1.24		32.0	SURCHARGED	
4.002	S318	1.227	0.000	2.11		52.3	SURCHARGED	
1.011	S319	0.034	0.000	0.10		127.4	SURCHARGED	
5.000	S320	-0.076	0.000	0.00		8.4	OK	
5.001	S321	0.009	0.000	0.01		10.7	SURCHARGED	
1.012	S322	0.058	0.000	0.03		97.0	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 3

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.013	S323	120 Winter	30	+0%	30/60 Winter				105.336
1.014	S324	120 Winter	30	+0%	30/15 Summer				105.335

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.013	S323	0.214	0.000	0.03		49.5	SURCHARGED	
1.014	S324	1.532	0.000	1.03		35.6	SURCHARGED	

STORM SEWER DESIGN

Rainfall Simulation

1:30 year event with Surcharged Outfall

Surcharged Outfall Details for Surface Network 3

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.014	S325	103.900	103.500	103.500	0	0

Datum (m) 103.400 Offset (mins) 0

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
1	1.000	42	1.000	83	1.000	124	1.000	165	1.000	206	1.000
2	1.000	43	1.000	84	1.000	125	1.000	166	1.000	207	1.000
3	1.000	44	1.000	85	1.000	126	1.000	167	1.000	208	1.000
4	1.000	45	1.000	86	1.000	127	1.000	168	1.000	209	1.000
5	1.000	46	1.000	87	1.000	128	1.000	169	1.000	210	1.000
6	1.000	47	1.000	88	1.000	129	1.000	170	1.000	211	1.000
7	1.000	48	1.000	89	1.000	130	1.000	171	1.000	212	1.000
8	1.000	49	1.000	90	1.000	131	1.000	172	1.000	213	1.000
9	1.000	50	1.000	91	1.000	132	1.000	173	1.000	214	1.000
10	1.000	51	1.000	92	1.000	133	1.000	174	1.000	215	1.000
11	1.000	52	1.000	93	1.000	134	1.000	175	1.000	216	1.000
12	1.000	53	1.000	94	1.000	135	1.000	176	1.000	217	1.000
13	1.000	54	1.000	95	1.000	136	1.000	177	1.000	218	1.000
14	1.000	55	1.000	96	1.000	137	1.000	178	1.000	219	1.000
15	1.000	56	1.000	97	1.000	138	1.000	179	1.000	220	1.000
16	1.000	57	1.000	98	1.000	139	1.000	180	1.000	221	1.000
17	1.000	58	1.000	99	1.000	140	1.000	181	1.000	222	1.000
18	1.000	59	1.000	100	1.000	141	1.000	182	1.000	223	1.000
19	1.000	60	1.000	101	1.000	142	1.000	183	1.000	224	1.000
20	1.000	61	1.000	102	1.000	143	1.000	184	1.000	225	1.000
21	1.000	62	1.000	103	1.000	144	1.000	185	1.000	226	1.000
22	1.000	63	1.000	104	1.000	145	1.000	186	1.000	227	1.000
23	1.000	64	1.000	105	1.000	146	1.000	187	1.000	228	1.000
24	1.000	65	1.000	106	1.000	147	1.000	188	1.000	229	1.000
25	1.000	66	1.000	107	1.000	148	1.000	189	1.000	230	1.000
26	1.000	67	1.000	108	1.000	149	1.000	190	1.000	231	1.000
27	1.000	68	1.000	109	1.000	150	1.000	191	1.000	232	1.000
28	1.000	69	1.000	110	1.000	151	1.000	192	1.000	233	1.000
29	1.000	70	1.000	111	1.000	152	1.000	193	1.000	234	1.000
30	1.000	71	1.000	112	1.000	153	1.000	194	1.000	235	1.000
31	1.000	72	1.000	113	1.000	154	1.000	195	1.000	236	1.000
32	1.000	73	1.000	114	1.000	155	1.000	196	1.000	237	1.000
33	1.000	74	1.000	115	1.000	156	1.000	197	1.000	238	1.000
34	1.000	75	1.000	116	1.000	157	1.000	198	1.000	239	1.000
35	1.000	76	1.000	117	1.000	158	1.000	199	1.000	240	1.000
36	1.000	77	1.000	118	1.000	159	1.000	200	1.000	241	1.000
37	1.000	78	1.000	119	1.000	160	1.000	201	1.000	242	1.000
38	1.000	79	1.000	120	1.000	161	1.000	202	1.000	243	1.000
39	1.000	80	1.000	121	1.000	162	1.000	203	1.000	244	1.000
40	1.000	81	1.000	122	1.000	163	1.000	204	1.000	245	1.000
41	1.000	82	1.000	123	1.000	164	1.000	205	1.000	246	1.000

Surcharged Outfall Details for Surface Network 3

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
247	1.000	266	1.000	285	1.000	304	1.000	323	1.000	342	1.000
248	1.000	267	1.000	286	1.000	305	1.000	324	1.000	343	1.000
249	1.000	268	1.000	287	1.000	306	1.000	325	1.000	344	1.000
250	1.000	269	1.000	288	1.000	307	1.000	326	1.000	345	1.000
251	1.000	270	1.000	289	1.000	308	1.000	327	1.000	346	1.000
252	1.000	271	1.000	290	1.000	309	1.000	328	1.000	347	1.000
253	1.000	272	1.000	291	1.000	310	1.000	329	1.000	348	1.000
254	1.000	273	1.000	292	1.000	311	1.000	330	1.000	349	1.000
255	1.000	274	1.000	293	1.000	312	1.000	331	1.000	350	1.000
256	1.000	275	1.000	294	1.000	313	1.000	332	1.000	351	1.000
257	1.000	276	1.000	295	1.000	314	1.000	333	1.000	352	1.000
258	1.000	277	1.000	296	1.000	315	1.000	334	1.000	353	1.000
259	1.000	278	1.000	297	1.000	316	1.000	335	1.000	354	1.000
260	1.000	279	1.000	298	1.000	317	1.000	336	1.000	355	1.000
261	1.000	280	1.000	299	1.000	318	1.000	337	1.000	356	1.000
262	1.000	281	1.000	300	1.000	319	1.000	338	1.000	357	1.000
263	1.000	282	1.000	301	1.000	320	1.000	339	1.000	358	1.000
264	1.000	283	1.000	302	1.000	321	1.000	340	1.000	359	1.000
265	1.000	284	1.000	303	1.000	322	1.000	341	1.000	360	1.000

Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 3

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.281
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360
Return Period(s) (years) 30
Climate Change (%) 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S301	15 Winter	30	+0%	30/15 Winter				113.994
1.001	S302	15 Winter	30	+0%	30/15 Summer				113.887
1.002	S303	15 Winter	30	+0%					113.640
2.000	S304	15 Winter	30	+0%					115.685
2.001	S305	15 Winter	30	+0%					115.076
2.002	S306	15 Winter	30	+0%					114.456
1.003	S307	15 Winter	30	+0%					113.390
1.004	S308	15 Winter	30	+0%					112.499
1.005	S309	15 Winter	30	+0%					111.973
1.006	S310	15 Winter	30	+0%					111.328
1.007	S311	15 Winter	30	+0%					110.207
3.000	S312	15 Winter	30	+0%					112.528
1.008	S313	15 Winter	30	+0%					109.803
1.009	S314	15 Winter	30	+0%					109.408
1.010	S315	180 Winter	30	+0%	30/120 Winter				106.491
4.000	S316	15 Winter	30	+0%	30/15 Summer				109.899
4.001	S317	15 Winter	30	+0%	30/15 Summer				108.269
4.002	S318	15 Winter	30	+0%	30/15 Summer				106.878
1.011	S319	240 Winter	30	+0%	30/60 Winter				106.401
5.000	S320	240 Winter	30	+0%	30/60 Winter				106.401
5.001	S321	240 Winter	30	+0%	30/60 Winter				106.401
1.012	S322	240 Winter	30	+0%	30/60 Winter				106.401

Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 3

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S301	0.019	0.000	0.97		35.2	SURCHARGED	
1.001	S302	0.025	0.000	1.11		40.8	SURCHARGED	
1.002	S303	-0.095	0.000	0.78		62.8	OK	
2.000	S304	-0.162	0.000	0.17		14.5	OK	
2.001	S305	-0.134	0.000	0.34		28.3	OK	
2.002	S306	-0.124	0.000	0.41		36.0	OK	
1.003	S307	-0.111	0.000	0.70		120.5	OK	
1.004	S308	-0.097	0.000	0.78		129.6	OK	
1.005	S309	-0.082	0.000	0.86		145.3	OK	
1.006	S310	-0.095	0.000	0.80		153.4	OK	
1.007	S311	-0.244	0.000	0.43		163.3	OK	
3.000	S312	-0.134	0.000	0.34		25.1	OK	
1.008	S313	-0.184	0.000	0.64		212.3	OK	
1.009	S314	-0.236	0.000	0.46		241.3	OK	
1.010	S315	0.603	0.000	0.19		83.7	SURCHARGED	
4.000	S316	0.072	0.000	1.07		27.1	SURCHARGED	
4.001	S317	0.391	0.000	1.24		32.0	SURCHARGED	
4.002	S318	1.227	0.000	2.11		52.3	SURCHARGED	
1.011	S319	1.099	0.000	0.06		79.4	SURCHARGED	
5.000	S320	0.989	0.000	0.00		5.3	SURCHARGED	
5.001	S321	1.074	0.000	0.01		14.1	SURCHARGED	
1.012	S322	1.123	0.000	0.03		74.7	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 3

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.013	S323	240 Winter	30	+0%	30/60 Winter				106.401
1.014	S324	240 Winter	30	+0%	30/15 Summer				106.400

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.013	S323	1.279	0.000	0.03		62.9	SURCHARGED	
1.014	S324	2.597	0.000	1.03		35.8	SURCHARGED	

STORM SEWER DESIGN

Rainfall Simulation

1:100 year event +30% Climate Change

Simulation Criteria for Surface Network 3

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.800	Storm Duration (mins)	30
Ratio R	0.281		

Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 3

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.281
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360
Return Period(s) (years) 100
Climate Change (%) 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S301	15 Winter	100	+30%	100/15 Summer				114.562
1.001	S302	15 Winter	100	+30%	100/15 Summer				114.345
1.002	S303	15 Winter	100	+30%	100/15 Summer				114.045
2.000	S304	15 Winter	100	+30%					115.705
2.001	S305	15 Winter	100	+30%					115.108
2.002	S306	15 Winter	100	+30%					114.493
1.003	S307	15 Winter	100	+30%	100/15 Summer				113.779
1.004	S308	15 Winter	100	+30%	100/15 Summer				112.923
1.005	S309	15 Winter	100	+30%	100/15 Summer				112.322
1.006	S310	15 Winter	100	+30%	100/15 Summer				111.504
1.007	S311	15 Winter	100	+30%					110.243
3.000	S312	15 Winter	100	+30%					112.560
1.008	S313	15 Winter	100	+30%					109.875
1.009	S314	15 Winter	100	+30%					109.465
1.010	S315	180 Winter	100	+30%	100/30 Summer				106.934
4.000	S316	15 Winter	100	+30%	100/15 Summer				110.691
4.001	S317	15 Winter	100	+30%	100/15 Summer				109.797
4.002	S318	15 Winter	100	+30%	100/15 Summer				108.086
1.011	S319	180 Winter	100	+30%	100/15 Winter				106.742
5.000	S320	180 Winter	100	+30%	100/15 Winter				106.741
5.001	S321	180 Winter	100	+30%	100/15 Winter				106.741
1.012	S322	180 Winter	100	+30%	100/15 Winter				106.741

Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 3

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S301	0.587	0.000	1.42		51.5	SURCHARGED	
1.001	S302	0.483	0.000	1.63		59.9	SURCHARGED	
1.002	S303	0.310	0.000	1.10		87.7	SURCHARGED	
2.000	S304	-0.142	0.000	0.29		24.3	OK	
2.001	S305	-0.102	0.000	0.57		47.4	OK	
2.002	S306	-0.087	0.000	0.68		60.4	OK	
1.003	S307	0.278	0.000	0.97		165.3	SURCHARGED	
1.004	S308	0.327	0.000	1.05		174.2	SURCHARGED	
1.005	S309	0.267	0.000	1.14		191.8	SURCHARGED	
1.006	S310	0.082	0.000	1.05		201.6	SURCHARGED	
1.007	S311	-0.207	0.000	0.56		215.4	OK	
3.000	S312	-0.102	0.000	0.57		42.1	OK	
1.008	S313	-0.113	0.000	0.90		297.4	OK	
1.009	S314	-0.179	0.000	0.66		350.3	OK	
1.010	S315	1.046	0.000	0.32		138.7	SURCHARGED	
4.000	S316	0.864	0.000	1.52		38.5	SURCHARGED	
4.001	S317	1.919	0.000	1.66		42.8	SURCHARGED	
4.002	S318	2.435	0.000	2.81		69.7	SURCHARGED	
1.011	S319	1.440	0.000	0.12		160.8	SURCHARGED	
5.000	S320	1.329	0.000	0.01		14.2	SURCHARGED	
5.001	S321	1.414	0.000	0.01		23.3	SURCHARGED	
1.012	S322	1.464	0.000	0.07		188.5	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 3

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.013	S323	180 Winter	100	+30%	100/15 Summer				106.740
1.014	S324	180 Winter	100	+30%	100/15 Summer				106.739

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.013	S323	1.618	0.000	0.10		193.6	SURCHARGED	
1.014	S324	2.936	0.000	1.20		41.8	FLOOD RISK	

Storm Water Network 4

STORM SEWER DESIGN

Network Design Details (1 in 2 yr), Online Controls & Storage Structures

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 4

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	18.800	Add Flow / Climate Change (%)	0
Ratio R	0.281	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Surface Network 4

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	44.626	0.915	48.8	0.051	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	62.713	1.492	42.0	0.078	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	55.083	0.334	164.9	0.157	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	78.483	2.116	37.1	0.099	0.00	0.0	0.600	o	375	Pipe/Conduit	
3.000	21.967	0.295	74.5	0.017	5.00	0.0	0.600	o	225	Pipe/Conduit	
3.001	23.540	0.316	74.5	0.173	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	46.945	2.235	21.0	0.109	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.40	116.777	0.051	0.0	0.0	0.0	1.88	74.7	6.9
1.001	50.00	5.91	115.862	0.129	0.0	0.0	0.0	2.02	80.5	17.5
2.000	50.00	5.90	114.704	0.157	0.0	0.0	0.0	1.02	40.4	21.3
1.002	50.00	6.35	114.220	0.385	0.0	0.0	0.0	2.98	329.5	52.1
3.000	50.00	5.24	112.865	0.017	0.0	0.0	0.0	1.52	60.3	2.3
3.001	50.00	5.50	112.570	0.190	0.0	0.0	0.0	1.52	60.3	25.7
1.003	49.52	6.55	112.104	0.684	0.0	0.0	0.0	3.97	438.3	91.7

Network Design Table for Surface Network 4

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.004	20.767	0.052	399.4	0.045	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.005	31.022	0.078	397.7	0.050	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.006	25.220	0.063	400.3	0.075	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.007	14.107	0.035	403.1	0.051	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.008	7.765	0.047	165.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.004	48.47	6.89	109.794	0.729	0.0	0.0	0.0	1.01	160.8	95.7
1.005	47.77	7.13	108.692	0.779	0.0	0.0	0.0	2.14	3790.0	100.8
1.006	47.22	7.33	108.614	0.854	0.0	0.0	0.0	2.14	3777.6	109.2
1.007	46.91	7.44	108.551	0.905	0.0	0.0	0.0	2.13	3764.7	115.0
1.008	46.56	7.57	108.516	0.905	0.0	0.0	0.0	1.01	40.3«	115.0

Online Controls for Surface Network 4

Depth/Flow Relationship Manhole: S414, DS/PN: 1.008, Volume (m³): 38.0

Invert Level (m) 108.516

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.3600	0.800	20.7500	2.000	23.3300	3.200	29.5100
0.200	13.6600	1.000	19.4100	2.200	24.4700	3.400	30.4200
0.300	18.9100	1.200	18.8000	2.400	25.5600	3.600	31.3000
0.400	21.8000	1.400	19.5200	2.600	26.6000	3.800	32.1600
0.500	22.7900	1.600	20.8700	2.800	27.6000		
0.600	22.5500	1.800	22.1300	3.000	28.5700		

Storage Structures for Surface Network 4

Tank or Pond Manhole: S414, DS/PN: 1.008

Invert Level (m) 110.850

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	586.3	0.500	777.8

STORM SEWER DESIGN

SW Manhole Schedules

Manhole Schedules for Surface Network 4

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S401	118.202	1.425	Open Manhole	1350	1.000	116.777	225				
S402	118.769	2.907	Open Manhole	1500	1.001	115.862	225	1.000	115.862	225	
S404	116.129	1.425	Open Manhole	1350	2.000	114.704	225				
S405	116.593	2.373	Open Manhole	1800	1.002	114.220	375	1.001	114.370	225	
								2.000	114.370	225	
S407	114.290	1.425	Open Manhole	1350	3.000	112.865	225				
S408	114.145	1.575	Open Manhole	1350	3.001	112.570	225	3.000	112.570	225	
S409	113.875	1.771	Open Manhole	1800	1.003	112.104	375	1.002	112.104	375	
								3.001	112.254	225	
S410	112.253	2.459	Open Manhole	1500	1.004	109.794	450	1.003	109.869	375	
S411	111.534	2.842	Open Manhole	3000	1.005	108.692	1500	1.004	109.742	450	
S412	111.708	3.094	Open Manhole	3000	1.006	108.614	1500	1.005	108.614	1500	
S413	111.426	2.875	Open Manhole	3000	1.007	108.551	1500	1.006	108.551	1500	
S414	111.120	2.604	Open Manhole	3000	1.008	108.516	225	1.007	108.516	1500	
S415	108.700	0.231	Open Manhole	0		OUTFALL		1.008	108.469	225	

STORM SEWER DESIGN

Rainfall Simulation

1:30 year event

Simulation Criteria for Surface Network 4

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.800	Storm Duration (mins)	30
Ratio R	0.281		

Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 4

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.281
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360
Return Period(s) (years) 30
Climate Change (%) 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S401	15 Winter	30	+0%					116.846
1.001	S402	15 Winter	30	+0%					115.973
2.000	S404	15 Winter	30	+0%	30/15 Summer				114.985
1.002	S405	15 Winter	30	+0%					114.371
3.000	S407	15 Winter	30	+0%					112.910
3.001	S408	15 Winter	30	+0%					112.780
1.003	S409	15 Winter	30	+0%					112.287
1.004	S410	15 Winter	30	+0%	30/15 Summer				110.304
1.005	S411	120 Winter	30	+0%	30/120 Winter				110.244
1.006	S412	120 Winter	30	+0%	30/60 Winter				110.244
1.007	S413	120 Winter	30	+0%	30/60 Winter				110.244
1.008	S414	120 Winter	30	+0%	30/15 Summer				110.243

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S401	-0.156	0.000	0.20		14.2	OK	
1.001	S402	-0.114	0.000	0.48		37.1	OK	
2.000	S404	0.056	0.000	1.10		42.6	SURCHARGED	
1.002	S405	-0.224	0.000	0.33		104.8	OK	

Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 4

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
3.000	S407	-0.180	0.000	0.09		4.8	OK	
3.001	S408	-0.015	0.000	1.00		55.3	OK	
1.003	S409	-0.192	0.000	0.47		189.5	OK	
1.004	S410	0.060	0.000	1.56		203.7	SURCHARGED	
1.005	S411	0.052	0.000	0.03		78.6	SURCHARGED	
1.006	S412	0.130	0.000	0.02		54.8	SURCHARGED	
1.007	S413	0.193	0.000	0.02		34.9	SURCHARGED	
1.008	S414	1.502	0.000	0.74		22.7	SURCHARGED	

STORM SEWER DESIGN

Rainfall Simulation

1:30 year event with Surcharged Outfall

Surcharged Outfall Details for Surface Network 4

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.008	S415	108.700	108.469	0.000	0	0

Datum (m) 108.370 Offset (mins) 0

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
1	1.000	42	1.000	83	1.000	124	1.000	165	1.000	206	1.000
2	1.000	43	1.000	84	1.000	125	1.000	166	1.000	207	1.000
3	1.000	44	1.000	85	1.000	126	1.000	167	1.000	208	1.000
4	1.000	45	1.000	86	1.000	127	1.000	168	1.000	209	1.000
5	1.000	46	1.000	87	1.000	128	1.000	169	1.000	210	1.000
6	1.000	47	1.000	88	1.000	129	1.000	170	1.000	211	1.000
7	1.000	48	1.000	89	1.000	130	1.000	171	1.000	212	1.000
8	1.000	49	1.000	90	1.000	131	1.000	172	1.000	213	1.000
9	1.000	50	1.000	91	1.000	132	1.000	173	1.000	214	1.000
10	1.000	51	1.000	92	1.000	133	1.000	174	1.000	215	1.000
11	1.000	52	1.000	93	1.000	134	1.000	175	1.000	216	1.000
12	1.000	53	1.000	94	1.000	135	1.000	176	1.000	217	1.000
13	1.000	54	1.000	95	1.000	136	1.000	177	1.000	218	1.000
14	1.000	55	1.000	96	1.000	137	1.000	178	1.000	219	1.000
15	1.000	56	1.000	97	1.000	138	1.000	179	1.000	220	1.000
16	1.000	57	1.000	98	1.000	139	1.000	180	1.000	221	1.000
17	1.000	58	1.000	99	1.000	140	1.000	181	1.000	222	1.000
18	1.000	59	1.000	100	1.000	141	1.000	182	1.000	223	1.000
19	1.000	60	1.000	101	1.000	142	1.000	183	1.000	224	1.000
20	1.000	61	1.000	102	1.000	143	1.000	184	1.000	225	1.000
21	1.000	62	1.000	103	1.000	144	1.000	185	1.000	226	1.000
22	1.000	63	1.000	104	1.000	145	1.000	186	1.000	227	1.000
23	1.000	64	1.000	105	1.000	146	1.000	187	1.000	228	1.000
24	1.000	65	1.000	106	1.000	147	1.000	188	1.000	229	1.000
25	1.000	66	1.000	107	1.000	148	1.000	189	1.000	230	1.000
26	1.000	67	1.000	108	1.000	149	1.000	190	1.000	231	1.000
27	1.000	68	1.000	109	1.000	150	1.000	191	1.000	232	1.000
28	1.000	69	1.000	110	1.000	151	1.000	192	1.000	233	1.000
29	1.000	70	1.000	111	1.000	152	1.000	193	1.000	234	1.000
30	1.000	71	1.000	112	1.000	153	1.000	194	1.000	235	1.000
31	1.000	72	1.000	113	1.000	154	1.000	195	1.000	236	1.000
32	1.000	73	1.000	114	1.000	155	1.000	196	1.000	237	1.000
33	1.000	74	1.000	115	1.000	156	1.000	197	1.000	238	1.000
34	1.000	75	1.000	116	1.000	157	1.000	198	1.000	239	1.000
35	1.000	76	1.000	117	1.000	158	1.000	199	1.000	240	1.000
36	1.000	77	1.000	118	1.000	159	1.000	200	1.000	241	1.000
37	1.000	78	1.000	119	1.000	160	1.000	201	1.000	242	1.000
38	1.000	79	1.000	120	1.000	161	1.000	202	1.000	243	1.000
39	1.000	80	1.000	121	1.000	162	1.000	203	1.000	244	1.000
40	1.000	81	1.000	122	1.000	163	1.000	204	1.000	245	1.000
41	1.000	82	1.000	123	1.000	164	1.000	205	1.000	246	1.000

Surcharged Outfall Details for Surface Network 4

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
247	1.000	266	1.000	285	1.000	304	1.000	323	1.000	342	1.000
248	1.000	267	1.000	286	1.000	305	1.000	324	1.000	343	1.000
249	1.000	268	1.000	287	1.000	306	1.000	325	1.000	344	1.000
250	1.000	269	1.000	288	1.000	307	1.000	326	1.000	345	1.000
251	1.000	270	1.000	289	1.000	308	1.000	327	1.000	346	1.000
252	1.000	271	1.000	290	1.000	309	1.000	328	1.000	347	1.000
253	1.000	272	1.000	291	1.000	310	1.000	329	1.000	348	1.000
254	1.000	273	1.000	292	1.000	311	1.000	330	1.000	349	1.000
255	1.000	274	1.000	293	1.000	312	1.000	331	1.000	350	1.000
256	1.000	275	1.000	294	1.000	313	1.000	332	1.000	351	1.000
257	1.000	276	1.000	295	1.000	314	1.000	333	1.000	352	1.000
258	1.000	277	1.000	296	1.000	315	1.000	334	1.000	353	1.000
259	1.000	278	1.000	297	1.000	316	1.000	335	1.000	354	1.000
260	1.000	279	1.000	298	1.000	317	1.000	336	1.000	355	1.000
261	1.000	280	1.000	299	1.000	318	1.000	337	1.000	356	1.000
262	1.000	281	1.000	300	1.000	319	1.000	338	1.000	357	1.000
263	1.000	282	1.000	301	1.000	320	1.000	339	1.000	358	1.000
264	1.000	283	1.000	302	1.000	321	1.000	340	1.000	359	1.000
265	1.000	284	1.000	303	1.000	322	1.000	341	1.000	360	1.000

Simulation Criteria for Surface Network 4

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.800	Storm Duration (mins)	30
Ratio R	0.281		

Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 4

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.281
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360
Return Period(s) (years) 30
Climate Change (%) 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S401	15 Winter	30	+0%					116.846
1.001	S402	15 Winter	30	+0%					115.973
2.000	S404	15 Winter	30	+0%	30/15 Summer				114.985
1.002	S405	15 Winter	30	+0%					114.371
3.000	S407	15 Winter	30	+0%					112.910
3.001	S408	15 Winter	30	+0%					112.780
1.003	S409	15 Winter	30	+0%					112.287
1.004	S410	180 Winter	30	+0%	30/15 Summer				110.901
1.005	S411	180 Winter	30	+0%	30/60 Winter				110.894
1.006	S412	180 Winter	30	+0%	30/60 Summer				110.894
1.007	S413	180 Winter	30	+0%	30/60 Summer				110.893
1.008	S414	180 Winter	30	+0%	30/15 Summer				110.893

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S401	-0.156	0.000	0.20		14.2	OK	
1.001	S402	-0.114	0.000	0.48		37.1	OK	
2.000	S404	0.056	0.000	1.10		42.6	SURCHARGED	
1.002	S405	-0.224	0.000	0.33		104.8	OK	

Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 4

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
3.000	S407	-0.180	0.000	0.09		4.8	OK	
3.001	S408	-0.015	0.000	1.00		55.3	OK	
1.003	S409	-0.192	0.000	0.47		189.5	OK	
1.004	S410	0.657	0.000	0.45		59.3	SURCHARGED	
1.005	S411	0.702	0.000	0.03		61.6	SURCHARGED	
1.006	S412	0.780	0.000	0.02		51.1	SURCHARGED	
1.007	S413	0.842	0.000	0.03		50.8	SURCHARGED	
1.008	S414	2.152	0.000	0.74		22.7	FLOOD RISK	

STORM SEWER DESIGN

Rainfall Simulation

1:100 year event +30% Climate Change

Simulation Criteria for Surface Network 4

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.800	Storm Duration (mins)	30
Ratio R	0.281		

Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 4

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.281
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.800	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0	DVD Status	ON
Analysis Timestep	Fine	Inertia Status	ON
DTS Status	ON		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360
Return Period(s) (years)	100
Climate Change (%)	30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	S401	15 Winter	100	+30%					116.868
1.001	S402	15 Winter	100	+30%					116.018
2.000	S404	15 Winter	100	+30%	100/15 Summer				115.607
1.002	S405	15 Winter	100	+30%					114.419
3.000	S407	15 Winter	100	+30%	100/15 Summer				113.270
3.001	S408	15 Winter	100	+30%	100/15 Summer				113.257
1.003	S409	15 Winter	100	+30%					112.351
1.004	S410	120 Winter	100	+30%	100/15 Summer				111.080
1.005	S411	120 Winter	100	+30%	100/15 Summer				111.071
1.006	S412	120 Winter	100	+30%	100/15 Summer				111.071
1.007	S413	120 Winter	100	+30%	100/15 Summer				111.070
1.008	S414	120 Winter	100	+30%	100/15 Summer				111.070

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	S401	-0.134	0.000	0.33		23.8	OK	
1.001	S402	-0.069	0.000	0.79		61.6	OK	
2.000	S404	0.678	0.000	1.69		65.6	SURCHARGED	
1.002	S405	-0.176	0.000	0.54		167.5	OK	

Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 4

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
3.000	S407	0.180	0.000	0.21		11.4	SURCHARGED	
3.001	S408	0.462	0.000	1.56		86.3	SURCHARGED	
1.003	S409	-0.128	0.000	0.75		302.8	OK	
1.004	S410	0.836	0.000	0.97		127.0	SURCHARGED	
1.005	S411	0.879	0.000	0.06		134.8	SURCHARGED	
1.006	S412	0.957	0.000	0.07		146.7	SURCHARGED	
1.007	S413	1.019	0.000	0.10		153.9	SURCHARGED	
1.008	S414	2.329	0.000	0.86		26.3	FLOOD RISK	

Foul Water Network 1

FOUL SEWER DESIGN

Foul Design Details

FOUL SEWERAGE DESIGN

Design Criteria for Foul Network 1

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.200
Flow Per Person (l/per/day)	222.00	Maximum Backdrop Height (m)	1.500
Persons per House	3.00	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	1.00
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Foul Network 1

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	22.412	0.252	88.9	0.000	4	0.0	1.500	o	150	Pipe/Conduit	
1.001	30.458	0.459	66.3	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
1.002	6.126	0.086	71.0	0.000	4	0.0	1.500	o	150	Pipe/Conduit	
1.003	27.937	1.472	19.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
1.004	48.126	1.604	30.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
1.005	7.840	0.093	84.3	0.000	12	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	109.907	0.000	0.0	4	0.0	12	0.30	0.93	16.4	0.2
1.001	109.655	0.000	0.0	4	0.0	11	0.33	1.08	19.0	0.2
1.002	109.196	0.000	0.0	8	0.0	15	0.40	1.04	18.4	0.4
1.003	109.109	0.000	0.0	8	0.0	11	0.63	2.02	35.6	0.4
1.004	107.637	0.000	0.0	8	0.0	12	0.54	1.60	28.3	0.4
1.005	106.033	0.000	0.0	20	0.0	24	0.50	0.95	16.9	0.9

FOUL SEWER DESIGN

Foul Manhole Schedules

Manhole Schedules for Foul Network 1

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
F101	111.557	1.650	Open Manhole	1200	1.000	109.907	150				
F102	111.307	1.652	Open Manhole	1200	1.001	109.655	150	1.000	109.655	150	
F103	110.881	1.685	Open Manhole	1200	1.002	109.196	150	1.001	109.196	150	
F103A	110.783	1.674	Open Manhole	1200	1.003	109.109	150	1.002	109.109	150	
F104	110.408	2.771	Open Manhole	1350	1.004	107.637	150	1.003	107.637	150	
F105	108.250	2.217	Open Manhole	1200	1.005	106.033	150	1.004	106.033	150	
F3	107.963	2.023	Open Manhole	1350		OUTFALL		1.005	105.940	150	

Foul Water Network 2

FOUL SEWER DESIGN

Foul Design Details

FOUL SEWERAGE DESIGN

Design Criteria for Foul Network 2

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.200
Flow Per Person (l/per/day)	222.00	Maximum Backdrop Height (m)	1.500
Persons per House	3.00	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	1.00
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Foul Network 2

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	19.011	0.190	100.0	0.000	8	0.0	1.500	o	150	Pipe/Conduit	
1.001	17.079	0.127	135.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
1.002	41.497	0.384	108.1	0.000	4	0.0	1.500	o	150	Pipe/Conduit	
2.000	23.674	0.696	34.0	0.000	2	0.0	1.500	o	150	Pipe/Conduit	
2.001	30.655	1.482	20.7	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
1.003	33.461	0.903	37.1	0.000	6	0.0	1.500	o	150	Pipe/Conduit	
1.004	18.393	0.136	135.0	0.000	4	0.0	1.500	o	150	Pipe/Conduit	
1.005	19.269	0.143	134.7	0.000	3	0.0	1.500	o	150	Pipe/Conduit	
1.006	25.847	0.897	28.8	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
3.000	19.008	0.190	100.0	0.000	12	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	113.450	0.000	0.0	8	0.0	16	0.36	0.88	15.5	0.4
1.001	113.260	0.000	0.0	8	0.0	17	0.32	0.75	13.3	0.4
1.002	113.133	0.000	0.0	12	0.0	20	0.39	0.84	14.9	0.6
2.000	114.927	0.000	0.0	2	0.0	7	0.33	1.51	26.6	0.1
2.001	114.231	0.000	0.0	2	0.0	6	0.39	1.93	34.1	0.1
1.003	112.749	0.000	0.0	20	0.0	20	0.67	1.44	25.5	0.9
1.004	111.846	0.000	0.0	24	0.0	30	0.45	0.75	13.3	1.1
1.005	111.710	0.000	0.0	27	0.0	31	0.47	0.75	13.3	1.2
1.006	111.567	0.000	0.0	27	0.0	21	0.80	1.64	28.9	1.2
3.000	110.860	0.000	0.0	12	0.0	20	0.41	0.88	15.5	0.6

Network Design Table for Foul Network 2

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.007	35.335	0.262	134.9	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
1.008	21.005	1.541	13.6	0.000	6	0.0	1.500	o	150	Pipe/Conduit	
4.000	41.037	0.304	135.0	0.000	9	0.0	1.500	o	150	Pipe/Conduit	
1.009	47.405	0.627	75.6	0.000	6	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.007	110.670	0.000	0.0	39	0.0	37	0.52	0.75	13.3	1.8
1.008	110.408	0.000	0.0	45	0.0	23	1.22	2.38	42.1	2.1
4.000	109.171	0.000	0.0	9	0.0	18	0.33	0.75	13.3	0.4
1.009	108.867	0.000	0.0	60	0.0	40	0.73	1.01	17.8	2.8

FOUL SEWER DESIGN

Foul Manhole Schedules

Manhole Schedules for Foul Network 2

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
F201	115.805	2.355	Open Manhole	1200	1.000	113.450	150				
F202	115.503	2.243	Open Manhole	1200	1.001	113.260	150	1.000	113.260	150	
F203	115.282	2.149	Open Manhole	1200	1.002	113.133	150	1.001	113.133	150	
F204	116.577	1.650	Open Manhole	1200	2.000	114.927	150				
F205	115.887	1.656	Open Manhole	1200	2.001	114.231	150	2.000	114.231	150	
F206	114.945	2.196	Open Manhole	1350	1.003	112.749	150	1.002	112.749	150	
								2.001	112.749	150	
F207	113.867	2.021	Open Manhole	1200	1.004	111.846	150	1.003	111.846	150	
F208	113.506	1.796	Open Manhole	1350	1.005	111.710	150	1.004	111.710	150	
F209	113.263	1.696	Open Manhole	1200	1.006	111.567	150	1.005	111.567	150	
F210	113.044	2.184	Open Manhole	1200	3.000	110.860	150				
F211	112.803	2.133	Open Manhole	1350	1.007	110.670	150	1.006	110.670	150	
								3.000	110.670	150	
F212	112.093	1.685	Open Manhole	1200	1.008	110.408	150	1.007	110.408	150	
F213	110.821	1.650	Open Manhole	1200	4.000	109.171	150				
F214	111.454	2.587	Open Manhole	1350	1.009	108.867	150	1.008	108.867	150	
								4.000	108.867	150	
F20	109.898	1.658	Open Manhole	1200		OUTFALL		1.009	108.240	150	

Foul Water Network 3

FOUL SEWER DESIGN

Foul Design Details

FOUL SEWERAGE DESIGN

Design Criteria for Foul Network 3

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.200
Flow Per Person (l/per/day)	222.00	Maximum Backdrop Height (m)	1.500
Persons per House	3.00	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	1.00
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Foul Network 3

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	60.334	0.603	100.1	0.000	6	0.0	1.500	o	150	Pipe/Conduit	
2.000	56.779	2.969	19.1	0.000	5	0.0	1.500	o	150	Pipe/Conduit	
1.001	75.976	2.250	33.8	0.000	11	0.0	1.500	o	150	Pipe/Conduit	
3.000	28.239	0.466	60.6	0.000	11	0.0	1.500	o	150	Pipe/Conduit	
1.002	46.479	1.343	34.6	0.000	5	0.0	1.500	o	150	Pipe/Conduit	
1.003	24.445	0.707	34.6	0.000	5	0.0	1.500	o	150	Pipe/Conduit	
1.004	31.403	0.908	34.6	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
1.005	32.574	0.937	34.8	0.000	7	0.0	1.500	o	150	Pipe/Conduit	
1.006	17.710	0.131	135.0	0.000	2	0.0	1.500	o	150	Pipe/Conduit	
1.007	26.316	0.195	135.0	0.000	6	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	114.507	0.000	0.0	6	0.0	14	0.32	0.88	15.5	0.3
2.000	116.873	0.000	0.0	5	0.0	9	0.54	2.01	35.5	0.2
1.001	113.904	0.000	0.0	22	0.0	20	0.71	1.51	26.7	1.0
3.000	112.120	0.000	0.0	11	0.0	17	0.47	1.13	19.9	0.5
1.002	111.654	0.000	0.0	38	0.0	26	0.84	1.49	26.4	1.8
1.003	110.311	0.000	0.0	43	0.0	28	0.87	1.49	26.4	2.0
1.004	109.604	0.000	0.0	43	0.0	28	0.87	1.49	26.4	2.0
1.005	108.696	0.000	0.0	50	0.0	30	0.91	1.49	26.3	2.3
1.006	107.759	0.000	0.0	52	0.0	43	0.57	0.75	13.3	2.4
1.007	107.628	0.000	0.0	58	0.0	46	0.59	0.75	13.3	2.7

Network Design Table for Foul Network 3

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.008	28.432	0.211	135.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
1.009	14.716	0.154	95.7	0.000	8	0.0	1.500	o	150	Pipe/Conduit	
4.000	22.656	2.248	10.1	0.000	11	0.0	1.500	o	150	Pipe/Conduit	
1.010	9.126	0.091	100.3	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
5.000	29.446	0.260	113.3	0.000	8	0.0	1.500	o	150	Pipe/Conduit	
5.001	23.998	0.212	113.2	0.000	8	0.0	1.500	o	150	Pipe/Conduit	
1.011	57.766	1.457	39.6	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
1.012	25.668	0.190	135.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
1.013	25.667	0.145	177.0	0.000	3	0.0	1.500	o	225	Pipe/Conduit	
1.014	26.249	0.141	186.2	0.000	3	0.0	1.500	o	225	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.008	107.433	0.000	0.0	58	0.0	46	0.59	0.75	13.3	2.7
1.009	107.223	0.000	0.0	66	0.0	45	0.69	0.90	15.8	3.1
4.000	109.317	0.000	0.0	11	0.0	11	0.87	2.77	49.0	0.5
1.010	107.069	0.000	0.0	77	0.0	49	0.71	0.87	15.5	3.6
5.000	107.450	0.000	0.0	8	0.0	17	0.34	0.82	14.5	0.4
5.001	107.190	0.000	0.0	16	0.0	23	0.42	0.82	14.5	0.7
1.011	106.978	0.000	0.0	93	0.0	42	1.04	1.39	24.6	4.3
1.012	105.521	0.000	0.0	93	0.0	59	0.67	0.75	13.3	4.3
1.013	105.256	0.000	0.0	96	0.0	55	0.59	0.86	34.3	4.4
1.014	105.111	0.000	0.0	99	0.0	56	0.59	0.84	33.4	4.6

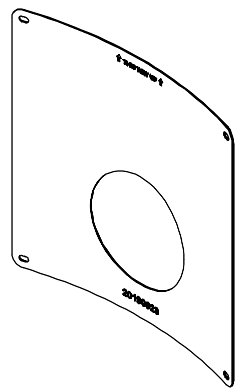
FOUL SEWER DESIGN

Foul Manhole Schedules

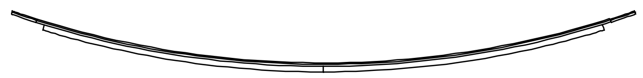
Manhole Schedules for Foul Network 3

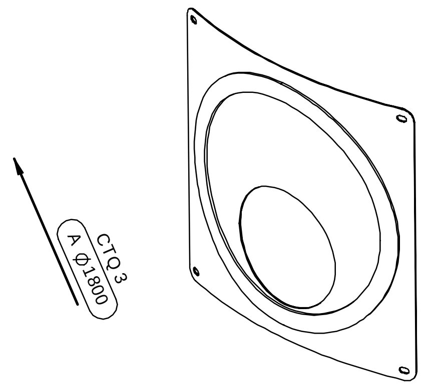
MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
F301	116.135	1.628	Open Manhole	1350	1.000	114.507	150				
F302	118.523	1.650	Open Manhole	1200	2.000	116.873	150				
F303	116.560	2.656	Open Manhole	1800	1.001	113.904	150	1.000	113.904	150	
								2.000	113.904	150	
F305	114.158	2.038	Open Manhole	1200	3.000	112.120	150				
F306	113.928	2.274	Open Manhole	1350	1.002	111.654	150	1.001	111.654	150	
								3.000	111.654	150	
F307	112.317	2.006	Open Manhole	1200	1.003	110.311	150	1.002	110.311	150	
F308	111.461	1.857	Open Manhole	1350	1.004	109.604	150	1.003	109.604	150	
F309	111.705	3.009	Open Manhole	1200	1.005	108.696	150	1.004	108.696	150	
F310	111.341	3.582	Open Manhole	1200	1.006	107.759	150	1.005	107.759	150	
F311	111.072	3.444	Open Manhole	1350	1.007	107.628	150	1.006	107.628	150	
F312	110.592	3.159	Open Manhole	1200	1.008	107.433	150	1.007	107.433	150	
F313	110.160	2.937	Open Manhole	1200	1.009	107.223	150	1.008	107.223	150	
F314	110.967	1.650	Open Manhole	1200	4.000	109.317	150				
F315	109.998	2.929	Open Manhole	1200	1.010	107.069	150	1.009	107.069	150	
								4.000	107.069	150	
F316	109.019	1.569	Open Manhole	1350	5.000	107.450	150				
F317	109.714	2.524	Open Manhole	1350	5.001	107.190	150	5.000	107.190	150	
F318	109.577	2.599	Open Manhole	1350	1.011	106.978	150	1.010	106.978	150	
								5.001	106.978	150	
F319	107.205	1.684	Open Manhole	1200	1.012	105.521	150	1.011	105.521	150	
F320	107.189	1.933	Open Manhole	1350	1.013	105.256	225	1.012	105.331	150	
F321	106.834	1.723	Open Manhole	1200	1.014	105.111	225	1.013	105.111	225	
F23	106.952	1.982	Open Manhole	1200		OUTFALL		1.014	104.970	225	

ITEM NO.	Description	WEIGHT	QTY.
1	QPLATE ROUND WALL FRONT PLATE	7.12	1
2	OUTLET PIPE SEAL	0.371	1

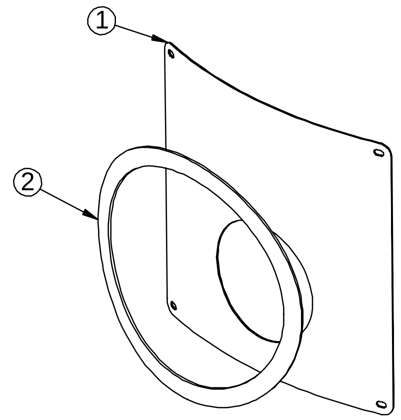


ISOMETRIC VIEW (FRONT)
SCALE 1:10

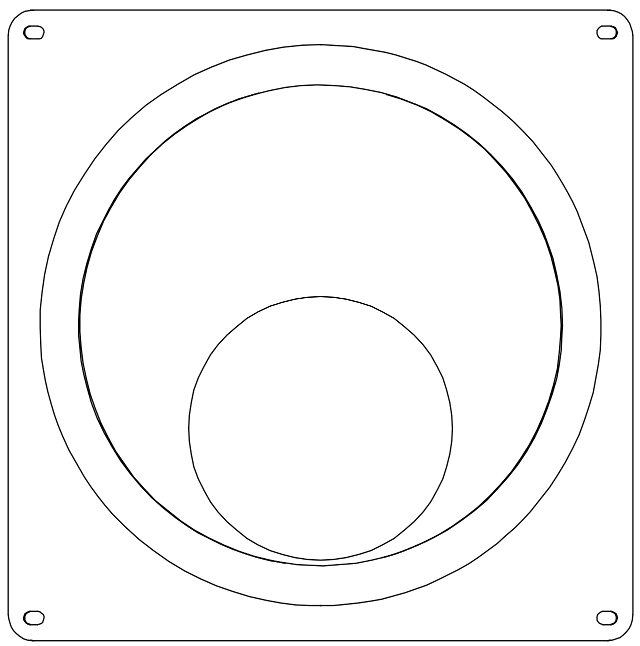


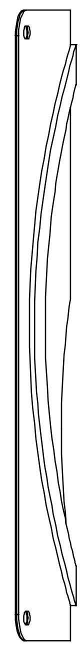


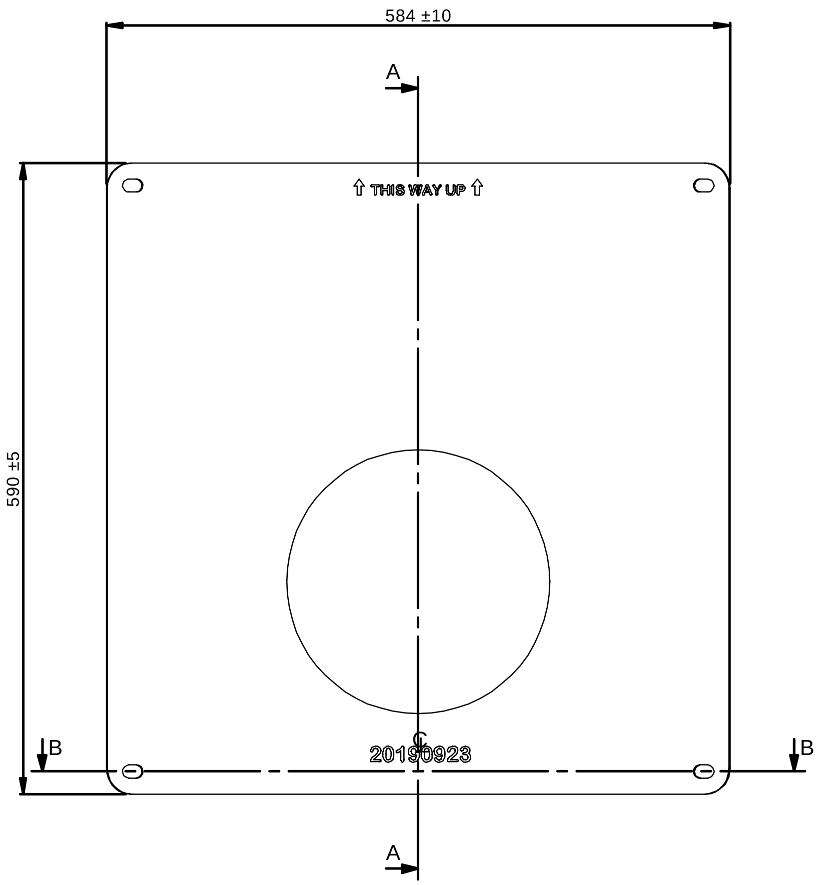
ISOMETRIC VIEW (REAR)
SCALE 1:10

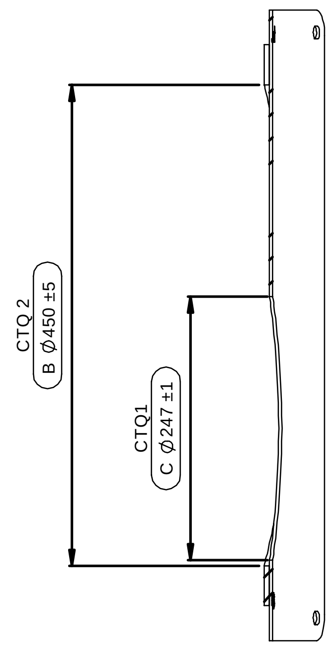


ISOMETRIC EXPLODED VIEW
SCALE 1:10

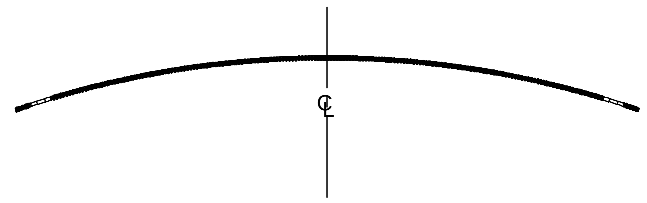








SECTION A-A



SECTION B-B

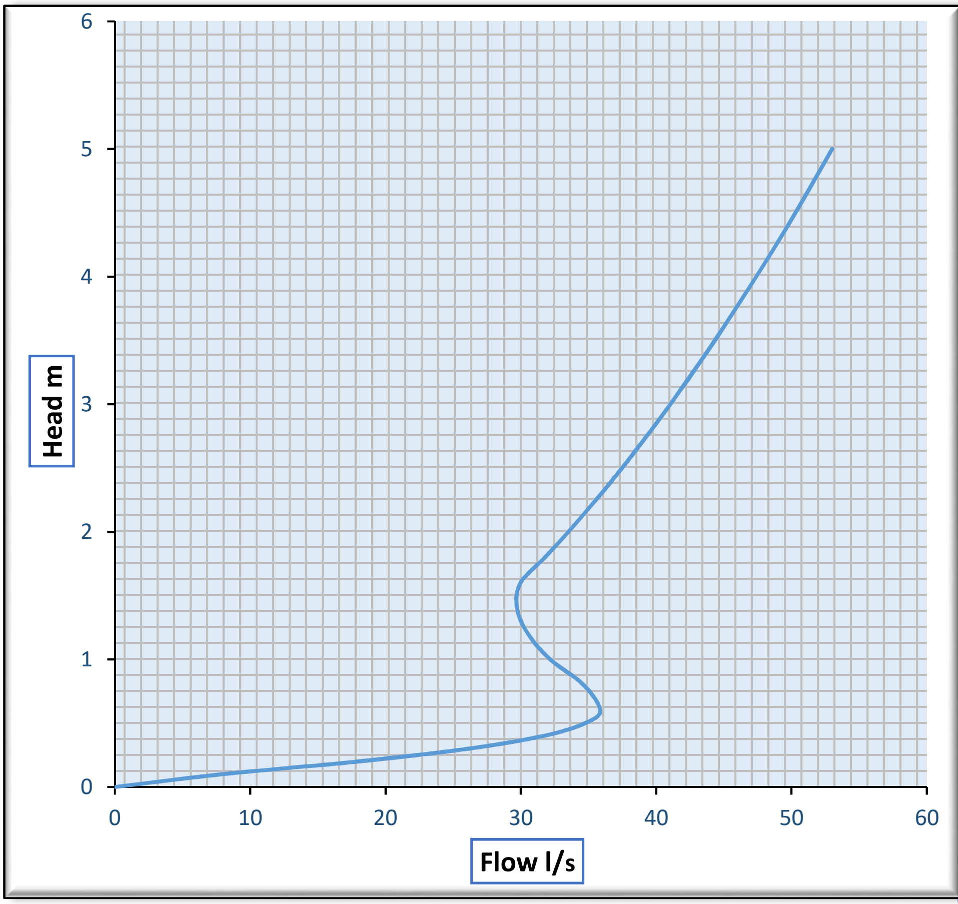
ACO Technologies plc	ACO Business Park, Hitchin Road, Shefford, Bedfordshire, SG17 5TE, UK. Tel: 01462 816666, www.aco.co.uk	Drawing Number: Q-PLATE-RW SL20190923	Part Number: SEE TABLE
		Title: ACO QPLATE ROUND WALL	
Project No: N/A		Material: N/A - ASSEMBLY	Units: mm
Created By:	Created at: 23/09/2019	Surface Finish: SEE NOTES	Format: A2
General Tolerance: SEE NOTES		Weight: 7.49kg / Projection: ISO-E	Scale: 1:5
Protection Note: DIN ISO 16016			Sheet: 2 of 2

CROWN WATER Data Sheet

230 mm QR5 Type Vortex Flow Control

Job Ref : 4280619

Client Name	Baratt Homes	Date	28/06/2019
Project Name	Chipping Lane, Longridg	For the attention of	Corinne Doyle



Head m	Flow l/s
0	0.000
0.1	7.970
0.2	17.960
0.3	26.120
0.4	31.670
0.5	34.740
0.6	35.860
0.8	34.640
1	32.170
1.2	30.530
1.4	29.720
1.6	29.980
1.8	31.800
2	33.520
2.2	35.160
2.4	36.720
2.6	38.220
3	41.050
3.4	43.700
3.8	46.200
4.2	48.580
4.6	50.840
5	53.000

Design Flow	42.4 l/s	Flush Flow	35.93 l/s
Design Head	3.2 m	At Head	0.611 m
Minimum PipePipe	300 mm	Kickback Flow	29.37 l/s
Sump Depth	540 mm	At Head	1.491 m

Note: Surface Water Only

Crown Water Ltd
Index House
Ascot SL5 7ET
Tel 01344 886996 Fax 01344 886646
sales@crownwater.com
Company Registration Number *9514593*

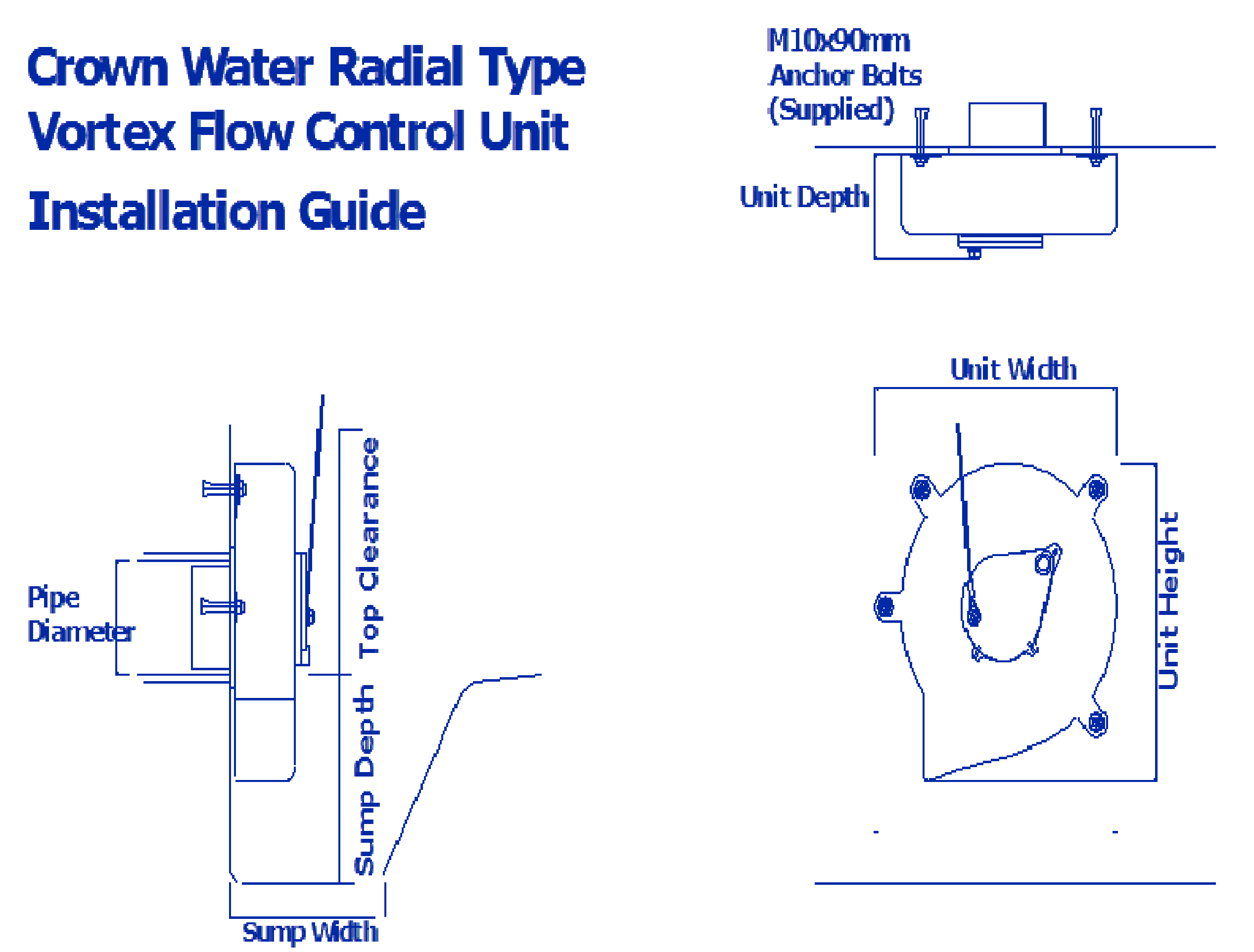
ISO 9001
REGISTERED FIRM

CROWN WATER

230 mm QR5 Type Vortex Flow Control

Job Ref	4280619

Client Name	Baratt Homes	Date	28/06/2019
Project Name	Chipping Lane, Longridg	For the attention of	Corinne Doyle



Unit Outlet Diameter	230mm	Sump Depth (Min)	540 mm
Unit Height	1160 mm	Sump Width (Min)	420 mm
Unit Width	1110 mm	Pipe Diameter (Min)	300mm
Unit Depth	270 mm	Top Clearance(Min)	750 mm

Note: Surface Water Only

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Company Registration Number *9514593*

QMS
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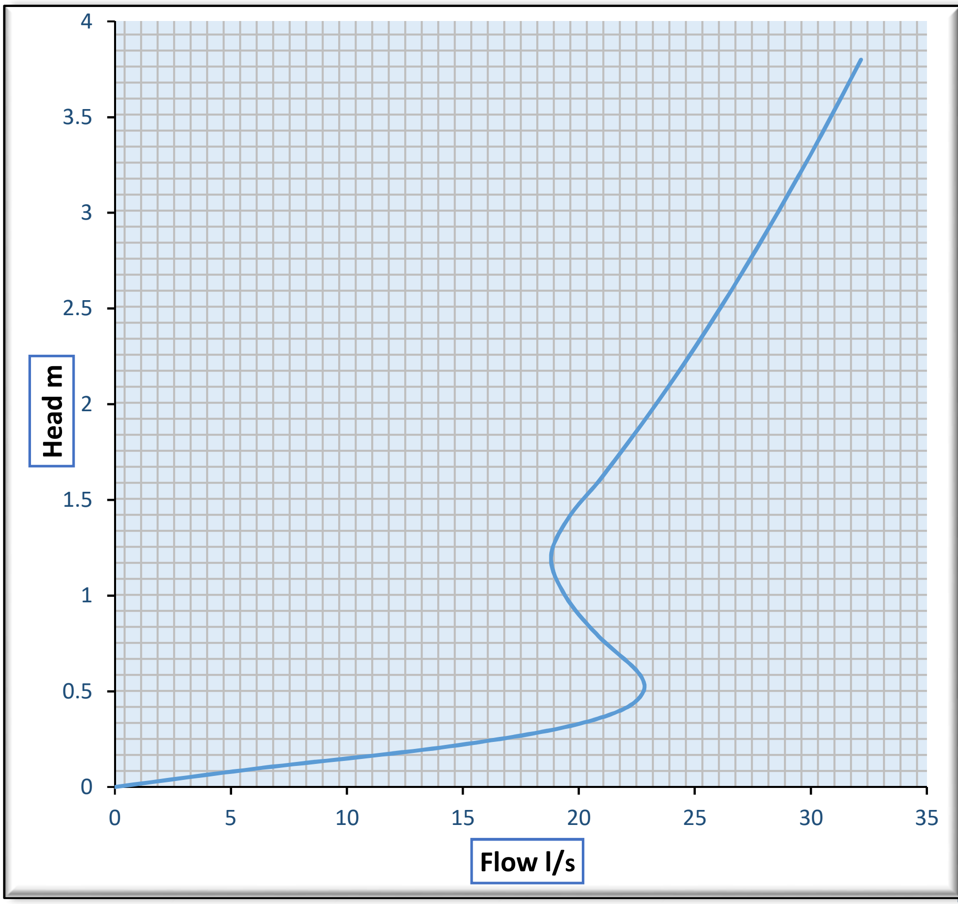
CROWN WATER Data Sheet
192 mm QR5 Type Vortex Flow Control

Job Ref : 4280619

Client Name	Baratt Homes	Date	28/06/2019
Project Name	Chipping Lane, Longridg	For the attention of	Corinne Doyle



Head m	Flow l/s
0	0.000
0.1	6.360
0.2	13.660
0.3	18.910
0.4	21.800
0.5	22.790
0.6	22.550
0.8	20.750
1	19.410
1.2	18.800
1.4	19.520
1.6	20.870
1.8	22.130
2	23.330
2.2	24.470
2.4	25.560
2.6	26.600
2.8	27.600
3	28.570
3.2	29.510
3.4	30.420
3.6	31.300
3.8	32.160

Design Flow	26.6 l/s	Flush Flow	22.83 l/s
Design Head	2.6 m	At Head	0.509 m
Minimum PipePipe	225 mm	Kickback Flow	18.67 l/s
Sump Depth	470 mm	At Head	1.244 m

Note: Surface Water Only

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sales@crownwater.com
Company Registration Number *9514593*

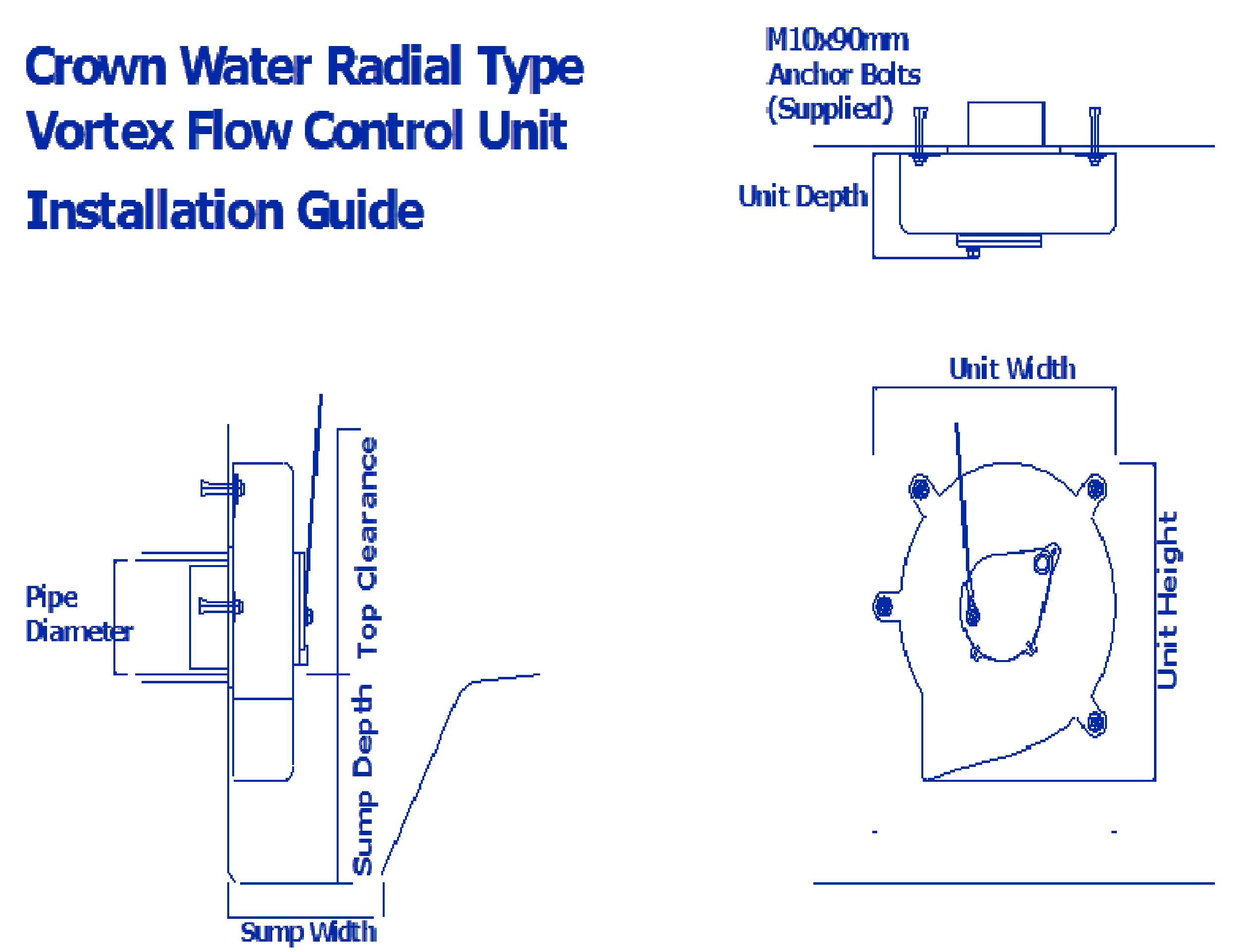
QMS ISO 9001 REGISTERED FIRM

CROWN WATER

Job Ref	4280619

192 mm QR5 Type Vortex Flow Control

Client Name	Baratt Homes	Date	28/06/2019
Project Name	Chipping Lane, Longridg	For the attention of	Corinne Doyle



Unit Outlet Diameter	192mm	Sump Depth (Min)	470 mm
Unit Height	980 mm	Sump Width (Min)	380 mm
Unit Width	930 mm	Pipe Diameter (Min)	225mm
Unit Depth	230 mm	Top Clearance(Min)	605 mm

Note: Surface Water Only

Crown Water Ltd
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Ascot SL5 7ET
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sales@crownwater.com
Company Registration Number *9514593*

QMS ISO 9001 REGISTERED FIRM

Appendix E
Extract from FRA for Phase 1

BETTS HYDRO
CONSULTING ENGINEERS

Chipping Lane, Longridge

FLOOD RISK ASSESSMENT & SUSTAINABLE DRAINAGE ASSESSMENT

For

Barratt Homes
BDW Trading Limited
Barratt House, Cartwright Way,
Forest Business Park, Bardon Hill,
Coalville,
Leicestershire,
LE67 1UF

BARRATT HOMES

March 2016

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BETTS HYDRO
CONSULTING ENGINEERS

Chipping Lane, Longridge
FLOOD RISK ASSESSMENT
& SUSTAINABLE DRAINAGE ASSESSMENT

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EXECUTIVE SUMMARY

This Flood Risk Assessment (FRA) & Sustainable Drainage Assessment has been prepared for a proposed **residential development** and associated infrastructure located at **Chipping Lane, Longridge**. The site is located within **Flood Zone 1** according to the Environment Agency's (EA's) online flood maps. The National Planning Policy Framework (NPPF) requires a FRA for sites greater than 1 ha. The proposals are 'residential' in nature, classified as 'more vulnerable' in Table 2 within the Technical Guidance to the NPPF. This type of development is appropriate in Flood Zone 1.

This FRA has identified the site to be at **low risk** from all sources of flooding including; fluvial, tidal, pluvial, groundwater, sewer related and flooding from artificial sources. The development is accessible during times of extreme flooding as the site is within Flood Zone 1.

The development proposal was granted outline planning application (N° 3/2014/0764) on the 29th October 2015. This FRA has built upon the FRA submitted with the application completed by RSK (March 2015, Ref: 880500-R1). The previous FRA proposed that run-off rates will be restricted to QBar. In this report, **QBar** is calculated as **8.3 l/s/ha**. See Appendix C for Hydrological Calculations. Any discrepancy between this QBar and the previous figure is due to refined FEH catchment characteristics being utilised within the ICP SuDS method.

The existing site is classed as greenfield. Surface water runoff from the existing site flows overland in a north-westerly direction before outfalling to a land drainage ditch/ordinary watercourse situated along the northern border. This ditch flows west before outfalling via a 600mm dia pipe to contribute to the Higgin Brook catchment.

The ground investigation report carried out by Soiltechnics (Feb 2016, Ref: STN3505NM-G01) indicates that infiltration is **not viable** at this site.

Surface water will outfall via the existing pathways (i.e. to the on-site ordinary watercourse) at a maximum rate of QBar (l/s). The restriction of runoff rates on increased impermeable areas will create storm water storage volumes. These will be retained on-site for events up to and including the 1 in 100 year event plus an allowance for climate change. Sustainable Drainage Systems (SuDS) could be incorporated into the planning layout which will assist in the reduction of surface water runoff from areas of hardstanding.

The nearest public foul sewers are located within Inglewhite Road to the south-east of the site. The conveyance route of foul flows will be determined during detailed design. A pumped solution will likely be required and early liaisons with UU regarding adoptable pump design are recommended.

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- MicroDrainage WinDES (v.14.1) – Calculation of Greenfield run-off rates IH124/ICP-SUDS, Greenfield run-off volumes, rates of rainfall and stormwater storage estimates.

Abbreviations & Acronyms

AEP	Annual Exceedance Probability
BGL	Below Ground Level
BGS	British Geological Survey
CC	Climate Change
EA	Environment Agency
FEH	Flood Estimation Handbook
FRA	Flood Risk Assessment
FZ	Flood Zone
Ha	Hectare
IDB	Internal Drainage Board
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
mAOD	Metres Above Ordnance Datum
NGR	National Grid Reference
NPPF	National Planning Policy Framework
NSRI	National Soil Resources Institute
OS	Ordnance Survey
PFRA	Preliminary Flood Risk Assessment
PPS	Planning Policy Statement
QSE	Quick Storage Estimate
QBAR	Mean Annual Flood
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
UU	United Utilities

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1.0 INTRODUCTION

1.1.1 The impact of flooding on the natural and built environment are material planning considerations. The NPPF sets out the Government's objectives for the planning system, how planning should facilitate and promote sustainable patterns of development, avoiding flood risk and accommodating the impacts of climate change. Government policy with respect to development in flood risk areas is contained within the NPPF and the supporting Technical Guidance.

1.1.2 The NPPF requires a FRA for sites greater than 1 ha. The proposals are 'residential' in nature, classified as 'more vulnerable' in Table 2 within the Technical Guidance to the NPPF. This type of development is appropriate in Flood Zone 1.

1.1.3 The development proposal was granted outline planning application (N° 3/2014/0764) on the 29th October 2015. This FRA has built upon the FRA submitted with the application completed by RSK (March 2015, Ref: 880500-R1).

1.1.4 The NPPF advises that the LPA should consult with the EA for advice on flood issues at a strategic level and in relation to planning applications.

2.0 EXISTING SITE LOCATION

2.1 Location

2.1.1 The site is located on land off Chipping Lane, Longridge, PR3 2NA. The OS NGR is 360073E, 437980N.

2.1.2 The site is surrounded by greenfield land to the north, east and west and by residential areas to the south. Chipping Lane forms the western site boundary.

2.2 Existing and Historical Land Use

2.2.1 The site is currently classed as greenfield. No other land uses have been identified as part of this report.

2.3 Topography

2.3.1 The site slopes in a north-westerly direction with levels ranging from around 121m AOD near the eastern border to 102m AOD in the north-west.

3.0 DEVELOPMENT PROPOSALS

3.1 Nature of the development

3.1.1 The nature of the development is residential and comprises of residential units associated infrastructure. A copy of the development layout for Phase I is included in Appendix A.

4.0 SOURCES OF FLOOD RISK

4.1 Fluvial Flood Risk

4.1.1 The flood risk of the site has been assessed using EA online Flood Maps.

Flood Zone 1 – Low Risk (<0.1%)

Flood Zone 2 – Medium Risk (1% – 0.1% fluvial, 0.5% – 0.1% tidal)

Flood Zone 3 – High Risk (>1% fluvial, >0.5% tidal)

Figure 1: EA Flood Map for Planning (Rivers and Sea).

4.1.2 Figure 1 shows that the site is within Flood Zone 1, which would indicate a **low risk** from fluvial flooding.

4.2 Tidal Flooding

4.2.1 As there is no coastline or tidal river near to the site, tidal flood risk is deemed **low**.

4.3 Pluvial Flood Risk

4.3.1 Pluvial (surface water) flooding occurs when rainwater is unable to drain away through the normal drainage systems or soak into the ground, but lies on or flows over the ground instead.

4.3.2 Pluvial flood risk as indicated by the EA map (Figure 2) shows that the site is predominantly at **very low** to **low** risk.

- Very low risk (<0.1%)
- Low risk (0.1% - 1%)
- Medium risk (1% - 3.3%)
- High risk (>3.3%)

Figure 2: The EA's Indicative Surface Water Flood Risk Map.

4.3.3 There are some areas of low to medium risk that appear to follow the direction of overland flow. There is a singular area of medium to high risk located centrally to the site that is indicative of a topographic low point.

4.3.4 The development proposals, although increasing the impermeable area of the site, will provide a betterment on the pre-existing scenario in that any exceedance flows for storm events up to and including the 100 year event plus 30% climate change, will be attenuated on-site prior to a restricted outfall.

4.3.5 Finished floor levels will be raised at least 150mm above the external levels and external areas of hardstanding will comply with building regulations and divert water away from the proposed dwellings. This will further mitigate pluvial flood risk.

4.3.6 Therefore the pluvial flood risk to the development is overall considered to be **low.**

4.4 Sewer Related Flood Risk

4.4.1 Rainwater is sometimes drained into combined sewers. Foul water flooding can occur in areas prone to overland flow when the sewer is overwhelmed by heavy rainfall and will continue until the water drains away. It can also occur when the sewer becomes blocked or is of inadequate capacity, this could lead to there being a high risk of internal property flooding with contaminated water.

4.4.2 United Utilities records indicate that there is a 375mm diameter surface water pipe from the eastern site boundary which cuts through the site before outfalling to Higgin Brook near the centre of the site. A 3m easement will apply from this SWS in accordance with UU guidelines.

4.4.3 New sewers will be designed and constructed in accordance with Sewers for Adoption and put up for adoption by United Utilities as part of the detailed design (stc).

4.4.4 Flood Risk from sewer related sources is considered to be **low**. See Appendix B for UU sewer records.

4.5 Groundwater Flood Risk

4.5.1 In general terms groundwater flooding can occur from three main sources: - raised water tables, seepage and percolation and groundwater recovery or rebound.

- If groundwater levels are naturally close to the surface then this can present a flood risk during times of intense rainfall.
- Seepage and percolation occur where embankments above ground level hold water. In these cases water travels through the embankment material and emerges on the opposite side of the embankment.
- Groundwater recovery/rebound occurs where the water table has been artificially depressed by abstraction. When the abstraction stops the water table makes a recovery to its original level. There is the potential for groundwater flooding in low lying areas where groundwater levels have been depressed below their pre-pumping conditions, where these were at or close to ground level.

4.5.2 The online BGS maps show that the underlying geology consists of the Bowland Shale Formation, whilst the Soilscapes online Map indicates that the soil has impeded drainage. The presence of surface water flood lines in the direction of overland flow in Figure 2 is also indicative of the presence of poorly permeable underlying clay soils.

4.5.3 Groundwater flood risk is therefore considered to be '**low**', this will be further mitigated by the increase in Finished Floor Levels by at least 150mm above existing external levels.

4.6 Artificial Sources of Flood Risk

4.6.1 The site is partially at risk of flooding from the 'Dilworth Upper' reservoir, yet the risk designation is yet 'to be determined' according to the EA online maps and information. Reservoir flooding is extremely rare, therefore the flood risk from artificial sources is deemed **low**.

4.7 Flood Risk Mitigation Measures & Residual Risks

4.7.1 Finished Floor Levels will be a minimum of 150mm above the external levels (following any re-grade). External levels within proximity will fall away from proposed dwellings in accordance with building regulations.

4.7.2 Surface water run-off rates will be restricted through the use of vortex flow control devices. The increased volume of run-off for storms greater than the 30 year event can be mitigated through the use of SuDS (evapotranspiration/bio-retention/rainwater re-use).

4.7.3 The development is considered accessible during the extreme storm events as the site is within Flood Zone 1.

5.0 SURFACE WATER MANAGEMENT

5.1 Pre-Development Surface Water Run-off

5.1.1 The previous FRA completed by RSK (March 2015, Ref: 880500-R1) proposed that run-off rates will be restricted to QBar. In this report, QBar is calculated as 8.3 l/s/ha. See Appendix C for Hydrological Calculations. Any discrepancy between this QBar and the previous figure is due to refined FEH catchment characteristics being utilised within the ICP SuDS method.

5.1.2 The pre-development (greenfield) runoff rates are shown in Table 1. The ICP SuDS method was utilised using FEH catchment characteristics.

Storm Event	Greenfield Rate (l/s/ha)
Q1 year	7.2
QBar	8.3
Q30 years	14.0
Q100 years	17.2

Table 1: Greenfield Run-off Rates (ICP SuDS)

5.2 Post-Development Surface Water Run-off

5.2.1 The impermeable area will increase as a result of the development and increased run-off rates will be restricted to QBar (l/s/ha) thereby providing **significant betterment** to the downstream catchment for all storm events greater than the average annual event.

5.2.2 Rates will be restricted through the use of a vortex flow control device. Increased run-off volumes for storms greater than the 30 year event can be reduced through the use of SuDS (evapotranspiration/bio-retention/rainwater reuse).

5.2.3 Storm-water storage volumes will be attenuated on-site prior to outfall. Table 2 indicates the estimated volumes of storm-water storage that will be required if flows are restricted to variable discharge rates.

5.2.4 The impermeable area is estimated to be 60% of the total site area. This is a conservative estimation that considers gardens, permeable driveways and landscaped areas.

Storm Event	Storage Estimate (m^3/ha)
Q1 year	32 – 73
QBar (~ 2.3 years)	45 - 96
Q30 years	141 – 249
Q100 years + cc	327 - 507

Table 2: Quick Storage Estimates

5.2.5 Hydrological Calculations are included within Appendix C. The above figures are estimates only and will be recalculated during detailed design.

5.3 Sustainable Drainage Systems (SuDS)

5.3.1 In accordance with the NPPF, SuDS should be used wherever possible to manage surface water and reduce the impact on downstream watercourses and sewers.

5.3.2 SuDS have the ability to address four core objectives; water quantity, water quality, amenity and biodiversity. With the appropriate system specified, all four core objectives can be satisfied. Where possible, peak surface water discharge rates to watercourses and sewers should be reduced.

5.3.3 Preference should always be given to practical SuDS over conventional pipe systems. Opportunities should be taken to provide soft landscaping on site to minimise surface water run-off, improve bio-diversity and increase visual enhancement.

5.3.4 The ground investigation report carried out by Soiltechnics (Feb 2016, Ref: STN3505NM-G01) indicates that infiltration is **not viable** at this site.

5.3.5 There is potential to utilise SuDS on this site, with large areas of POS provided within the layout at the lowest points of the site. Due to the level gradient of the site, shallow SuDS would be preferable to systems such as deep ponds or detention basins. Suitable SuDS would include the use of swales and bio-retention areas.

5.3.7 It is important that SuDS is seen as a multi-use commodity, and that areas that benefit from SuDS, and the additional environmental and aesthetic enhancement they can bring if designed properly, are open to the public.

5.4 Methods of Surface Water Management

5.4.1 There are three methods that have been reviewed for the management and discharge of surface water detailed below; these may be applied individually or collectively to form a complete strategy. They should be applied in the order of priority listed below.

5.4.2 **Discharge via Infiltration** - The ground investigation report carried out by Soiltechnics (Feb 2016, Ref: STN3505NM-G01) indicates that infiltration is **not viable** at this site.

5.4.3 **Discharge to Watercourse** – There are several on-site watercourses which the site currently drains to. These are designated 'ordinary watercourses' and ordinary watercourse consent should be applied for with Lancashire County Council prior to any on-site works. As the watercourses are not designated as 'Main River', a 3-5m easement is considered appropriate.

5.4.4 **Discharge to Public Sewer** – Surface water will not outfall to a public sewer.

5.5 Climate Change

5.5.1 The UK climate is changing significantly will vary greatly by region with more short duration and high intensity rainfall events as well as more periods of long duration rainfall.

5.5.2 The NPPF Technical Guidance states that the recommended national precautionary sensitivity ranges for increase of peak rainfall intensity is 30% until 2115. The impact of climate change means there is likely to be a long term increase in average sea levels.

5.5.3 An increase in flood water levels means that flooding events will occur more frequently and have a greater impact. Any increase flood risk to the site from climate change is likely to be related to the increase in rainfall intensity and duration.

5.5.4 An additional 30% to accommodate climate change will be incorporated into the design of the stormwater storage attenuation.

5.6 Foul Water Management

5.6.1 The nearest public foul sewers are located within Inglewhite Road to the south-east of the site. The conveyance route of foul flows will be determined during detailed design. A pumped solution will likely be required and early liaisons with UU regarding adoptable pump design are recommended. Sewers will be designed and constructed in accordance with Sewers for Adoption.

6.0 SUMMARY

6.1 Conclusion and Recommendations

6.1.1 This report has been prepared for a development proposal of residential dwellings and associated infrastructure. The site lies within Flood Zone 1. The residential proposals are classified as 'more vulnerable'. This type of development is considered to be appropriate in accordance with the NPPF.

6.1.2 The report has indicated that the site is at **low** risk of flooding from fluvial, tidal, sewer related and artificial sources. There is some medium indicative risk of pluvial flooding which will be reduced and mitigated by the implementation of the development proposal. Flood risk to the surrounding area as a result of the development will be significantly reduced due to the restriction of proposed run-off rates to mimic the existing rate for the average annual event (QBar).

6.1.3 Attenuation will be provided on-site for storm events up to and including the 1 in 100 year event + 30% climate change.

6.1.4 Any residual or unforeseen flood risk to the proposed development will be further mitigated by raising finished floor levels to at least 150mm above external levels. External levels will fall away from dwellings in accordance with Building Regulations.

6.1.5 Applications for sewer adoption will be discussed and submitted during detailed design.

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Environment Agency – www.environment-agency.gov.uk
Flood Forum –www.floodforum.org.uk
Google Maps – www.maps.google.co.uk
Streetmap – www.streetmap.co.uk

Appendix F
MicroDrainage Simulations for Phase 1

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for SW1.SWS

Pipe Sizes Surface Water Network 1 Manhole Sizes Surface Water Network 1

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	18.800	Add Flow / Climate Change (%)	0
Ratio R	0.280	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for SW1.SWS

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	34.856	0.087	400.6	0.185	5.00	0.0	0.600	o	1200	Pipe/Conduit	
1.001	14.100	0.028	503.6	0.037	0.00	0.0	0.600	o	1500	Pipe/Conduit	
2.000	26.078	0.153	170.4	0.056	5.00	0.0	0.600	o	225	Pipe/Conduit	
2.001	26.997	0.429	62.9	0.018	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.002	9.582	0.056	171.1	0.055	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.003	30.639	0.361	84.9	0.127	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	12.887	0.026	495.7	0.043	0.00	0.0	0.600	o	1500	Pipe/Conduit	
3.000	37.925	0.181	209.5	0.083	5.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	50.00	5.31	103.006	0.185	0.0	0.0	0.0	1.86	2106.9	25.1
1.001	50.00	5.44	102.619	0.222	0.0	0.0	0.0	1.90	3365.7	30.1
2.000	50.00	5.44	104.865	0.056	0.0	0.0	0.0	1.00	39.7	7.6
2.001	50.00	5.71	104.712	0.074	0.0	0.0	0.0	1.65	65.7	10.0
2.002	50.00	5.87	104.283	0.129	0.0	0.0	0.0	1.00	39.6	17.5
2.003	50.00	6.23	104.227	0.256	0.0	0.0	0.0	1.42	56.5	34.7
1.002	50.00	6.34	102.591	0.521	0.0	0.0	0.0	1.92	3392.6	70.5
3.000	50.00	5.58	103.977	0.083	0.0	0.0	0.0	1.08	76.5	11.2

Network Design Table for SW1.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
3.001	12.547	0.031	404.7	0.010	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.003	20.839	0.042	496.2	0.033	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.004	19.697	0.039	505.1	0.054	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.005	11.281	0.023	490.5	0.000	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.006	21.474	0.043	499.4	0.000	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.007	11.233	0.022	510.6	0.063	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.008	47.046	0.094	500.5	0.103	0.00	0.0	0.600	o	1500	Pipe/Conduit	
4.000	32.098	0.597	53.8	0.048	5.00	0.0	0.600	o	225	Pipe/Conduit	
4.001	27.069	0.068	398.1	0.092	0.00	0.0	0.600	o	525	Pipe/Conduit	
1.009	39.272	0.080	490.9	0.024	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.010	20.549	0.041	501.2	0.075	0.00	0.0	0.600	o	1500	Pipe/Conduit	
5.000	31.163	0.663	47.0	0.036	5.00	0.0	0.600	o	225	Pipe/Conduit	
5.001	24.755	0.688	36.0	0.075	0.00	0.0	0.600	o	225	Pipe/Conduit	
5.002	7.704	0.198	39.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
5.003	6.655	0.126	53.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
5.004	6.888	0.066	104.4	0.602	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.005	30.420	0.317	96.0	0.024	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.006	7.929	0.091	87.1	0.023	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
3.001	50.00	5.79	103.646	0.093	0.0	0.0	0.0	1.00	159.7	12.6
1.003	49.52	6.52	102.565	0.647	0.0	0.0	0.0	1.92	3390.9	86.8
1.004	48.99	6.69	102.523	0.701	0.0	0.0	0.0	1.90	3360.7	93.0
1.005	48.69	6.79	102.484	0.701	0.0	0.0	0.0	1.93	3410.6	93.0
1.006	48.14	6.98	102.461	0.701	0.0	0.0	0.0	1.91	3379.8	93.0
1.007	47.85	7.08	102.418	0.764	0.0	0.0	0.0	1.89	3342.3	99.0
1.008	46.70	7.49	102.396	0.867	0.0	0.0	0.0	1.91	3376.1	109.7
4.000	50.00	5.30	104.242	0.048	0.0	0.0	0.0	1.79	71.1	6.5
4.001	50.00	5.70	103.345	0.140	0.0	0.0	0.0	1.12	241.7	19.0
1.009	45.81	7.83	102.302	1.031	0.0	0.0	0.0	1.93	3409.1	127.9
1.010	45.35	8.01	102.222	1.106	0.0	0.0	0.0	1.91	3373.7	135.8
5.000	50.00	5.27	108.172	0.036	0.0	0.0	0.0	1.91	76.1	4.9
5.001	50.00	5.46	107.509	0.111	0.0	0.0	0.0	2.19	87.0	15.0
5.002	50.00	5.52	106.821	0.111	0.0	0.0	0.0	2.10	83.5	15.0
5.003	50.00	5.58	106.623	0.111	0.0	0.0	0.0	1.80	71.6	15.0
5.004	50.00	5.64	106.273	0.713	0.0	0.0	0.0	1.99	316.5	96.5
5.005	50.00	5.88	106.207	0.737	0.0	0.0	0.0	2.08	330.1	99.8
5.006	50.00	5.95	105.890	0.760	0.0	0.0	0.0	2.18	346.6	102.9

Network Design Table for SW1.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
5.007	19.595	0.338	58.0	0.036	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.008	12.502	0.272	46.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.009	9.280	0.023	403.5	0.096	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.010	11.131	0.028	400.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.011	19.961	0.139	143.6	0.018	0.00	0.0	0.600	o	450	Pipe/Conduit	
5.012	13.450	0.157	85.7	0.055	0.00	0.0	0.600	o	450	Pipe/Conduit	
6.000	41.858	1.231	34.0	0.057	5.00	0.0	0.600	o	225	Pipe/Conduit	
6.001	39.560	1.364	29.0	0.099	0.00	0.0	0.600	o	225	Pipe/Conduit	
6.002	13.898	0.409	34.0	0.040	0.00	0.0	0.600	o	225	Pipe/Conduit	
6.003	48.787	1.203	40.6	0.291	0.00	0.0	0.600	o	375	Pipe/Conduit	
5.013	18.119	0.045	402.6	0.012	0.00	0.0	0.600	o	525	Pipe/Conduit	
5.014	27.409	0.069	397.2	0.047	0.00	0.0	0.600	o	525	Pipe/Conduit	
5.015	14.736	0.037	398.3	0.099	0.00	0.0	0.600	o	525	Pipe/Conduit	
5.016	6.640	0.017	390.6	0.012	0.00	0.0	0.600	o	525	Pipe/Conduit	
7.000	24.649	0.325	75.8	0.037	5.00	0.0	0.600	o	225	Pipe/Conduit	
5.017	17.660	0.044	401.4	0.017	0.00	0.0	0.600	o	525	Pipe/Conduit	
5.018	66.145	0.165	400.9	0.099	0.00	0.0	0.600	o	525	Pipe/Conduit	
5.019	62.798	0.157	400.0	0.131	0.00	0.0	0.600	o	525	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
5.007	50.00	6.07	105.799	0.796	0.0	0.0	0.0	2.67	425.3	107.8
5.008	50.00	6.14	105.461	0.796	0.0	0.0	0.0	3.01	477.9	107.8
5.009	50.00	6.29	105.189	0.892	0.0	0.0	0.0	1.01	160.0	120.8
5.010	49.67	6.47	105.166	0.892	0.0	0.0	0.0	1.01	160.7	120.8
5.011	49.06	6.67	105.138	0.910	0.0	0.0	0.0	1.69	269.5	120.9
5.012	48.75	6.77	104.999	0.965	0.0	0.0	0.0	2.20	349.5	127.4
6.000	50.00	5.31	108.448	0.057	0.0	0.0	0.0	2.25	89.5	7.7
6.001	50.00	5.58	107.217	0.156	0.0	0.0	0.0	2.44	97.0	21.1
6.002	50.00	5.68	105.853	0.196	0.0	0.0	0.0	2.25	89.5	26.5
6.003	50.00	5.97	105.294	0.487	0.0	0.0	0.0	2.85	315.1	65.9
5.013	47.94	7.04	103.941	1.464	0.0	0.0	0.0	1.11	240.3	190.1
5.014	46.79	7.45	103.896	1.511	0.0	0.0	0.0	1.12	241.9	191.5
5.015	46.20	7.67	103.827	1.610	0.0	0.0	0.0	1.12	241.6	201.5
5.016	45.95	7.77	103.790	1.622	0.0	0.0	0.0	1.13	244.0	201.8
7.000	50.00	5.27	104.399	0.037	0.0	0.0	0.0	1.50	59.8	5.0
5.017	45.27	8.04	103.773	1.676	0.0	0.0	0.0	1.11	240.7	205.5
5.018	42.94	9.03	103.729	1.775	0.0	0.0	0.0	1.11	240.8	206.4
5.019	40.99	9.97	103.564	1.906	0.0	0.0	0.0	1.11	241.1	211.6

Network Design Table for SW1.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
5.020	26.670	0.067	398.1	0.039	0.00	0.0	0.600	o	1500	Pipe/Conduit	
5.021	39.206	0.098	400.0	0.000	0.00	0.0	0.600	o	1500	Pipe/Conduit	
5.022	34.028	0.085	400.3	0.084	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.011	44.746	0.089	500.0	0.000	0.00	0.0	0.600	o	1500	Pipe/Conduit	
1.012	8.914	0.053	168.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
5.020	40.59	10.17	102.432	1.945	0.0	0.0	0.0	2.14	3788.4	213.8
5.021	40.02	10.48	102.365	1.945	0.0	0.0	0.0	2.14	3779.1	213.8
5.022	39.54	10.75	102.267	2.029	0.0	0.0	0.0	2.14	3777.5	217.3
1.011	38.86	11.14	102.182	3.135	0.0	0.0	0.0	1.91	3377.8	329.9
1.012	38.65	11.26	102.093	3.135	0.0	0.0	0.0	1.21	85.5«	329.9

Manhole Schedules for SW1.SWS

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
1	105.233	2.227	Open Manhole	2400	1.000	103.006	1200				
2	105.924	3.305	Open Manhole	2400	1.001	102.619	1500	1.000	102.919	1200	
15	106.290	1.425	Open Manhole	1350	2.000	104.865	225				
16	106.358	1.646	Open Manhole	1350	2.001	104.712	225	2.000	104.712	225	
17	105.854	1.571	Open Manhole	1350	2.002	104.283	225	2.001	104.283	225	
18	105.655	1.428	Open Manhole	1500	2.003	104.227	225	2.002	104.227	225	
3	105.961	3.370	Open Manhole	2400	1.002	102.591	1500	1.001	102.591	1500	
								2.003	103.866	225	
19	105.531	1.554	Open Manhole	1800	3.000	103.977	300				
20	105.820	2.174	Open Manhole	1500	3.001	103.646	450	3.000	103.796	300	
4	105.808	3.243	Open Manhole	2700	1.003	102.565	1500	1.002	102.565	1500	
								3.001	103.615	450	
5	105.622	3.099	Open Manhole	2400	1.004	102.523	1500	1.003	102.523	1500	
6	105.847	3.363	Open Manhole	2400	1.005	102.484	1500	1.004	102.484	1500	
7	105.909	3.448	Open Manhole	2400	1.006	102.461	1500	1.005	102.461	1500	
8	105.721	3.303	Open Manhole	2400	1.007	102.418	1500	1.006	102.418	1500	
9	105.581	3.185	Open Manhole	2400	1.008	102.396	1500	1.007	102.396	1500	
21	105.667	1.425	Open Manhole	1350	4.000	104.242	225				
22	105.259	1.914	Open Manhole	1800	4.001	103.345	525	4.000	103.645	225	
10	105.002	2.700	Open Manhole	3000	1.009	102.302	1500	1.008	102.302	1500	
								4.001	103.277	525	
11	104.922	2.700	Open Manhole	3000	1.010	102.222	1500	1.009	102.222	1500	
23	109.597	1.425	Open Manhole	1350	5.000	108.172	225				
24	108.947	1.438	Open Manhole	1500	5.001	107.509	225	5.000	107.509	225	
25	108.247	1.426	Open Manhole	1350	5.002	106.821	225	5.001	106.821	225	
26	108.049	1.426	Open Manhole	1350	5.003	106.623	225	5.002	106.623	225	
27	107.924	1.651	Open Manhole	1500	5.004	106.273	450	5.003	106.498	225	
28	107.857	1.650	Open Manhole	1500	5.005	106.207	450	5.004	106.207	450	
29	107.540	1.650	Open Manhole	1500	5.006	105.890	450	5.005	105.890	450	
30	107.449	1.650	Open Manhole	1500	5.007	105.799	450	5.006	105.799	450	
31	107.646	2.185	Open Manhole	1500	5.008	105.461	450	5.007	105.461	450	
32	107.569	2.380	Open Manhole	1500	5.009	105.189	450	5.008	105.189	450	
33	107.430	2.264	Open Manhole	1500	5.010	105.166	450	5.009	105.166	450	
34	107.241	2.103	Open Manhole	1500	5.011	105.138	450	5.010	105.138	450	
35	106.909	1.910	Open Manhole	1500	5.012	104.999	450	5.011	104.999	450	
46	109.881	1.433	Open Manhole	1350	6.000	108.448	225				
47	108.671	1.454	Open Manhole	1350	6.001	107.217	225	6.000	107.217	225	
48	107.297	1.444	Open Manhole	1350	6.002	105.853	225	6.001	105.853	225	

Manhole Schedules for SW1.SWS

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
49	106.894	1.600	Open Manhole	1350	6.003	105.294	375	6.002	105.444	225	
36	106.895	2.954	Open Manhole	1800	5.013	103.941	525	5.012	104.842	450	826
								6.003	104.091	375	
37	106.951	3.055	Open Manhole	1800	5.014	103.896	525	5.013	103.896	525	
38	106.608	2.781	Open Manhole	1800	5.015	103.827	525	5.014	103.827	525	
39	106.386	2.596	Open Manhole	1800	5.016	103.790	525	5.015	103.790	525	
50	105.824	1.425	Open Manhole	1350	7.000	104.399	225				
40	106.262	2.489	Open Manhole	1800	5.017	103.773	525	5.016	103.773	525	
								7.000	104.074	225	1
41	105.972	2.243	Open Manhole	1800	5.018	103.729	525	5.017	103.729	525	
42	105.729	2.165	Open Manhole	1800	5.019	103.564	525	5.018	103.564	525	
43	105.566	3.134	Open Manhole	2700	5.020	102.432	1500	5.019	103.407	525	
44	105.250	2.885	Open Manhole	2700	5.021	102.365	1500	5.020	102.365	1500	
45	104.968	2.701	Open Manhole	3000	5.022	102.267	1500	5.021	102.267	1500	
12	104.882	2.701	Open Manhole	3000	1.011	102.182	1500	1.010	102.181	1500	
								5.022	102.182	1500	
13	104.793	2.700	Open Manhole	3000	1.012	102.093	300	1.011	102.093	1500	
14	102.473	0.433	Open Manhole	600		OUTFALL		1.012	102.040	300	

Online Controls for SW1.SWS

Hydro-Brake Optimum® Manhole: 13, DS/PN: 1.012, Volume (m^3): 92.9

Unit Reference	MD-SHE-0278-5000-2200-5000
Design Head (m)	2.200
Design Flow (l/s)	50.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Diameter (mm)	278
Invert Level (m)	102.093
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	2100

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.200	49.8	Kick-Flo®	1.423	40.4
Flush-Flo™	0.654	49.7	Mean Flow over Head Range	-	43.0

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	8.7	1.200	46.1	3.000	57.9	7.000	87.3
0.200	28.6	1.400	41.3	3.500	62.3	7.500	90.3
0.300	45.1	1.600	42.7	4.000	66.5	8.000	93.1
0.400	47.7	1.800	45.2	4.500	70.4	8.500	95.9
0.500	49.1	2.000	47.6	5.000	74.1	9.000	98.6
0.600	49.7	2.200	49.8	5.500	77.6	9.500	101.3
0.800	49.4	2.400	51.9	6.000	81.0		
1.000	48.3	2.600	54.0	6.500	84.2		

Storage Structures for SW1.SWS

Tank or Pond Manhole: 13, DS/PN: 1.012

Invert Level (m) 103.650

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	947.9	0.200	1029.2	0.400	1113.4	0.600	1200.5
0.100	988.1	0.300	1070.9	0.500	1156.6	0.750	1267.7

Summary of Critical Results by Maximum Level (Rank 1) for SW1.SWS

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.282
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.800	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360
Return Period(s) (years)	30
Climate Change (%)	0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	180 Winter	30	+0%					103.692
1.001	2	180 Winter	30	+0%					103.692
2.000	15	15 Winter	30	+0%					104.969
2.001	16	15 Winter	30	+0%					104.804
2.002	17	15 Winter	30	+0%	30/15 Summer				104.697
2.003	18	15 Winter	30	+0%	30/15 Summer				104.639
1.002	3	180 Winter	30	+0%					103.692
3.000	19	15 Winter	30	+0%					104.097
3.001	20	15 Winter	30	+0%					103.802
1.003	4	180 Winter	30	+0%					103.692
1.004	5	180 Winter	30	+0%					103.692
1.005	6	180 Winter	30	+0%					103.693
1.006	7	180 Winter	30	+0%					103.694
1.007	8	180 Winter	30	+0%					103.693
1.008	9	180 Winter	30	+0%					103.693
4.000	21	15 Winter	30	+0%					104.311
4.001	22	180 Winter	30	+0%					103.691
1.009	10	180 Winter	30	+0%					103.691
1.010	11	180 Winter	30	+0%					103.688
5.000	23	15 Winter	30	+0%					108.229

Summary of Critical Results by Maximum Level (Rank 1) for SW1.SWS

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.514	0.000	0.01		14.6	OK	
1.001	2	-0.427	0.000	0.01		15.5	OK	
2.000	15	-0.121	0.000	0.43		15.6	OK	
2.001	16	-0.133	0.000	0.34		20.7	OK	
2.002	17	0.189	0.000	1.06		34.8	SURCHARGED	
2.003	18	0.187	0.000	1.22		64.6	SURCHARGED	
1.002	3	-0.399	0.000	0.03		33.9	OK	
3.000	19	-0.180	0.000	0.33		23.6	OK	
3.001	20	-0.294	0.000	0.26		26.4	OK	
1.003	4	-0.373	0.000	0.02		38.7	OK	
1.004	5	-0.331	0.000	0.02		36.6	OK	
1.005	6	-0.291	0.000	0.03		32.9	OK	
1.006	7	-0.267	0.000	0.02		30.4	OK	
1.007	8	-0.225	0.000	0.03		30.1	OK	
1.008	9	-0.203	0.000	0.01		33.1	OK	
4.000	21	-0.156	0.000	0.20		13.5	OK	
4.001	22	-0.179	0.000	0.06		11.7	OK	
1.009	10	-0.111	0.000	0.01		29.5	OK	
1.010	11	-0.034	0.000	0.02		27.7	OK	
5.000	23	-0.168	0.000	0.14		10.1	OK	

Summary of Critical Results by Maximum Level (Rank 1) for SW1.SWS

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
5.001	24	15 Winter	30	+0%					107.610
5.002	25	15 Winter	30	+0%					106.937
5.003	26	15 Winter	30	+0%					106.757
5.004	27	15 Winter	30	+0%					106.714
5.005	28	15 Summer	30	+0%					106.464
5.006	29	15 Winter	30	+0%					106.340
5.007	30	15 Winter	30	+0%					106.047
5.008	31	15 Winter	30	+0%	30/15 Winter				105.933
5.009	32	15 Winter	30	+0%	30/15 Summer				105.826
5.010	33	15 Winter	30	+0%	30/15 Summer				105.696
5.011	34	15 Winter	30	+0%					105.548
5.012	35	15 Winter	30	+0%					105.424
6.000	46	15 Winter	30	+0%					108.515
6.001	47	15 Winter	30	+0%					107.330
6.002	48	15 Winter	30	+0%					105.999
6.003	49	15 Winter	30	+0%					105.483
5.013	36	15 Winter	30	+0%	30/15 Summer				105.295
5.014	37	15 Winter	30	+0%	30/15 Summer				105.173
5.015	38	15 Winter	30	+0%	30/15 Summer				105.038
5.016	39	15 Winter	30	+0%	30/15 Summer				104.887
7.000	50	30 Winter	30	+0%	30/15 Summer				104.750
5.017	40	30 Winter	30	+0%	30/15 Summer				104.738
5.018	41	30 Winter	30	+0%	30/15 Summer				104.585
5.019	42	30 Winter	30	+0%	30/15 Summer				104.252
5.020	43	180 Winter	30	+0%					103.703
5.021	44	180 Winter	30	+0%					103.700
5.022	45	180 Winter	30	+0%					103.693
1.011	12	180 Winter	30	+0%	30/120 Winter				103.685
1.012	13	180 Winter	30	+0%	30/15 Summer				103.684

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
5.001	24	-0.124	0.000	0.41		32.8	OK	
5.002	25	-0.109	0.000	0.52		32.7	OK	
5.003	26	-0.091	0.000	0.65		32.5	OK	
5.004	27	-0.009	0.000	1.00		169.1	OK	
5.005	28	-0.193	0.000	0.62		175.0	OK	
5.006	29	0.000	0.000	1.05		178.8	OK	
5.007	30	-0.202	0.000	0.57		186.6	OK	
5.008	31	0.023	0.000	0.63		185.0	SURCHARGED	
5.009	32	0.187	0.000	2.13		201.1	SURCHARGED	
5.010	33	0.080	0.000	2.01		200.6	SURCHARGED	
5.011	34	-0.040	0.000	0.96		201.0	OK	
5.012	35	-0.025	0.000	0.93		207.7	OK	
6.000	46	-0.158	0.000	0.19		16.0	OK	
6.001	47	-0.112	0.000	0.50		45.7	OK	

Summary of Critical Results by Maximum Level (Rank 1) for SW1.SWS

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
6.002	48	-0.079	0.000	0.74		57.5	OK	
6.003	49	-0.186	0.000	0.50		144.8	OK	
5.013	36	0.829	0.000	1.74		303.2	SURCHARGED	
5.014	37	0.752	0.000	1.51		301.5	SURCHARGED	
5.015	38	0.686	0.000	2.03		310.7	SURCHARGED	
5.016	39	0.572	0.000	2.11		309.4	SURCHARGED	
7.000	50	0.126	0.000	0.15		8.5	SURCHARGED	
5.017	40	0.440	0.000	1.76		301.9	SURCHARGED	
5.018	41	0.331	0.000	1.41		311.1	SURCHARGED	
5.019	42	0.163	0.000	1.48		324.7	SURCHARGED	
5.020	43	-0.229	0.000	0.07		156.8	OK	
5.021	44	-0.165	0.000	0.06		142.1	OK	
5.022	45	-0.074	0.000	0.05		127.0	OK	
1.011	12	0.003	0.000	0.03		78.4	SURCHARGED	
1.012	13	1.291	0.000	0.81		49.9	SURCHARGED	

Surcharged Outfall Details for SW1.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.012	14	102.473	102.040	102.040	600	0

Datum (m) 102.040 Offset (mins) 0

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
1	0.520	42	0.520	83	0.520	124	0.520	165	0.520	206	0.520
2	0.520	43	0.520	84	0.520	125	0.520	166	0.520	207	0.520
3	0.520	44	0.520	85	0.520	126	0.520	167	0.520	208	0.520
4	0.520	45	0.520	86	0.520	127	0.520	168	0.520	209	0.520
5	0.520	46	0.520	87	0.520	128	0.520	169	0.520	210	0.520
6	0.520	47	0.520	88	0.520	129	0.520	170	0.520	211	0.520
7	0.520	48	0.520	89	0.520	130	0.520	171	0.520	212	0.520
8	0.520	49	0.520	90	0.520	131	0.520	172	0.520	213	0.520
9	0.520	50	0.520	91	0.520	132	0.520	173	0.520	214	0.520
10	0.520	51	0.520	92	0.520	133	0.520	174	0.520	215	0.520
11	0.520	52	0.520	93	0.520	134	0.520	175	0.520	216	0.520
12	0.520	53	0.520	94	0.520	135	0.520	176	0.520	217	0.520
13	0.520	54	0.520	95	0.520	136	0.520	177	0.520	218	0.520
14	0.520	55	0.520	96	0.520	137	0.520	178	0.520	219	0.520
15	0.520	56	0.520	97	0.520	138	0.520	179	0.520	220	0.520
16	0.520	57	0.520	98	0.520	139	0.520	180	0.520	221	0.520
17	0.520	58	0.520	99	0.520	140	0.520	181	0.520	222	0.520
18	0.520	59	0.520	100	0.520	141	0.520	182	0.520	223	0.520
19	0.520	60	0.520	101	0.520	142	0.520	183	0.520	224	0.520
20	0.520	61	0.520	102	0.520	143	0.520	184	0.520	225	0.520
21	0.520	62	0.520	103	0.520	144	0.520	185	0.520	226	0.520
22	0.520	63	0.520	104	0.520	145	0.520	186	0.520	227	0.520
23	0.520	64	0.520	105	0.520	146	0.520	187	0.520	228	0.520
24	0.520	65	0.520	106	0.520	147	0.520	188	0.520	229	0.520
25	0.520	66	0.520	107	0.520	148	0.520	189	0.520	230	0.520
26	0.520	67	0.520	108	0.520	149	0.520	190	0.520	231	0.520
27	0.520	68	0.520	109	0.520	150	0.520	191	0.520	232	0.520
28	0.520	69	0.520	110	0.520	151	0.520	192	0.520	233	0.520
29	0.520	70	0.520	111	0.520	152	0.520	193	0.520	234	0.520
30	0.520	71	0.520	112	0.520	153	0.520	194	0.520	235	0.520
31	0.520	72	0.520	113	0.520	154	0.520	195	0.520	236	0.520
32	0.520	73	0.520	114	0.520	155	0.520	196	0.520	237	0.520
33	0.520	74	0.520	115	0.520	156	0.520	197	0.520	238	0.520
34	0.520	75	0.520	116	0.520	157	0.520	198	0.520	239	0.520
35	0.520	76	0.520	117	0.520	158	0.520	199	0.520	240	0.520
36	0.520	77	0.520	118	0.520	159	0.520	200	0.520	241	0.520
37	0.520	78	0.520	119	0.520	160	0.520	201	0.520	242	0.520
38	0.520	79	0.520	120	0.520	161	0.520	202	0.520	243	0.520
39	0.520	80	0.520	121	0.520	162	0.520	203	0.520	244	0.520
40	0.520	81	0.520	122	0.520	163	0.520	204	0.520	245	0.520
41	0.520	82	0.520	123	0.520	164	0.520	205	0.520	246	0.520

Surcharged Outfall Details for SW1.SWS

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
247	0.520	266	0.520	285	0.520	304	0.520	323	0.520	342	0.520
248	0.520	267	0.520	286	0.520	305	0.520	324	0.520	343	0.520
249	0.520	268	0.520	287	0.520	306	0.520	325	0.520	344	0.520
250	0.520	269	0.520	288	0.520	307	0.520	326	0.520	345	0.520
251	0.520	270	0.520	289	0.520	308	0.520	327	0.520	346	0.520
252	0.520	271	0.520	290	0.520	309	0.520	328	0.520	347	0.520
253	0.520	272	0.520	291	0.520	310	0.520	329	0.520	348	0.520
254	0.520	273	0.520	292	0.520	311	0.520	330	0.520	349	0.520
255	0.520	274	0.520	293	0.520	312	0.520	331	0.520	350	0.520
256	0.520	275	0.520	294	0.520	313	0.520	332	0.520	351	0.520
257	0.520	276	0.520	295	0.520	314	0.520	333	0.520	352	0.520
258	0.520	277	0.520	296	0.520	315	0.520	334	0.520	353	0.520
259	0.520	278	0.520	297	0.520	316	0.520	335	0.520	354	0.520
260	0.520	279	0.520	298	0.520	317	0.520	336	0.520	355	0.520
261	0.520	280	0.520	299	0.520	318	0.520	337	0.520	356	0.520
262	0.520	281	0.520	300	0.520	319	0.520	338	0.520	357	0.520
263	0.520	282	0.520	301	0.520	320	0.520	339	0.520	358	0.520
264	0.520	283	0.520	302	0.520	321	0.520	340	0.520	359	0.520
265	0.520	284	0.520	303	0.520	322	0.520	341	0.520	360	0.520

Summary of Critical Results by Maximum Level (Rank 1) for SW1.SWS

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.282
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
DVD Status OFF
Inertia Status OFF

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360
Return Period(s) (years) 30
Climate Change (%) 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	240 Winter	30	+0%					103.736
1.001	2	240 Winter	30	+0%					103.736
2.000	15	15 Winter	30	+0%					104.969
2.001	16	15 Winter	30	+0%					104.804
2.002	17	15 Winter	30	+0%	30/15 Summer				104.697
2.003	18	15 Winter	30	+0%	30/15 Summer				104.639
1.002	3	240 Winter	30	+0%					103.736
3.000	19	15 Winter	30	+0%					104.097
3.001	20	15 Winter	30	+0%					103.802
1.003	4	240 Winter	30	+0%					103.736
1.004	5	240 Winter	30	+0%					103.736
1.005	6	240 Winter	30	+0%					103.736
1.006	7	240 Winter	30	+0%					103.736
1.007	8	240 Winter	30	+0%					103.736
1.008	9	240 Winter	30	+0%					103.736
4.000	21	15 Winter	30	+0%					104.311
4.001	22	180 Winter	30	+0%					103.735
1.009	10	240 Winter	30	+0%					103.735
1.010	11	240 Winter	30	+0%	30/180 Winter				103.732
5.000	23	15 Winter	30	+0%					108.229

Summary of Critical Results by Maximum Level (Rank 1) for SW1.SWS

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.470	0.000	0.01		10.9	OK	
1.001	2	-0.383	0.000	0.01		10.5	OK	
2.000	15	-0.121	0.000	0.43		15.6	OK	
2.001	16	-0.133	0.000	0.34		20.7	OK	
2.002	17	0.189	0.000	1.06		34.8	SURCHARGED	
2.003	18	0.187	0.000	1.22		64.6	SURCHARGED	
1.002	3	-0.355	0.000	0.02		23.7	OK	
3.000	19	-0.180	0.000	0.33		23.6	OK	
3.001	20	-0.294	0.000	0.26		26.4	OK	
1.003	4	-0.329	0.000	0.02		27.0	OK	
1.004	5	-0.287	0.000	0.02		24.6	OK	
1.005	6	-0.248	0.000	0.02		23.3	OK	
1.006	7	-0.225	0.000	0.01		23.0	OK	
1.007	8	-0.182	0.000	0.02		24.7	OK	
1.008	9	-0.160	0.000	0.01		27.7	OK	
4.000	21	-0.156	0.000	0.20		13.5	OK	
4.001	22	-0.135	0.000	0.06		11.7	OK	
1.009	10	-0.067	0.000	0.01		32.0	OK	
1.010	11	0.010	0.000	0.02		35.6	SURCHARGED	
5.000	23	-0.168	0.000	0.14		10.1	OK	

Summary of Critical Results by Maximum Level (Rank 1) for SW1.SWS

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
5.001	24	15 Winter	30	+0%					107.610
5.002	25	15 Winter	30	+0%					106.937
5.003	26	15 Winter	30	+0%					106.757
5.004	27	15 Winter	30	+0%					106.714
5.005	28	15 Summer	30	+0%					106.464
5.006	29	15 Winter	30	+0%					106.340
5.007	30	15 Winter	30	+0%					106.047
5.008	31	15 Winter	30	+0%	30/15 Winter				105.933
5.009	32	15 Winter	30	+0%	30/15 Summer				105.826
5.010	33	15 Winter	30	+0%	30/15 Summer				105.696
5.011	34	15 Winter	30	+0%					105.548
5.012	35	15 Winter	30	+0%					105.424
6.000	46	15 Winter	30	+0%					108.515
6.001	47	15 Winter	30	+0%					107.330
6.002	48	15 Winter	30	+0%					105.999
6.003	49	15 Winter	30	+0%					105.483
5.013	36	15 Winter	30	+0%	30/15 Summer				105.295
5.014	37	15 Winter	30	+0%	30/15 Summer				105.173
5.015	38	15 Winter	30	+0%	30/15 Summer				105.038
5.016	39	15 Winter	30	+0%	30/15 Summer				104.887
7.000	50	30 Winter	30	+0%	30/15 Summer				104.750
5.017	40	30 Winter	30	+0%	30/15 Summer				104.738
5.018	41	30 Winter	30	+0%	30/15 Summer				104.585
5.019	42	30 Winter	30	+0%	30/15 Summer				104.252
5.020	43	240 Winter	30	+0%					103.770
5.021	44	240 Winter	30	+0%					103.766
5.022	45	240 Winter	30	+0%					103.757
1.011	12	240 Winter	30	+0%	30/120 Winter				103.732
1.012	13	240 Winter	30	+0%	30/15 Summer				103.731

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
5.001	24	-0.124	0.000	0.41		32.8	OK	
5.002	25	-0.109	0.000	0.52		32.7	OK	
5.003	26	-0.091	0.000	0.65		32.5	OK	
5.004	27	-0.009	0.000	1.00		169.1	OK	
5.005	28	-0.193	0.000	0.62		175.0	OK	
5.006	29	0.000	0.000	1.05		178.8	OK	
5.007	30	-0.202	0.000	0.57		186.6	OK	
5.008	31	0.023	0.000	0.63		185.0	SURCHARGED	
5.009	32	0.187	0.000	2.13		201.1	SURCHARGED	
5.010	33	0.080	0.000	2.01		200.6	SURCHARGED	
5.011	34	-0.040	0.000	0.96		201.0	OK	
5.012	35	-0.025	0.000	0.93		207.7	OK	
6.000	46	-0.158	0.000	0.19		16.0	OK	
6.001	47	-0.112	0.000	0.50		45.7	OK	

Summary of Critical Results by Maximum Level (Rank 1) for SW1.SWS

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
6.002	48	-0.079	0.000	0.74		57.5	OK	
6.003	49	-0.186	0.000	0.50		144.8	OK	
5.013	36	0.829	0.000	1.74		303.2	SURCHARGED	
5.014	37	0.752	0.000	1.51		301.5	SURCHARGED	
5.015	38	0.686	0.000	2.03		310.7	SURCHARGED	
5.016	39	0.572	0.000	2.11		309.4	SURCHARGED	
7.000	50	0.126	0.000	0.15		8.5	SURCHARGED	
5.017	40	0.440	0.000	1.76		301.9	SURCHARGED	
5.018	41	0.331	0.000	1.41		311.1	SURCHARGED	
5.019	42	0.163	0.000	1.48		324.7	SURCHARGED	
5.020	43	-0.162	0.000	0.06		129.8	OK	
5.021	44	-0.099	0.000	0.05		118.9	OK	
5.022	45	-0.010	0.000	0.04		108.1	OK	
1.011	12	0.050	0.000	0.06		132.3	SURCHARGED	
1.012	13	1.338	0.000	0.81		49.9	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for SW1.SWS

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.282
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	18.800	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360
Return Period(s) (years)	100
Climate Change (%)	30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	240 Winter	100	+30%					104.203
1.001	2	240 Winter	100	+30%	100/120 Winter				104.202
2.000	15	15 Winter	100	+30%	100/15 Summer				105.484
2.001	16	15 Winter	100	+30%	100/15 Summer				105.433
2.002	17	15 Winter	100	+30%	100/15 Summer				105.357
2.003	18	15 Winter	100	+30%	100/15 Summer				105.249
1.002	3	240 Winter	100	+30%	100/120 Winter				104.203
3.000	19	240 Winter	100	+30%					104.204
3.001	20	240 Winter	100	+30%	100/120 Winter				104.203
1.003	4	240 Winter	100	+30%	100/120 Winter				104.203
1.004	5	240 Winter	100	+30%	100/120 Winter				104.203
1.005	6	240 Winter	100	+30%	100/60 Winter				104.203
1.006	7	240 Winter	100	+30%	100/60 Winter				104.203
1.007	8	240 Winter	100	+30%	100/60 Winter				104.203
1.008	9	240 Winter	100	+30%	100/60 Winter				104.203
4.000	21	15 Winter	100	+30%					104.333
4.001	22	240 Winter	100	+30%	100/60 Summer				104.204
1.009	10	240 Winter	100	+30%	100/30 Winter				104.203
1.010	11	240 Winter	100	+30%	100/30 Summer				104.203
5.000	23	15 Winter	100	+30%					108.247

Summary of Critical Results by Maximum Level (Rank 1) for SW1.SWS

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.003	0.000	0.01		20.3	OK	
1.001	2	0.083	0.000	0.02		21.9	SURCHARGED	
2.000	15	0.394	0.000	0.61		22.5	SURCHARGED	
2.001	16	0.496	0.000	0.52		31.7	SURCHARGED	
2.002	17	0.849	0.000	1.50		49.1	SURCHARGED	
2.003	18	0.797	0.000	1.78		93.9	SURCHARGED	
1.002	3	0.112	0.000	0.04		51.8	SURCHARGED	
3.000	19	-0.073	0.000	0.14		9.6	OK	
3.001	20	0.107	0.000	0.11		10.7	SURCHARGED	
1.003	4	0.138	0.000	0.04		61.1	SURCHARGED	
1.004	5	0.180	0.000	0.04		63.1	SURCHARGED	
1.005	6	0.219	0.000	0.05		62.2	SURCHARGED	
1.006	7	0.242	0.000	0.03		60.3	SURCHARGED	
1.007	8	0.285	0.000	0.06		63.5	SURCHARGED	
1.008	9	0.307	0.000	0.03		65.7	SURCHARGED	
4.000	21	-0.134	0.000	0.34		22.6	OK	
4.001	22	0.334	0.000	0.08		15.6	SURCHARGED	
1.009	10	0.401	0.000	0.03		73.1	SURCHARGED	
1.010	11	0.481	0.000	0.04		74.2	SURCHARGED	
5.000	23	-0.150	0.000	0.24		17.0	OK	

Summary of Critical Results by Maximum Level (Rank 1) for SW1.SWS

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
5.001	24	30 Winter	100	+30%	100/15 Winter			
5.002	25	30 Winter	100	+30%	100/15 Summer			
5.003	26	30 Winter	100	+30%	100/15 Summer			
5.004	27	30 Winter	100	+30%	100/15 Summer			
5.005	28	30 Winter	100	+30%	100/15 Summer			
5.006	29	30 Winter	100	+30%	100/15 Summer	100/30 Winter		
5.007	30	30 Winter	100	+30%	100/15 Summer			
5.008	31	30 Winter	100	+30%	100/15 Summer			
5.009	32	30 Winter	100	+30%	100/15 Summer			
5.010	33	30 Winter	100	+30%	100/15 Summer			
5.011	34	30 Winter	100	+30%	100/15 Summer			
5.012	35	30 Winter	100	+30%	100/15 Summer			
6.000	46	15 Winter	100	+30%				
6.001	47	15 Winter	100	+30%	100/15 Winter			
6.002	48	30 Winter	100	+30%	100/15 Summer			
6.003	49	30 Winter	100	+30%	100/15 Summer			
5.013	36	30 Winter	100	+30%	100/15 Summer			
5.014	37	30 Winter	100	+30%	100/15 Summer			
5.015	38	30 Winter	100	+30%	100/15 Summer			
5.016	39	30 Winter	100	+30%	100/15 Summer			
7.000	50	30 Winter	100	+30%	100/15 Summer			
5.017	40	30 Winter	100	+30%	100/15 Summer			
5.018	41	30 Winter	100	+30%	100/15 Summer			
5.019	42	30 Winter	100	+30%	100/15 Summer			
5.020	43	240 Winter	100	+30%	100/60 Winter			
5.021	44	240 Winter	100	+30%	100/60 Summer			
5.022	45	240 Winter	100	+30%	100/30 Winter			
1.011	12	240 Winter	100	+30%	100/30 Summer			
1.012	13	240 Winter	100	+30%	100/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
5.001	24	107.930	0.196	0.000	0.55		44.4	SURCHARGED	
5.002	25	107.870	0.824	0.000	0.64		39.8	SURCHARGED	
5.003	26	107.846	0.997	0.000	0.75		37.3	FLOOD RISK	
5.004	27	107.826	1.103	0.000	1.34		225.8	FLOOD RISK	
5.005	28	107.700	1.043	0.000	0.78		222.0	FLOOD RISK	
5.006	29	107.541	1.201	0.926	1.25		212.5	FLOOD	1
5.007	30	107.431	1.182	0.000	0.64		208.5	FLOOD RISK	
5.008	31	107.305	1.395	0.000	0.72		210.7	SURCHARGED	
5.009	32	107.177	1.539	0.000	2.42		227.9	SURCHARGED	
5.010	33	107.019	1.403	0.000	2.31		229.9	SURCHARGED	
5.011	34	106.862	1.274	0.000	1.12		234.7	SURCHARGED	
5.012	35	106.703	1.254	0.000	1.11		247.1	FLOOD RISK	
6.000	46	108.536	-0.137	0.000	0.32		26.8	OK	
6.001	47	107.472	0.030	0.000	0.82		75.8	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for SW1.SWS

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
6.002	48	106.984	0.906	0.000	0.89		69.7	SURCHARGED	
6.003	49	106.768	1.099	0.000	0.55		159.0	FLOOD RISK	
5.013	36	106.528	2.062	0.000	2.11		368.5	SURCHARGED	
5.014	37	106.299	1.878	0.000	1.89		377.7	SURCHARGED	
5.015	38	106.052	1.700	0.000	2.60		399.2	SURCHARGED	
5.016	39	105.782	1.467	0.000	2.74		401.5	SURCHARGED	
7.000	50	105.529	0.905	0.000	0.18		9.9	FLOOD RISK	
5.017	40	105.510	1.212	0.000	2.40		413.1	SURCHARGED	
5.018	41	105.221	0.967	0.000	1.95		430.6	SURCHARGED	
5.019	42	104.583	0.494	0.000	2.07		454.4	SURCHARGED	
5.020	43	104.205	0.273	0.000	0.10		220.1	SURCHARGED	
5.021	44	104.205	0.340	0.000	0.09		219.0	SURCHARGED	
5.022	45	104.204	0.437	0.000	0.09		226.8	SURCHARGED	
1.011	12	104.203	0.521	0.000	0.11		265.0	SURCHARGED	
1.012	13	104.202	1.809	0.000	0.81		49.9	SURCHARGED	

FOUL SEWERAGE DESIGN

Network Design Table for FW1 - PDS Export.FWS

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
1.000	21.577	0.755	28.6	0.000	6	0.0	1.500	o	150	
1.001	10.136	0.507	20.0	0.000	0	0.0	1.500	o	150	
1.002	9.531	0.071	135.0	0.000	6	0.0	1.500	o	150	
1.003	36.247	0.324	111.9	0.000	0	0.0	1.500	o	150	
1.004	36.094	0.690	52.3	0.000	0	0.0	1.500	o	150	
1.005	9.292	0.069	135.0	0.000	3	0.0	1.500	o	150	
1.006	7.293	0.054	135.0	0.000	0	0.0	1.500	o	150	
1.007	29.244	0.491	59.6	0.000	0	0.0	1.500	o	150	
1.008	9.888	0.482	20.5	0.000	8	0.0	1.500	o	150	
2.000	46.275	1.361	34.0	0.000	200	0.0	1.500	o	150	
2.001	35.226	1.761	20.0	0.000	5	0.0	1.500	o	150	
2.002	10.901	0.081	134.6	0.000	5	0.0	1.500	o	150	
2.003	23.107	0.098	235.8	0.000	195	0.0	1.500	o	225	
2.004	25.222	1.264	20.0	0.000	0	0.0	1.500	o	225	
1.009	27.745	0.118	235.1	0.000	0	0.0	1.500	o	225	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	107.117	0.000	0.0	6	0.0	11	0.50	1.64	29.0	0.3
1.001	106.362	0.000	0.0	6	0.0	10	0.57	1.97	34.7	0.3
1.002	105.855	0.000	0.0	12	0.0	21	0.37	0.75	13.3	0.6
1.003	105.784	0.000	0.0	12	0.0	20	0.39	0.83	14.6	0.6
1.004	105.460	0.000	0.0	12	0.0	17	0.51	1.21	21.4	0.6
1.005	104.770	0.000	0.0	15	0.0	24	0.39	0.75	13.3	0.7
1.006	104.702	0.000	0.0	15	0.0	24	0.39	0.75	13.3	0.7
1.007	104.648	0.000	0.0	15	0.0	19	0.52	1.14	20.1	0.7
1.008	104.157	0.000	0.0	23	0.0	18	0.86	1.94	34.3	1.1
2.000	108.240	0.000	0.0	200	0.0	62	1.37	1.51	26.6	9.4
2.001	106.879	0.000	0.0	205	0.0	54	1.68	1.96	34.7	9.6
2.002	105.118	0.000	0.0	210	0.0	96	0.83	0.75	13.3	9.8
2.003	104.962	0.000	0.0	405	0.0	131	0.79	0.75	29.7	19.0
2.004	104.864	0.000	0.0	405	0.0	66	1.97	2.58	102.4	19.0
1.009	103.600	0.000	0.0	428	0.0	136	0.80	0.75	29.7	20.1

FOUL SEWERAGE DESIGN

Network Design Table for FW1 - PDS Export.FWS

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
1.010	21.277	0.091	235.0	0.000	3	0.0	1.500	o	225	
1.011	9.211	0.039	235.0	0.000	7	0.0	1.500	o	225	
1.012	16.634	0.071	235.0	0.000	0	0.0	1.500	o	225	
1.013	34.291	1.593	21.5	0.000	2	0.0	1.500	o	225	
3.000	28.025	0.208	135.0	0.000	2	0.0	1.500	o	150	
3.001	23.238	0.332	70.0	0.000	0	0.0	1.500	o	150	
3.002	12.851	0.643	20.0	0.000	4	0.0	1.500	o	150	
3.003	28.939	1.453	19.9	0.000	7	0.0	1.500	o	150	
4.000	35.578	0.404	88.1	0.000	7	0.0	1.500	o	150	
4.001	13.249	0.103	128.9	0.000	4	0.0	1.500	o	150	
3.004	13.280	0.099	134.0	0.000	4	0.0	1.500	o	150	
5.000	32.509	1.086	29.9	0.000	4	0.0	1.500	o	150	
5.001	13.165	0.663	19.9	0.000	0	0.0	1.500	o	150	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.010	103.482	0.000	0.0	431	0.0	136	0.80	0.75	29.7	20.2
1.011	103.391	0.000	0.0	438	0.0	138	0.81	0.75	29.7	20.5
1.012	103.352	0.000	0.0	438	0.0	138	0.81	0.75	29.7	20.5
1.013	103.281	0.000	0.0	440	0.0	70	1.96	2.48	98.6	20.6
3.000	104.652	0.000	0.0	2	0.0	9	0.21	0.75	13.3	0.1
3.001	104.444	0.000	0.0	2	0.0	8	0.26	1.05	18.5	0.1
3.002	104.112	0.000	0.0	6	0.0	10	0.57	1.96	34.7	0.3
3.003	103.470	0.000	0.0	13	0.0	14	0.73	1.97	34.8	0.6
4.000	102.524	0.000	0.0	7	0.0	15	0.36	0.93	16.5	0.3
4.001	102.120	0.000	0.0	11	0.0	20	0.36	0.77	13.6	0.5
3.004	102.017	0.000	0.0	28	0.0	32	0.48	0.76	13.4	1.3
5.000	103.667	0.000	0.0	4	0.0	9	0.43	1.61	28.4	0.2
5.001	102.581	0.000	0.0	4	0.0	8	0.49	1.97	34.8	0.2

FOUL SEWERAGE DESIGN

Network Design Table for FW1 - PDS Export.FWS

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
3.005	20.894	0.155	134.8	0.000	0	0.0	1.500	o	150	
1.014	17.155	0.073	235.0	0.000	0	0.0	1.500	o	225	
1.015	13.743	0.058	235.0	0.000	2	0.0	1.500	o	225	
1.016	21.770	0.093	235.0	0.000	0	0.0	1.500	o	225	
1.017	11.274	0.162	69.6	0.000	8	0.0	1.500	o	225	
6.000	34.974	0.259	135.0	0.000	5	0.0	1.500	o	150	
7.000	13.792	0.521	26.5	0.000	8	0.0	1.500	o	150	
6.001	51.228	0.379	135.0	0.000	0	0.0	1.500	o	150	
6.002	27.732	0.590	47.0	0.000	13	0.0	1.500	o	150	
6.003	10.422	0.077	135.0	0.000	5	0.0	1.500	o	150	
6.004	56.806	0.421	135.0	0.000	0	0.0	1.500	o	750	
1.018	3.254	0.024	135.0	0.000	0	0.0	1.500	o	150	
1.019	185.986	-4.482	-41.5	0.000	0	0.0	1.500	o	300	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
3.005	101.918	0.000	0.0	32	0.0	34	0.50	0.75	13.3	1.5
1.014	101.688	0.000	0.0	472	0.0	145	0.82	0.75	29.7	22.1
1.015	101.615	0.000	0.0	474	0.0	145	0.82	0.75	29.7	22.2
1.016	101.557	0.000	0.0	474	0.0	145	0.82	0.75	29.7	22.2
1.017	101.464	0.000	0.0	482	0.0	101	1.31	1.38	54.8	22.6
6.000	103.029	0.000	0.0	5	0.0	14	0.28	0.75	13.3	0.2
7.000	103.291	0.000	0.0	8	0.0	12	0.56	1.71	30.2	0.4
6.001	102.770	0.000	0.0	13	0.0	22	0.38	0.75	13.3	0.6
6.002	102.390	0.000	0.0	26	0.0	24	0.67	1.28	22.6	1.2
6.003	101.800	0.000	0.0	31	0.0	34	0.49	0.75	13.3	1.5
6.004	101.723	0.000	0.0	31	0.0	22	0.39	2.15	950.7	1.5
1.018	101.302	0.000	0.0	513	0.0	150	0.75	0.75	13.3«	24.0
1.019	101.278	0.000	0.0	513	0.0	300	0.14	0.14	9.6«	24.0

FOUL SEWERAGE DESIGN

Network Design Table for FW1 - PDS Export.FWS

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
1.020	7.073	0.021	340.0	0.000	0	0.0	1.500	o	300	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.020	105.760	0.000	0.0	513	0.0	142	0.73	0.75	53.0	24.0

Manhole Schedules for FW1 - PDS Export.FWS

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
1	108.762	1.645	Open Manhole	1350	1.000	107.117	150				
2	108.164	1.802	Open Manhole	1200	1.001	106.362	150	1.000	106.362	150	
3	107.960	2.105	Open Manhole	1350	1.002	105.855	150	1.001	105.855	150	
4	107.858	2.074	Open Manhole	1200	1.003	105.784	150	1.002	105.784	150	
5	107.505	2.045	Open Manhole	1200	1.004	105.460	150	1.003	105.460	150	
6	107.578	2.808	Open Manhole	1200	1.005	104.770	150	1.004	104.770	150	
7	107.447	2.745	Open Manhole	1200	1.006	104.702	150	1.005	104.702	150	
8	107.337	2.689	Open Manhole	1200	1.007	104.648	150	1.006	104.648	150	
9	106.880	2.723	Open Manhole	1200	1.008	104.157	150	1.007	104.157	150	
20	109.898	1.658	Open Manhole	1200	2.000	108.240	150				
21	108.550	1.671	Open Manhole	1200	2.001	106.879	150	2.000	106.879	150	
22	107.328	2.210	Open Manhole	1350	2.002	105.118	150	2.001	105.118	150	
23	106.952	1.990	Open Manhole	1200	2.003	104.962	225	2.002	105.037	150	
24	106.615	1.751	Open Manhole	1200	2.004	104.864	225	2.003	104.864	225	
10	106.852	3.252	Open Manhole	1200	1.009	103.600	225	1.008	103.675	150	
								2.004	103.600	225	
11	106.898	3.416	Open Manhole	1200	1.010	103.482	225	1.009	103.482	225	
12	106.549	3.158	Open Manhole	1200	1.011	103.391	225	1.010	103.391	225	
13	106.397	3.045	Open Manhole	1200	1.012	103.352	225	1.011	103.352	225	
14	106.160	2.879	Open Manhole	1350	1.013	103.281	225	1.012	103.281	225	
25	106.302	1.650	Open Manhole	1200	3.000	104.652	150				
26	106.321	1.877	Open Manhole	1200	3.001	104.444	150	3.000	104.444	150	
27	105.875	1.763	Open Manhole	1200	3.002	104.112	150	3.001	104.112	150	
28	105.655	2.185	Open Manhole	1200	3.003	103.470	150	3.002	103.470	150	
31	105.283	2.759	Open Manhole	1200	4.000	102.524	150				
32	105.918	3.798	Open Manhole	1200	4.001	102.120	150	4.000	102.120	150	
29	105.942	3.925	Open Manhole	1200	3.004	102.017	150	3.003	102.017	150	
								4.001	102.017	150	
33	105.617	1.950	Open Manhole	1200	5.000	103.667	150				
34	105.795	3.214	Open Manhole	1200	5.001	102.581	150	5.000	102.581	150	
30	105.781	3.863	Open Manhole	1200	3.005	101.918	150	3.004	101.918	150	
								5.001	101.918	150	
15	105.682	3.994	Open Manhole	1350	1.014	101.688	225	1.013	101.688	225	
								3.005	101.763	150	

Manhole Schedules for FW1 - PDS Export.FWS

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
16	105.764	4.149	Open Manhole	1350	1.015	101.615	225	1.014	101.615	225	
17	105.885	4.328	Open Manhole	1200	1.016	101.557	225	1.015	101.557	225	
18	105.724	4.260	Open Manhole	1500	1.017	101.464	225	1.016	101.464	225	
36	105.595	2.566	Open Manhole	1200	6.000	103.029	150				
41	105.841	2.550	Open Manhole	1200	7.000	103.291	150				
37	106.021	3.251	Open Manhole	1200	6.001	102.770	150	6.000	102.770	150	
								7.000	102.770	150	
38	105.301	2.911	Open Manhole	1350	6.002	102.390	150	6.001	102.390	150	
39	104.996	3.196	Open Manhole	1200	6.003	101.800	150	6.002	101.800	150	
43	105.000	3.277	Open Manhole	2100	6.004	101.723	750	6.003	101.723	150	
19	105.800	4.498	Open Manhole	2400	1.018	101.302	150	1.017	101.302	225	
								6.004	101.302	750	
42	105.800	4.522	Open Manhole	1200	1.019	101.278	300	1.018	101.278	150	
44	108.350	2.590	Open Manhole	1200	1.020	105.760	300	1.019	105.760	300	
UU1802	108.570	2.831	Open Manhole	0		OUTFALL		1.020	105.739	300	