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WASTE RESOURCE MANAGEMENT

Endless Energy Ltd

Keighley Clean Energy Facility, Aire Valley Road, Keighley

Flood Risk Assessment

August 2016

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Endless Energy Ltd

Keighley Clean Energy Facility, Aire Valley Road, Keighley

Flood Risk Assessment

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MINERAL ESTATES AND QUARRYING
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SH11087-020	Drainage Layout	1: 1000@A1
SH11087-021	Manhole Schedules	NTS

1 INTRODUCTION

1.1 Instructions

1.1.1 This report is prepared in accordance with instructions from Endless Energy Ltd. It follows the drainage principles established by the granting of planning permission for the previous similar application in April 2014 (Ref. 13/04217/FUL) and by the subsequent discharge of the relevant planning conditions for that permission (Nos 31. 32 and 34; Ref. 13/04217/SUB01).

1.2 Background Information

National Planning Policy Framework

1.2.1 The National Planning Policy Framework and associated Technical Guidance explain how flood risk should be taken into consideration during the planning and development process. NPPF specifies a *sequential test* and an *exception test* to guide local planning authorities on the suitability of proposed development sites. It categorises flood risk by *flood zone* and defines the types of development *appropriate* to each flood zone according to *vulnerability*. The flood zones are defined as:

- Zone 1: Areas with a Low Probability of flooding (annual probability less than 0.1% or 1 in 1000 years).
- Zone 2: Areas with a Medium Probability of flooding (annual probability between 0.1% (1 in 1000 years) and 1.0% (1in 100 years) for rivers, 0.1 – 0.5% (1 in 1000 to 1 in 200 years) for coastal areas.
- Zone 3a: Areas with a High Probability of flooding (annual probability greater than 1.0% (1 in 100 years) for rivers, 0.5% (1 in 200 years) for coastal areas).
- Zone 3b: The Functional Floodplain (probability as Zone 3a).

Environment Agency Flood Maps

1.2.2 The Environment Agency (EA) predicts the likelihood of flooding via a national series of indicative flood maps, available to the public by request and via the EA website. These maps show the Flood Zones, described above, coloured in different shades of blue.

City of Bradford Metropolitan District Council Strategic Flood Risk Assessment

1.2.3 As part of their Local Development Framework (LDF) documentation, local authorities are required to produce a Strategic Flood Risk Assessment (SFRA) which sets the scene

for flood risk in their areas. The Bradford SFRA was not available for viewing from the City of Bradford Metropolitan District Council website.

City of Bradford Metropolitan District Council Preliminary Flood Risk Assessment

1.2.4 A Preliminary Flood Risk Assessment (PFRA) is a high level screening exercise to identify areas where there is significant flood risk in national terms and covers the risk of flooding from local sources, namely Ordinary Watercourses, surface water run-off and groundwater. It does not directly consider flooding from main rivers or from sewers.

1.2.5 PFRAs have been produced by Lead Local Flood Authorities (LLFAs) in England and Wales to fulfil statutory requirements in the Flood Risk Regulations 2009. In this case the LLFA is City of Bradford Metropolitan District Council and its PFRA was published in June 2011.

1.3 Data Sources

1.3.1 Flood data for the site and its surroundings has been obtained from the EA – attached at Appendix I. The EA planning application consultation response has been added.

1.3.2 Pre-Planning Sewerage Enquiry advice, including sewerage records, as provided by Yorkshire Water Services (YWS) - attached at Appendix II. The YWS planning application consultation response has been added.

2 SITE INFORMATION

2.1 Existing Site

2.1.1 The site is Keighley Clean Energy Facility, Aire Valley Road, Keighley and is located as shown on the Drawing No 548.02(--)500 *Proposed Site Plan – Overall Layout*. The site comprises about 3.5 ha of vacant Brownfield land and is bounded by gas holders of Thwaite Gas Works and industrial units to the west, Aire Valley Road to the north and a railway line and agriculture to the south and east. The site is located 3 km to the east of Keighley town centre.

2.1.2 The site was inspected with respect to flood risk by Wardell Armstrong on 16 August 2013 and 17 January 2014. The ground is generally level but is hummocky with reworked soil cover in the west and dense vegetative soil surface cover in the east. The site visit did not identify any official land drainage network on site but a drainage ditch was observed along the boundary with the Aire Valley Road and an area of standing water had formed by natural water flows along the central northern boundary.

2.1.3 The site is Brownfield and the existing impermeable area is significant due to a large coverage of reclaimed ground and un-vegetated soil cover in the western part of the site, but minimal impermeable area is present in the east due to vegetative cover.

2.2 Development Proposals

2.2.1 It is proposed that the site be developed for industrial use as an Energy from Waste plant as shown on Drawing No 548.02(--)500. According to NPPF, commercial/industrial land use is classed as 'less vulnerable' to flooding.

2.2.2 The proposed degree of coverage of the site by impermeable surfacing (roofs, access roads, service yards and car parks) is about 2.3 ha which constitutes about 65% of the total site area.

2.3 Watercourses and Local Drainage

2.3.1 The nearest surface watercourse is the River Aire, a Main River, about 220m to the north. The drainage authority is City of Bradford MDC.

2.4 Sewerage

2.4.1 According to Yorkshire Water Services– see Appendix II - there are public foul/combined sewers recorded crossing/running close to the site with diameters of 750mm, 900mm, 1200mm, 1350mm, 1400mm, 990/660mm and 915/610mm.

2.4.2 The local Waste Water Treatment Works is Marley WWTW which is approximately 300m to the east of the site.

2.5 Easements

2.5.1 No buildings are to be erected within 6.5 metres, nor trees planted within 5 metres of these public sewers. It may not be acceptable to raise or lower ground levels over these sewers, nor to restrict access to the manholes on these sewers.

2.6 Geology and Hydrogeology

2.6.1 The site is located on made ground underlain by alluvium and Glacial Till and Millstone Grit which is classified as a Minor or Secondary A Aquifer.

3 FLOODING INFORMATION

3.1 Flood History

3.1.1 According to the EA, there are no records of flooding at the site – see Appendix I.

3.1.2 The Bradford PFRA contains no records of historical flooding at the site.

3.2 Potential for Flooding

Fluvial Flooding

3.2.1 The EA Flood Map – see Appendix I - shows the site to be located in Flood Zone 1, i.e. an area with a Low Probability of flooding (annual probability less than 0.1% (1 in 1000 years).

Flooding from Surface Water Run-off

3.2.2 As the site is more than 1 ha in area, it is a requirement of NPPF that flood risk from surface water run-off be assessed.

3.2.3 Surface water flooding, either in the form of overland flow or standing water, could be caused by allowing water to flow directly off the site onto the adjoining land or by overloading the drainage system to the point where it will surcharge.

3.2.4 No specific details of flooding at the site were presented in the PFRA.

3.2.5 Prior to the demolition of the site infrastructure, the development area was predominantly hard surfaced roofs and yards and is currently vacant Brownfield land.

3.2.6 The impermeable area of roofs, access roads, service yards and car parks for the proposed development as shown on Drawing No 548.02(--) 500 will be about 2.3 ha, about 65% of the total site area of 3.5 ha.

3.2.7 Given that the existing site is conservatively estimated to be around 70% impermeable (2.5 ha) and that the proposed development will be slightly less (2.3 ha), there will be a small decrease in surface water run-off.

Groundwater Flooding

3.2.8 Given the geology of the area, there are no local records of significant groundwater flooding available other than in relation to cellar flooding in the PFRA.

4 FLOOD RISK ASSESSMENT

4.1 Fluvial Flooding

4.1.1 The site is within Flood Zone 1 and has a low probability of flooding. The chance of flooding each year is less than 0.1% (1 in 1,000). Consequently, there is no significant risk of flooding from fluvial sources for the site and future development will not be required to satisfy the Sequential Test.

4.2 Flooding from Surface Water Run-off

Surface Water Run-Off

4.2.1 Surface water run-off will be attenuated to the Greenfield rate using SuDS-based devices and discharged to the River Aire as shown on Drawing No SH11087-010 *Drainage Strategy*.

4.2.2 Surface water run-off from the impermeable areas has been modelled using Micro Drainage software for a 1 in 100 year storm with an allowance of 20% for climate change – see Section 4.5 below. In order to limit the discharge to the Greenfield run-off rate of 25 litres per second, a storage volume of about 1700 m^3 was estimated using Micro Drainage Quick Storage for the original planning application.

Sustainable Urban Drainage Systems (SuDS)

4.2.3 In the preliminary design shown on Drawing No SH11087-010, the necessary attenuation is achieved via an underground tank in the western part of the site, located between two major plant buildings. This feature proved the feasibility of underground storage which is likely to remain as a major factor in the final design for the following reasons:

- The shallow natural geology on the site, consisting mainly of alluvium (up to 20m thick), combined with the contamination which remains in the ground at depth, is likely to eliminate infiltration as a potential drainage technique.
- Because the site needs to drain from east to west to connect to the River Aire to the west of the old landfill area, the storage feature will need to be at the western end where there is no space in the layout for external SuDS features, such as open ponds or swales.

4.2.4 As part of the detailed design undertaken to discharge the planning conditions of the original permission, other SuDS devices, such as oversized pipes and permeable paving with cellular storage beneath have been incorporated into the drainage network.

These devices have had the effect of reducing the volume necessary for the underground tank shown on Drawing No SH11087-010. As shown on Drawing No SH11087-020 *Drainage Layout*, two relatively small areas of shallow cellular storage will now suffice.

4.2.5 The principle of the on-site drainage system is that all road and yard water will be passed though suitable oil interceptors before being stored in the underground tank, whereas roof water from the buildings will be delivered to the tank without passing through the interceptors.

4.2.6 The outlet from the drainage system will pass through a Hydrobrake which will limit the flow to 25 l/s before being delivered to the River Aire via a 225mm diameter pipe, thrust bored beneath the dual carriageway of the Aire Valley Road.

4.2.7 The surface water drainage system will also be designed in accordance with Sewers for Adoption (6th Edition) with sufficient capacity for a 1 in 30 year event. The system will allow minor surcharging during a 1 in 100 event, but no surface water will be permitted to leave the site. As can be seen from the hydraulic calculations added at Appendix III, the drainage system shown can achieve this aim between the site and the River Aire.

4.2.8 All relevant authorities will be kept fully informed regarding the detailed design of the surface water drainage system. It is normal practice for detailed surface water drainage design to be subject to the approval of the local planning authority subsequent to the grant of planning permission and this will be sought from City of Bradford Metropolitan District Council at the appropriate time.

4.2.9 Consequently, it is not considered that there will be any significant flooding caused either within the site or in the surrounding area by future site surface water.

4.3 Foul Sewerage

4.3.1 As advised by YWS in the Pre-Planning Sewerage advice and confirmed at a meeting held at Western House, Bradford on 26 November 2013, a foul sewer connection may be made to any of the 1400/1350/900mm diameter public combined sewers crossing the site.

4.3.2 As part of the detailed design undertaken to discharge the planning conditions of the extant permission (13/04217/FUL), a foul sewer system was devised which connects to the 1350mm diameter public combined sewer at the eastern end of the site as shown on Drawing No SH11087-020. At the appropriate time, application will be made

to YWS for consent to discharge foul sewage from the proposed development to the public sewer system.

4.3.3 All relevant authorities will be kept fully informed regarding the detailed design of the foul sewerage system. It is normal practice for detailed foul water drainage design to be subject to the approval of the local planning authority subsequent to the grant of planning permission and this will be sought from City of Bradford Metropolitan District Council at the appropriate time.

4.4 Groundwater Flooding

4.4.1 It is unlikely that there is any significant risk of groundwater flooding at the site.

4.5 Allowance for Climate Change

4.5.1 Climate change has been taken account of in calculating the storage volumes for the SuDS-based drainage system in line with the EA publication *Flood risk assessments: climate change allowances*, dated 19 February 2016 – see Appendix III.

4.6 Residual Risk

4.6.1 The site is situated in Flood Zone 1 and the site development is unlikely to warrant the adoption of any warning or evacuation procedure or the incorporation of flood resilient materials into the design.

4.7 Sequential Test

4.7.1 The proposed development lies within in NPPF Flood Zone 1 and thus the Sequential Test is not required.

5 CONCLUSIONS

5.1.1 The site is entirely situated in Flood Zone 1 with no significant risk of fluvial flooding. The proposed commercial land use fully complies with the planning guidance relating to flood risk and drainage.

5.1.2 Surface water run-off will be dealt with on site by appropriate SuDS related techniques, namely attenuation storage. The outflow will be directed to the River Aire at the Greenfield run-off rate. The feasibility of such a system has been established by the surface water drainage design described above.

5.1.3 There is no evidence of any significant risk of groundwater flooding.

5.1.4 Foul water will be discharged to public combined sewer.

5.1.5 Climate change has been allowed for in the storage calculations.

5.1.6 No warning or evacuation procedures or the incorporation of flood resilient materials will be necessary.

5.1.7 The Sequential Test is not a requirement for the development which will be entirely located in Flood Zone 1.

5.1.8 With regard to flood risk, therefore, the site is suitable for the proposed development.

A P P E N D I X I

Environment Agency Correspondence

Lymer, James

From:	Beech, Cheryl [Cheryl.Beech@environment-agency.gov.uk]
Sent:	13 August 2013 13:57
To:	Lymer, James
Subject:	Your Enquiry: RFI/2013/26659
Attachments:	Standard_Notice sept 2012.pdf; VAT Receipt.pdf; Flood History Map.pdf; Flood Map.pdf; Node Point Locations.pdf; NPPF TG Climate Change extract.pdf; River Aire Model Results.pdf; River Worth Model Results - Defended.pdf; River Worth Model Results - Undefended.pdf

Our Ref: RFI/2013/26659

Your Ref:

Dear James

RE: Land off Marley Road, Keighley

Thank you for your request of 29 July 2013 regarding the above site.

Supporting Information

The Flood Map

Please see the see enclosed extract from the Flood Map.

The Flood Map provides information on flooding from rivers and the sea for England and Wales. The Flood Map also has information on flood defences and the areas benefiting from those flood defences.

The Flood Map shows the following:

1. Flood Zone 3 (dark blue area on the enclosed map): natural flood plain area that could be affected by flooding from rivers and/or the sea – not taking into account the presence of any flood defences
   - For flooding from rivers the map indicates the extent of a flood with a 1% (1 in 100) chance of happening each year;
   - For flooding from the sea the map shows the extent of a flood with a 0.5% (1 in 200) chance of happening each year.

2. Flood Zone 2 (light blue area): natural flood plain area that could be affected by flooding from rivers and/or the sea – not taking into account the presence of any flood defences. Flood Zone 2:
   - indicates the extent of a flood with a 0.1% (1 in 1000) chance of happening each year.
   - and/or indicates the greatest recorded historic flood, whichever is greater.

3. Flood defences built in the last five years to protect against river floods with a 1% (1 in 100) chance of happening each year, together with some natural or constructed entities which retain, store or channel water and which may protect against smaller floods.

4. Areas benefiting from flood defences - areas that benefit from the flood defences shown, in the event of a river flood with a 1% (1 in 100) chance of happening each year, or a flood from the sea

with a 0.5% (1 in 200) chance of happening each year. If the defences were not there, these areas would flood.

Flood History

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

Water causing flooding can come from different places, for example from rivers or the sea; surface water (i.e. rainwater flowing over or accumulating on the ground before it is able to enter rivers or the drainage system); overflowing or backing up of sewers or drainage systems which have been overwhelmed or from groundwater rising up from underground aquifers.

Currently the Environment Agency can only supply flood risk data relating to the risk of flooding from rivers or the sea. However you should be aware that in recent years, there has been an increase in flood damage caused by surface water flooding or drainage systems that have been overwhelmed. Local Authorities and/or Water Companies may be able to provide some knowledge on the risk of flooding from sources other than rivers and the sea and we are working with these organisations to improve knowledge and understanding of surface water flooding.

Modelling - Lower River Aire Modelling – Knostrop Weir to confluence with River Ouse

See attached information from the Lower Model Update study (produced by Atkins in 2008).

Extracts consist of

- A spreadsheet showing:
    - results for peak water levels for the 0.5% (1 in 200yr), 1% (1 in 100yr), 2% (1 in 50yr), 4% (1 in 25yr) and 10% (1 in 10) annual chance events for the defended scenario and for peak water levels for the 1% (1 in 100yr) for the undefended scenario;
    - results for the 1% (1 in 100yr) peak water levels for the 2025 and 2115 Climate Change Scenario (+10% Flow combined with 200yr Tidal event);
- an associated map showing the location of the model node points.

Please note: there are no results available from this study for the 0.1% (1 in 1000yr) scenario.

Climate Change

See attached extract from the National Planning Policy Framework Technical Guidance by Communities and Local Government.

LIDAR Data

Light Detection and Ranging (LIDAR) is an airborne mapping technique, which uses a laser to measure the distance between the aircraft and the ground. This technique results in the production of an accurate, cost-effective terrain model suitable for assessing flood risk and other environmental applications.

The Environment Agency owns two LIDAR systems, which are installed in a survey aircraft along with its other operational remote sensing instruments.

The aircraft is positioned and navigated using Global Positioning System (GPS) corrected to known ground reference points. The aircraft typically flies at a height of about 800 metres above

ground level and a scanning mirror allows a swath width of about 600 metres to be surveyed during a flight.

To get a license for the data you will need to contact our Science Group, stating the area you are interested in (preferably an OS Grid Reference, or a map with the area outlined). There may be a charge for this data.

Low resolution Data is returned as an ASCII grid, which can easily be converted to a surface model for use in most GIS applications, and is provided in 2km x 2km tiles, at a resolution of 2m.

High resolution Data is also returned as an ASCII grid, in 0.5km x 0.5km tiles, at a resolution between 0.125 and 0.5m.

For current catalogue of coverage see: http://www.geomatics-group.co.uk/GeoCMS/order.aspx

To obtain the data and license agreement, please contact:

Environment Agency Geomatics
Phoenix House
Lower Bristol Road
Bath BA2 9ES
Tel: 01225 487658
Fax: 01225 487643
E-mail: archived-lidardata@environment-agency.gov.uk
Or visit the website at www.geomatics-group.co.uk

Unfortunately, we do not hold any information relating to groundwater flooding in this area. Mapping the risk of flooding from groundwater is complex and is currently not possible. There are no flood risk maps for groundwater. If you want to find out if a property could be at risk of flooding from groundwater or may have flooded in the past you should contact your Lead Local Flood Authority.

Greenfield surface water run off rates (to be agreed with Bradford Drainage Dept) would be expected from this development site. This applies for up to and including the 1 in 100 year (plus climate change) rainfall event.

The River Aire which is classed as main river is within 500m of the site.

We do not have information about unlicensed water abstractions.

There is one licensed abstraction within 1km of the site

NALD Abstraction Points

Licence No:	2/27/14/003
Area Code:	RIDIN
EA Area Name:	ENVIRONMENT AGENCY RIDINGS AREA
LEAP Code:	AIREL
LEAP Name:	AIRE LEAP
Original Effective Date:	01-Dec-1965
Issue No:	101
Increment No:	1
Start Date:	01-Apr-2008

Original Application No:	835
Version Application No:	835
Holder Name:	AMMERAAL BELTECH LTD
Address Line1:	FOXHOLES BUSINESS PARK
Address Line2:	JOHN TATE ROAD
Town:	HERTFORD
County:	HERTFORDSHIRE
Postcode:	SG13 7QE
Purpose Code:	I
Sub Purpose Code:	TXT
Use Code:	160
Purpose Description:	Industrial, Commercial And Public Services
Sub Purpose Description:	Textiles & Leather
Use Description:	General Use Relating To Secondary Category (Medium Loss)
Abstraction Start:	01/01
Abstraction End:	31/12
Lands:	PARKSIDE TANNERY,KEIGHLEY
Source of Supply Code:	G
Source Description:	GROUNDWATERS
Point Name:	BOREHOLE - MILLSTONE GRIT - KEIGHLEY
Point Type:	SP
NGR1:	SE07204130
Cartesian1 Easting:	407200
Cartesian1 Northing:	441300
Aquifer Type:	L2714 CARBONIFEROUS MILLSTONE GRIT 2\27\14 (RIVER WORTH CATCHMENT)

We do not have any groundwater chemistry/quality monitoring points within 1km of the site

We do not have any groundwater level monitoring points within 2km of the site

There are no landfill sites within 250m of the site.

This information is provided subject to the attached notice which we advise that you should read.

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http://www.surveyshack.com/link/a3d10

If you require any further help, please do not hesitate to contact me.

Yours sincerely

Cheryl Beech
Customers and Engagement Team
Direct Dial 0113 8196360
Email neyorkshire@environment-agency.gov.uk

Please note: I only work part time - my usual working days are Tuesday, Wednesday & Thursday

Have your say on the choices shaping the water environment. The Challenges and Choices consultation launches 22 June 2013.

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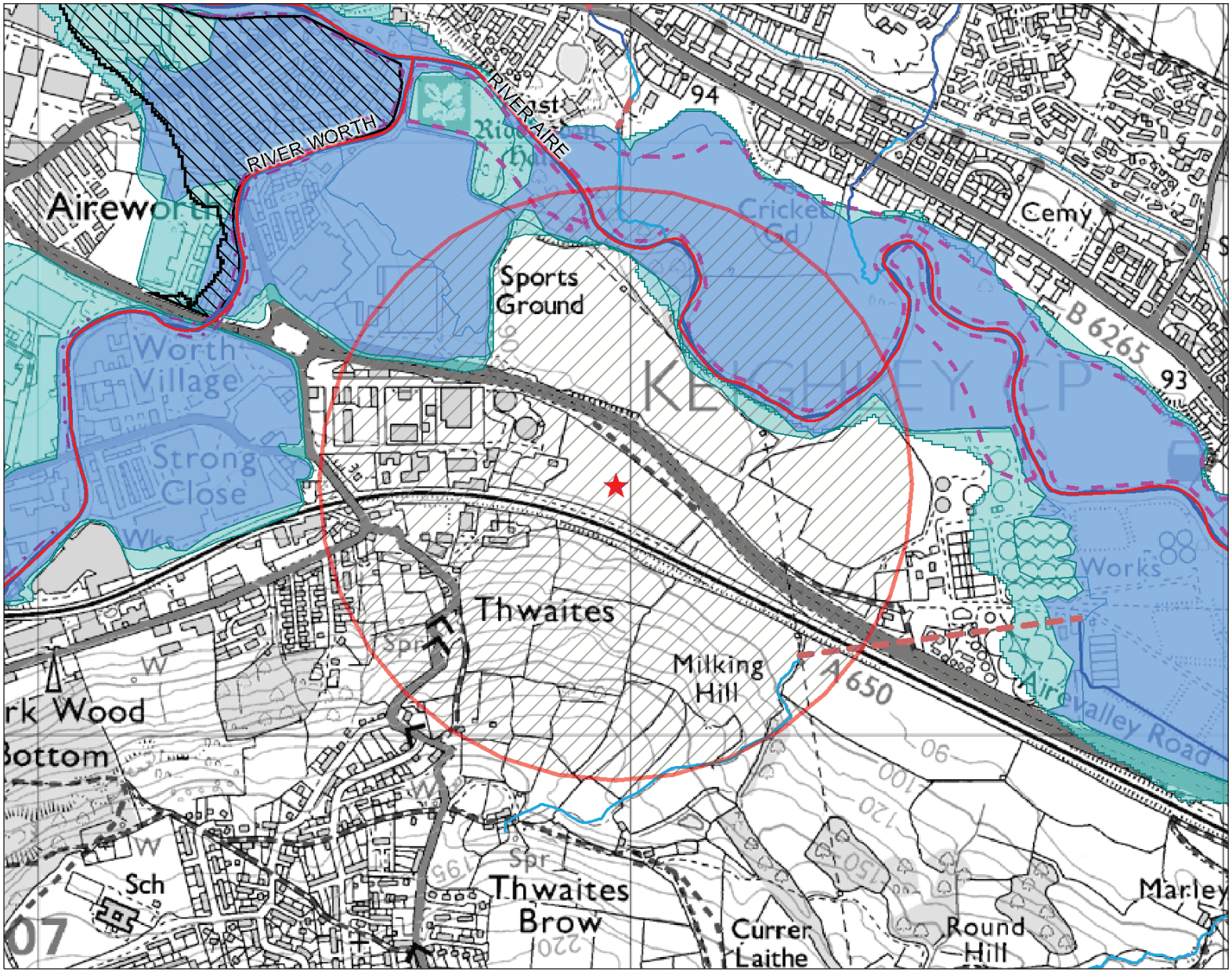
Flood Map Centred on 407977,441419 - created on 7/8/13 - Enquiry 26659



Environment Agency

Scale 1:10,001

N W E S

- Sealed Main Rivers
- Detailed River Network
- Primary River
- Secondary River
- Tertiary River
- Lake / Reservior
- Canal
- Culvert
- Canal Tunnel
- Underground River (inferred)
- Underground River (local knowledge)
- Underground River (Potential Sewer)
- Flood Map - Defences
- Areas Benefiting from Flood Defences
- Flood Map - Flood Storage Areas
- Flood Map - Flood Zone 3
- Flood Map - Flood Zone 2

Flood Map Areas (assuming no defences)

Flood Zone 3 shows the area that could be affected by flooding:
- from the sea with a 1 in 200 or greater chance of happening each year
- or from a river with a 1 in 100 or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to a 1 in 1000 chance of occurring each year.

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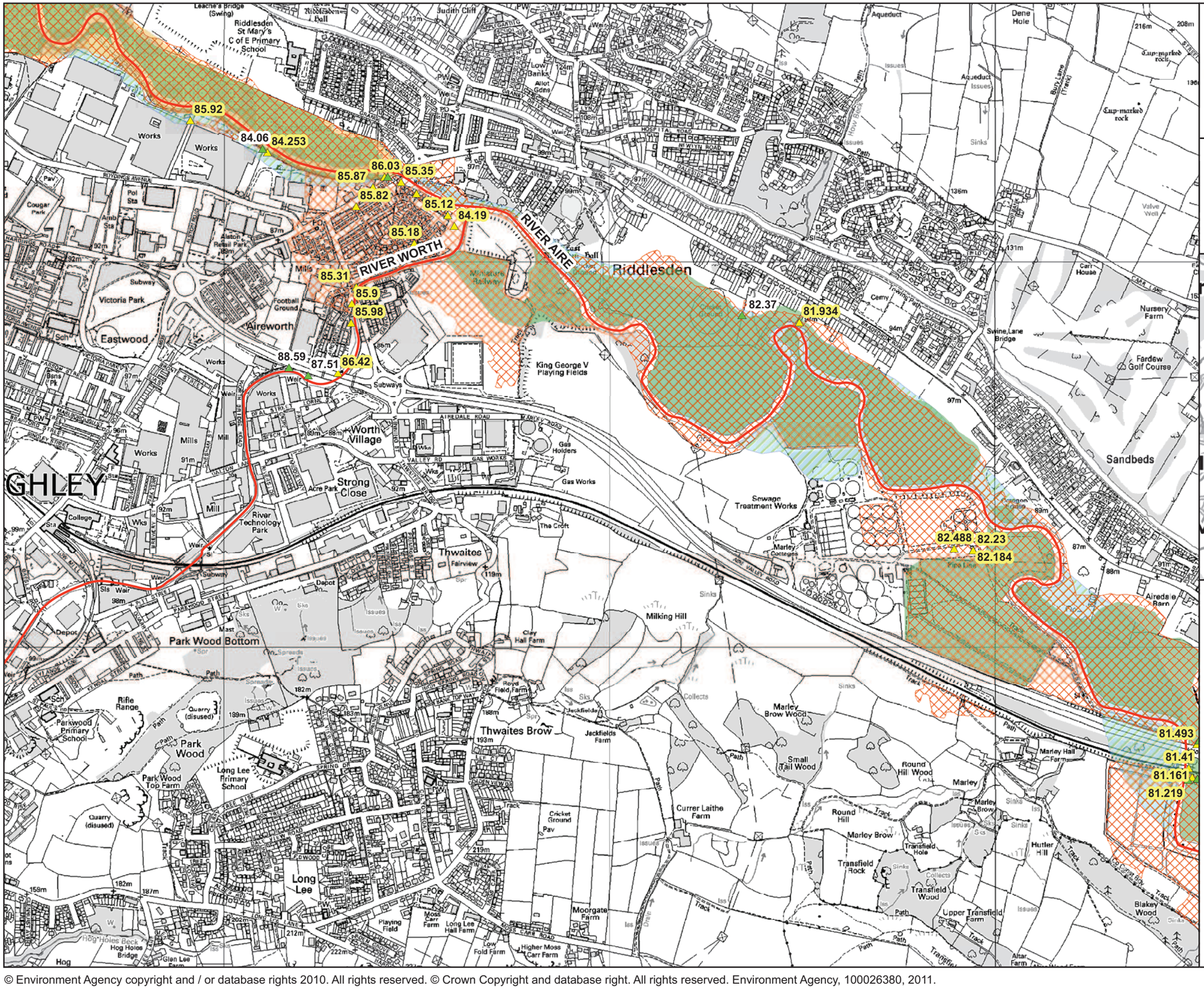
Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Flood History Map for Marley Road, Keighley - dated: 13/08/2013 [Ref: 26205]



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N W E S

Flood Extents

Legend

- Main River
- Feb 2002 Flood Event Flood Level (m)
- Autumn 2000 Flood Event Flood Level (m)
- Autumn 2000 Flood Event Flood Extent
- Feb 2002 Flood Event Extent
- 1995 Flood Event Flood Extent
- 1982 Flood Event Flood Extent
- River Aire 1978 Flood Event Flood Extent

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RFI 26659 - River Worth Model Results (Level - mAOD)

Undefended

Node	10yr	25yr	50yr	75yr	100yr	100yrCC	200yr
WORT01_00729	86.929	87.061	87.242	87.363	87.377	87.629	87.524
WORT01_00631	85.837	85.94	86.074	86.22	86.166	86.387	86.3
WORT01_00541	85.166	85.294	85.485	85.547	85.6	85.852	85.738
WORT01_00438	84.879	85.078	85.333	85.354	85.452	85.736	85.601

RFI 26659 - River Worth Model Results (Level - mAOD, Flow - m^3s)

Defended

NodePointName	ReturnPeriod	LevelValue	FlowValue
EA1231148	100	85.412	88.781
EA1231148	50	85.29	79.147
EA1231148	200	85.598	99.732
EA1231148	25	85.113	70.643
EA1231148	1000	87.133	145.894
EA1231148	10	84.842	58.294
EA1231148	75	85.354	85.052
EA1231148	25	85.353	70.669
EA1231148	1000	87.101	146.303
EA1231148	100	85.595	88.79
EA1231148	200	85.753	99.769
EA1231148	50	85.481	79.163
EA1231148	75	85.547	85.059
EA1231148	10	85.169	58.303
EA1231148	25	86.034	70.639
EA1231148	10	85.87	58.301
EA1231148	100	86.263	88.791
EA1231148	1000	87.087	146.536
EA1231148	200	86.38	99.772
EA1231148	50	86.151	79.161
EA1231148	75	86.22	85.049
EA1231148	200	87.524	99.766
EA1231148	50	87.242	79.163
EA1231148	100	87.377	88.793
EA1231148	25	87.118	70.635
EA1231148	10	86.929	58.306
EA1231148	1000	88.051	149.642
EA1231148	75	87.363	86.644

RFI 26659 - River Aire Model Results

Defended

Node Label	Baseline Design Event Peak Water Levels					
	10% Annual Chance Event WL (mAOD)	4% Annual Chance Event WL (mAOD)	2% Annual Chance Event WL (mAOD)	1.3% Annual Chance Event WL (mAOD)	1% Annual Chance Event WL (mAOD)	0.5% Annual Chance Event WL (mAOD)
2672205189	83.17	83.3	83.4	83.46	83.5	83.61
2672204882	82.76	82.91	83.04	83.1	83.14	83.28
2672204718	82.64	82.81	82.95	83.01	83.06	83.2
2672204544	82.47	82.68	82.84	82.91	82.96	83.11

Node Label	Baseline Design Events Peak Flow					
	10% Annual Chance Event Flow (m^3/s)	4% Annual Chance Event Flow (m^3/s)	2% Annual Chance Event Flow (m^3/s)	1.3% Annual Chance Event Flow (m^3/s)	1% Annual Chance Event Flow (m^3/s)	0.5% Annual Chance Event Flow (m^3/s)
2672205189	147.62	170.62	188.74	197.61	204.44	225.31
2672204882	151.5	177.19	197.56	207.7	215.62	239.33
2672204718	151.31	176.88	197.26	207.42	215.43	239.15
2672204544	151.02	176.46	196.88	207.19	215.23	238.94

Undefended

Node Label	Do Nothing Option 1A Scenario Peak Water Levels					
	10% Annual Chance Event WL (mAOD)	4% Annual Chance Event WL (mAOD)	2% Annual Chance Event WL (mAOD)	1.3% Annual Chance Event WL (mAOD)	1% Annual Chance Event WL (mAOD)	0.5% Annual Chance Event WL (mAOD)
2672205189	83.22	83.32	83.41	83.46	83.5	83.59
2672204882	82.81	82.94	83.05	83.1	83.14	83.26
2672204718	82.69	82.84	82.96	83.01	83.06	83.18
2672204544	82.54	82.71	82.85	82.91	82.95	83.08

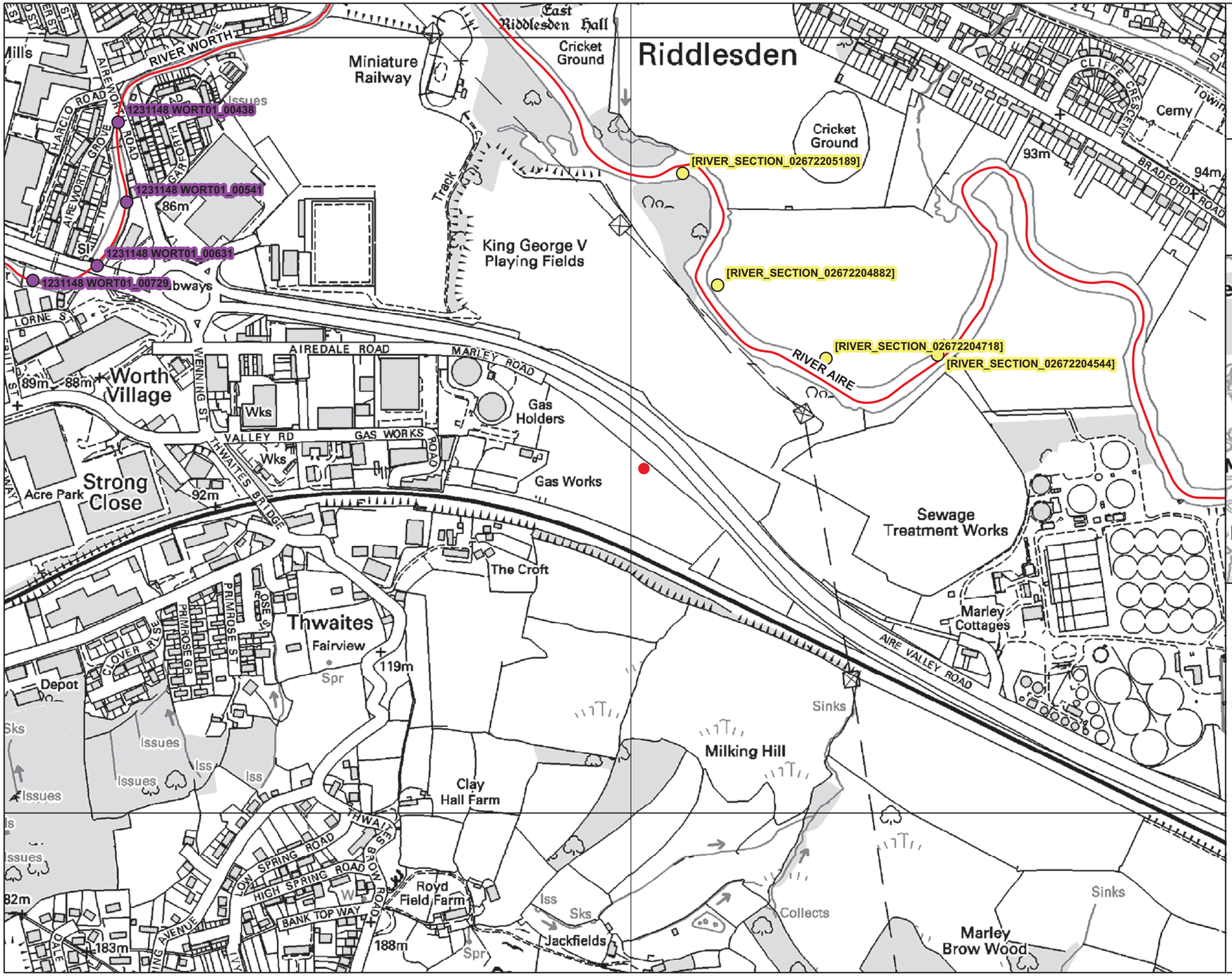
Node Label	Do Nothing Option 1A Peak Flows					
	10% Annual Chance Event Flow (m^3/s)	4% Annual Chance Event Flow (m^3/s)	2% Annual Chance Event Flow (m^3/s)	1.3% Annual Chance Event Flow (m^3/s)	1% Annual Chance Event Flow (m^3/s)	0.5% Annual Chance Event Flow (m^3/s)
2672205189	156.03	175.19	190.62	198.78	204.84	222.8
2672204882	160.5	182.01	199.58	208.89	215.88	236.34
2672204718	160.34	181.71	199.27	208.59	215.6	236.07
2672204544	160.04	181.3	198.91	208.26	215.28	235.79

Climate Change

Node Label	2050 Climate Change Scenario Peak Water Levels					
	10% Annual Chance Event WL (mAOD)	4% Annual Chance Event WL (mAOD)	2% Annual Chance Event WL (mAOD)	1.3% Annual Chance Event WL (mAOD)	1% Annual Chance Event WL (mAOD)	0.5% Annual Chance Event WL (mAOD)
2672205189	83.24	83.37	83.49	83.56	83.61	83.75
2672204882	82.84	83	83.14	83.22	83.28	83.46
2672204718	82.73	82.9	83.06	83.14	83.2	83.39
2672204544	82.58	82.79	82.95	83.04	83.11	83.31

Node Label	2050 Climate Change Scenario Peak Flow					
	10% Annual Chance Event Flow (m^3/s)	4% Annual Chance Event Flow (m^3/s)	2% Annual Chance Event Flow (m^3/s)	1.3% Annual Chance Event Flow (m^3/s)	1% Annual Chance Event Flow (m^3/s)	0.5% Annual Chance Event Flow (m^3/s)
2672205189	159.3	181.85	203.64	215.28	225.32	253.08
2672204882	164.58	190.02	214.82	228.02	239.41	271.04
2672204718	164.41	189.76	214.64	227.87	239.24	270.78
2672204544	164.17	189.49	214.43	227.71	239.03	270.53

Node Point Locations - Marley Road, Keighley Date Created: 13/08/2013



Environment Agency

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N W E S

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LEGEND

- River Aire Node Points
- River Worth Node point
- Main River

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Taking climate change into account

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

Table 4: Recommended contingency allowances for net sea level rises

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

Notes to table 4:

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

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

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

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

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

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

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

Notes to table 5:

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

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

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

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

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

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

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Ms Carole Howarth
City of Bradford Metropolitan District Council
Development Management
Jacobs Well
Bradford
West Yorkshire
BD1 5RW

Our ref: RA/2013/126690/01-L01
Your ref: 13/04217

Date: 06 November 2013

Dear Ms Howarth

DEVELOPMENT OF THREE PLANTS TO RECOVER ENERGY FROM WASTE, WITH MATERIALS RECEPTION AND FEEDSTOCK BUILDING, OFFICES, EDUCATION/VISITOR CENTRE, PARKING AND LANDSCAPING – LAND EAST OF FORMER GAS WORKS, AIREDALE ROAD, KEIGHLEY, WEST YORKSHIRE

Thank you for consulting us on the above application that we received on 17 October 2013.

We have no objection to the proposed development subject to the following conditions and comments.

FLOOD RISK
The proposed development will only meet the requirements of the National Planning Policy Framework if the following measures as detailed in the flood risk assessment submitted with this application are implemented and secured by way of a planning condition on any planning permission.

Condition:
The development permitted by this planning permission shall be carried out in accordance with the approved flood risk assessment (FRA), dated August 2013, and the following mitigation measures detailed within the FRA:

1. Limiting the surface water run-off generated by the up to and including 1 in 100 year critical storm so that it will not exceed the run-off from the undeveloped site and not increase the risk of flooding off-site. Surface water run-off rates to sewer should be finalised with Yorkshire Water.

The mitigation measures shall be fully implemented prior to occupation and subsequently in accordance with the timing / phasing arrangements embodied within the scheme, or within any other period as may subsequently be agreed, in writing, by the local planning authority.

Reason:
To prevent flooding by ensuring the satisfactory storage of/disposal of surface water from the site.

ENVIRONMENTAL PERMIT

In this response to the planning application, we have also include information gathered via permit pre-application discussions with a consultant representative dealing with the permit application. He has given verbal permission to disclose content from our discussions. The proposal includes several activities:

1. Energy from waste plant using moving grate technology. Waste will be refuse derived fuel. The source of the refuse derived fuel is currently unknown.

2. Tyre crumb melting plant which is a tyre pyrolysis process. Shredded tyre will be introduced to the pyrolysis reactor. The biochar will be sent off site for resale. The syngas will be cleaned to remove particulates and bio-oil (for onward sale) and then re-used in the pyrolysis process as a fuel.

3. Plastics melting plant which is a process of catalytic cracking of plastics to produce a combination of oils for onwards use as fuels. The oils are purified using distillation. The cracking, which is likely to be a pyrolysis process, will also produce a bituminous waste and a syngas which is recycled via the distillation column back to the pyrolysis process.

We have used our guidance for developments requiring planning permission and environmental permits and have established that there are no show stoppers or serious concerns relating to the location of the proposed development.

We have established that there are no show stoppers because:

The site is not on a groundwater source protection zone 1.

We have established that there are no serious concerns because:

- The site is not on a groundwater source protection zone 2 (nearest 3km away);
- The site is not near on within an air quality management zone (nearest 28km away);
- The site is not within 2km^2 of a SSSI (equivalent to radius of 0.7km, nearest in 2.9km away);
- The site is not within 10km^2 of a SAC/SPA or Ramsar site (equivalent to radius 1.78km, nearest is 2.9km away).

Informatives:

Our guidance, provides information on useful sector specific issues that we would want to raise in the planning process. These include:

1. The Operator will require an environmental permit, most likely from the Environment Agency. Our current understanding is that:

a. The RDF energy plant will be covered by chapter 5.1 of the Environmental Permitting Regulations ("EPR") and as such will need to comply with the requirements of chapter IV of the Industrial Emissions Directive ("IED") (formally the Waste Incineration Directive).

b. The tyre pyrolysis process will be a 5.1 activity also, and again this will need to comply with the requirements of chapter IV of the IED. However should the Operator be able to clean the returned syngas up to the same quality as equivalent virgin fuel, they would be able to apply for the end of waste test. This could mean that the process becomes a pyrolysis activity regulated under chapter 1.2 of the EPR.

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c. There is insufficient information provided at the moment to define whether the plastics melting process is a 5.1 activity or a 1.2 activity. We have asked the applicant for additional information regarding this. The implications are as per the tyre pyrolysis plant.

2. We note that the air emissions modelling data is based on the emissions from the RDF energy plant and also the tyre pyrolysis process. I note that the operator has used nitrogen oxides emission levels for the RDF energy plant, tighter than the chapter IV IED emission limit values to ensure that the impact on the Habitats site 2.9km to the north east of the site are insignificant.

In the planning application, the applicant has assumed that the emissions will be similar to those from a landfill gas engine. However these emissions will not be the same as those from an 'incineration' process. The applicant should revisit the abatement techniques on this process to look at achieving lower emissions, in particular to meet the requirements of chapter IV of the IED. The same comment may apply to the plastics melting plant, depending on any additional information that is provided for that process which will help to define what those emissions might be.

Once finalised, the applicant's modelling will be assessed as part of the permit application determination.

Incineration (and combustion) - Combined heat and power (CHP)-ready requirements:
We will require all new energy from waste plants (that don't include CHP from the outset) to be CHP-ready to a sufficient degree dictated by the likely future technically viable opportunities for heat supply in the vicinity of the plant. Environmental permit applications for these types of plants will, therefore, need to include a BAT assessment for CHP-readiness for which we will produce a guidance note. Permits for these plants are also likely to contain conditions that state opportunities to realise CHP should be reviewed from time to time. These opportunities may be created both by new building heat loads near the plant, and/or be due to changes in policy and financial incentives that make it more economically viable for the plant to be CHP.

The operator has indicated that the plant will be CHP ready and that there are potential opportunities to use the heat and energy generated.

We have not reviewed the information provided in detail as this will be done when an application is made for an Environmental Permit. Air emissions will be important for this development. The applicant should consider their impact in combination with background levels.

WATER RESOURCES
We advise the applicant to consult with Yorkshire Water regarding their capacity to supply mains water to this development. If the applicant is intending to source water from a new private abstraction they should refer to the Aire and Calder Catchment Abstraction Management Strategy (2013), available on the Environment Agency's website, for information about local water availability. We would also ask that the following standard paragraph is included:

If the applicant intends to abstract more than 20 cubic metres of water per day from a surface water source (e.g. stream or drain) or from underground strata (via borehole or well) for any particular purpose then they will need an abstraction licence from the Environment agency. There is no guarantee that a licence will be granted as this is

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dependent on available water resources and existing protected rights.

WATER EFFICIENCY

We have made previous comments regarding making efficient use of water in new developments. This does not appear to have been addressed within the application documents.

We endorse the efficient use of water, especially in new developments. Our Water Demand Management Team can provide information and advice on any aspect of water conservation including water saving technologies. New developments could take economic advantage of these technologies and should be considered. Wide spread use of these and other technologies that ensure efficient use of natural resources could support the environmental benefits of future proposals and could help attract investment to the area. Further advice can be obtained from our website at Environment Agency - Save Water .

WATER FRAMEWORK DIRECTIVE (2000/60/EC) / WATER QUALITY

We also reiterate our previous comments regarding the Water Framework Directive, as these have not been addressed in the application documents. The applicant should have regard to their obligations under the Water Framework Directive to protect and prevent deterioration of the water environment. Appropriate mitigation measures should be considered, and where feasible implemented, to ensure compliance with the Humber River Basin Management Plan and the wider aims of the WFD. The waterbody in which the site is located is currently failing to reach its target of 'Good Ecological Potential' under the WFD, and so the consideration of appropriate mitigation measures to ensure no deterioration is particularly important (consult Annex B of the Humber RBMP for more information on this waterbody's status and measures). Furthermore, we would welcome the incorporation of any measures which not only ensure no deterioration, but also contribute to improvement of this waterbody.

WASTE HIERARCHY

We wish to ensure that there are mechanisms in place to uphold the waste hierarchy and get the best outcome in terms of resource use, and we are pleased that these issues have been considered in the application.

The concept of 'need' is a matter for the planning authority, however under the waste hierarchy we do have a duty to ensure that the waste submitted to the process is truly residual and the facility is not competing for feedstock with treatment methods which are higher up the waste hierarchy. We are aware that other countries in Europe with a more developed EFW infrastructure have been successful in achieving recycling rates in excess of 60% alongside incineration, and that in the UK we still rely on landfill.

Defra's recent document 'Energy from Waste A Guide to the Debate - February 2013' is a useful summary of the issues involved, and states that '*The potential for energy from waste to consume materials which could otherwise be managed higher up in the waste hierarchy is a legitimate concern.*'

It goes on to say '*Provided the right action is taken to ensure separation and pre-treatment options are optimised, it is a risk that can be effectively addressed. Energy from waste can and should support, not compete, with effective recycling.*'

With this in mind, we understand that aside from the occasional removal of unsuitable materials there will be no further sorting or segregation of waste materials on site, and therefore any safeguards relating to ensuring compliance with the waste hierarchy will

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be 'upstream' of the plant with the suppliers of the waste.

The applicant must therefore be able to provide information which demonstrates its assertion that only residual waste – '*mixed waste that cannot be usefully reused or recycled (and would otherwise end up in landfill)*', will be used as fuel, without this we cannot be satisfied that the proposal meets the ambitions of the Waste Framework Directive and National Waste Strategy in ensuring that waste is dealt with at the optimum level within the hierarchy.

We propose that the applicant be required to submit a scheme to the planning authority setting out what arrangements will be made for the maintenance of the waste hierarchy in priority order by minimising the quantity of recyclable/reusable waste received for use as fuel through the operational lifetime of the development.

We can advise on the content of such a scheme if required.

LAND CONTAMINATION

Advice to LPA:

We consider that the controlled waters at this site are of low environmental sensitivity, therefore we will not be providing detailed site-specific advice or comments with regards to land contamination issues for this site.

The developer should address risks to controlled waters from contamination at the site, following the requirements of the National Planning Policy Framework and the Environment Agency 'Guiding Principles for Land Contamination'.

Advice to applicant:

We recommend that developers should:

1) Follow the risk management framework provided in CLR11, Model Procedures for the Management of Land Contamination, when dealing with land affected by contamination.

2) Refer to the Environment Agency Guiding Principles for Land Contamination for the type of information that we require in order to assess risks to controlled waters from the site. The Local Authority can advise on risk to other receptors, such as human health.

3) Refer to our guiding principles on groundwater protection are set out in our document GP3 - Groundwater Protection Policy and Practice, which is intended to be used by anyone interested in groundwater and particularly those proposing an activity which may impact groundwater. GP3 is available on our website at: http://www.environment-agency.gov.uk/research/library/publications/40741.aspx

4) Refer to our website at www.environment-agency.gov.uk for more information.

If you require clarification or further advice please contact me on the details below.

Yours sincerely

Mrs Beverley Lambert
Sustainable Places – Planning Advisor

Cont/d..

Direct dial 01904 822510
Direct fax 01904 822649
Direct e-mail bev.lambert@environment-agency.gov.uk

End

APPENDIX II

Yorkshire Water Correspondence

YorkshireWater

Yorkshire Water Services
Developer Services
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PO BOX 52
Bradford
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Tel: 0845 120 8482
Fax: (01274) 372 834

Email:
Technical.Sewerage@yorkshirewater.co.uk

For telephone enquiries ring:
Robert Illingworth on (0845)120 8482

Wardell Armstrong
Unit 5; Newton Business Centre
Thorncliffe Park
Chapeltown
S35 2PH

For the attention of James Lymer

Your Ref:
Our Ref: P010785

19th August 2013

Dear Sirs,

Land off Marley Road, Keighley - Pre Planning Sewerage Enquiry - P155239

Thank you for your letter received on the 1st of August 2013 and remittance. Our official VAT receipt has been sent to you under separate cover. Please find enclosed a complimentary extract from the Statutory Sewer Map which indicates the recorded position of the public sewers.

The following comments reflect our view, with regard to the public sewer network only, based on a 'desk top' study of the site:

The local Waste Water Treatment Works (WWTW) is Marley WWTW . It is understood that this WWTW may only have limited spare capacity, if any, available. We have contacted the respective treatment team for more information regarding the impact of proposed development and will contact you when an assessment has been made.

There is a waste water treatment works, under the control of Yorkshire Water, located near to the site. Vehicular access, including with large tankers, could be required at any time.

The proximity of the existing WWTW to the site may mean a loss of amenity for future residents / workers. In order to minimise the risk of odour, noise and nuisance, industry standards recommend that habitable buildings must not be located within 400 (four hundred) metres of the existing compound. To reduce the visible impact of the installation, the erection (by the developer) of suitable screening is advised.

There are 750mm, 900mm, 1200mm, 1350mm and 1400mm diameter and 990x660mm size and 915 x 610mm size public foul/combined water sewers recorded crossing/crossing close to the site. No buildings are to be erected within 6.5 (six point five) metres, nor trees planted within 5 (five) metres of these public sewers. It may not be acceptable to raise or lower ground levels over these sewers, nor to restrict access to the manholes on these sewers. If you wish to have one or other of these sewers diverted under Section 185 of the Water Industry Act 1991 an application should be made in writing. To discuss this matter, please telephone 0114 251 8321.

Development of the site should take place with separate systems for foul and surface water drainage. The separate system should extend to the public sewer.

Foul water may discharge to the 1400/1350/900mm diameter public combined water sewer recorded crossing within the site.

INVESTING IN VOLUNTEERS FOR EMPLOYERS
CUSTOMER SERVICE EXCELLENCE CSE

YorkshireWater

The developer's attention is drawn to Requirement H3 of the Building Regulations 2000. This establishes a preferred hierarchy for surface water disposal. Consideration should firstly be given to discharge to soakaway, infiltration system and watercourse in that priority order.

Sustainable Drainage Systems (SUDS), for example the use of soakaways and/or permeable hardstanding etc, may be a suitable solution for surface water disposal appropriate in this situation. You are advised to seek comments on the suitability of SUDS in this instance from the appropriate authorities.

Where appropriate, soakaways, swales and infiltration trenches (SUDS) may be adopted as part of the public sewer network. Further information may be seen in the DEFRA publication 'Interim Code of Practice for Sustainable Drainage Systems' (ISBN 0-86017-904-4). If the developer is considering adoption of SUDS they should contact our Developer Services Team on 0845 120 84 82.

The local public sewer network does not have capacity to accept any discharge of surface water from the proposal site. The developer is advised to contact the Environment Agency/local Land Drainage Authority/Internal Drainage Board with a view to establishing a suitable watercourse for discharge.

Please note further restrictions on surface water disposal from the site may be imposed by other parties. You are strongly advised to seek advice/comments from the Environment Agency/Land Drainage Authority/Internal Drainage Board, with regard to surface water disposal from the site.

It is understood that the River Aire is located to the North of the site. This appears to be the obvious place for surface water disposal.

An off-site surface water sewer may be required which may be provided by the developer and considered for adoption under Section 104 of the Water Industry Act 1991. Please telephone 0845 120 84 82 for advice on sewer adoptions. Alternatively, the developer may in certain circumstances be able to requisition off-site sewers under Section 98 of the Water Industry Act 1991 for which an application must be made in writing. For further information, please telephone 0845 120 84 82.

Prospectively adoptable sewers and pumping stations must be designed and constructed in accordance with the WRc publication "Sewers for Adoption - a design and construction guide for developers" 6th Edition as supplemented by Yorkshire Water's requirements, pursuant to an agreement under Section 104 of the Water Industry Act 1991. An application to enter into a Section 104 agreement must be made in writing prior to any works commencing on site. Please contact our Developer Services Team (telephone 0845 120 84 82) for further information.

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

As a last resort, highway drainage may be accepted under certain circumstances. If it can be demonstrated, through satisfactory evidence, that SUDS are not a viable option, there are no watercourses or highway drains available and if capacity is available within the public sewer network, highway drainage discharges to the public sewer network may be permitted. In this event, the developer may be required to enter into a formal agreement with Yorkshire Water Services under Section 115 Water Industry Act 1991 to discharge non-domestic flows into the public sewer network.

The site is within an area that may be affected by river, coastal or estuarine flooding. We would advise you to contact the Environment Agency for details.

Any new connection to an existing public sewer will require the prior approval of Yorkshire Water. You may obtain an application form from our website (www.yorkshirewater.com) or by telephoning 0845 120 84 82.

Yorkshire Water's Industrial Waste Manager must be consulted in respect of any proposed trade

effluent discharge to the public sewer.

All the above comments are based upon the information and records available at the present time. The information contained in this letter together with that shown on any extract from the Statutory Sewer Map that may be enclosed is believed to be correct and is supplied in good faith. Please note that capacity in the public sewer network is not reserved for specific future development. It is used up on a 'first come, first served' basis. You should visit the site and establish the line and level of any public sewers affecting your proposals before the commencement of any design work.

Yours faithfully

Robert Illingworth
Developer Services Technician

MARLEY ROAD

Gas Holders

Gas Distribution Station

Gas Valve Compound

El Sub Sta

Lay-by

Lay-by

River Aire

MP 211.25

THE CROFT

Regency Court
Rest Home

DW

AIREVALLEY ROAD

Lay-by

ETL

1.75

5.31

5.43

5.46

1.89

5.58

2.12

5.76

2.16y2.16

6

5.64

5.11

4.95

407907 : 441343	Map Name : SE0741SE	Title	Partial Key Foul Sewer = F Combined Sewer = C Surface Water Sewer = SW Trade Sewer = TD Partially Separate = PS
YorkshireWater Yorkshire Water, PO Box 500, Halifax Road, Bradford BD6 2LZ Contact Name : Illingworth Contact Tel :		Notes	This plan is furnished as a general guide only and no warranty as to its correctness is given or implied. This plan must not be relied upon in the event of excavations or other works made in the vicinity of public sewers. No house or property connections are shown.
		(Ody) COPYRIGHT STATEMENTS: Reproduced by permission of Ordnance Survey on behalf of HMSO © Crown copyright and database 2004. All rights reserved Ordnance Survey Licence number 100019559	Date Req : 19/08/2013, 15:09:16 Source : Sewer Network Enquiry
			Date Gen : 19/08/2013, 15:09:40

UPN: Undefined Originator: Illingworth, ,

YorkshireWater

Land & Planning
Yorkshire Water Services Ltd
PO Box 500
Western House
Western Way
Halifax Road
Bradford
BD6 2LZ

Tel: (01274) 691111
Fax: (01274) 692643

For telephone enquiries ring:
Z Fayyaz on (01274) 692072

E-mail Zaffer.Fayyaz@yorkshirewater.co.uk

Head of Service
Transportation & Planning Service
City of Bradford Metropolitan District Council
Planning Office
3rd Floor Jacobs Well
Bradford
BD1 5RW

Your Ref: 13/04217/FUL
Our Ref: P015359

11th November 2013

Dear Sir/Madam,

Land East Of Former Gas Works Airedale Road Keighley West Yorkshire - Development of three plants to recover energy from waste, with materials reception and feedstock building, offices, education/visitor centre, parking and landscaping

Thank you for consulting Yorkshire Water regarding the above proposed development. We have the following comments:

The submitted site layout (on drawings 548.02 (--) 007 (revision B) dated 18/09/2013 and 548.02 (--) 003 (first issue) dated July 2013 that have been prepared by Halliday Clark Architects) indicate various new structures will be sited over the public water supply infrastructure located within the site. This could seriously jeopardise Yorkshire Water's ability to maintain the its public network and is not acceptable. **We therefore OBJECT to the application as currently shown**. I strongly advise that, prior to determination of this application, the site layout is amended to allow for adequate protection of the water sewer and water mains. The following points should be addressed.

i) The submitted drawing appears to show a building, water tower, pond and covered walkway proposed to be built-over the line of public sewer/ water mains crossing the site - contrary to our request.

ii) The submitted drawing should show the site-surveyed position of company infrastructure crossing the site.

iii) The submitted drawing should show the required building stand-off distances from the public sewers/ water mains - or an agreed alternative scheme.

iv) Further to the above, the Flood Risk Assessment (prepared by Wardell Armstrong - Report SH11087 dated 30 August 2013) is **not** satisfactory from Yorkshire Water's viewpoint. The report states surface water is proposed to drain to combined sewer crossing the site. The public sewers does not have capacity to accept surface water from the development. Also, Chapter 12 of the Environmental Statement does not cover drainage in sufficient detail and ultimately refers to the FRA. Please clarify.

For further information regarding sewers contact Developer Services Team (telephone 0845 120 84 82). For further information and advice regarding water mains contact: The Water Business Unit (Distribution Assets West), Buttershaw Depot, Western Way, Halifax Road, Bradford BD6 2LZ.

Not withstanding the above, if planning permission is to be granted, the following conditions should be attached in order to protect the local aquatic environment and YW infrastructure:

Unless otherwise approved in writing by the local planning authority, no construction of buildings or other structures shall take place until measures to divert or otherwise formally close the sewers and water mains that are laid within the site have been implemented in accordance with details that have been submitted to and approved by the local Planning Authority.
(In the interest of satisfactory and sustainable drainage and to maintain the public water supply)

Unless otherwise agreed in writing by the local planning authority, no new tree planting or other obstruction (including ground cover reduction/ increase exceeding 0.5 metres) shall be located over or within 5.0 (five) metres either side of the centre line of the water mains, which cross the site.
(In order to allow sufficient access for maintenance and repair work at all times.)

The site shall be developed with separate systems of drainage for foul and surface water on and off site.
(In the interest of satisfactory and sustainable drainage)

No piped discharge of surface water from the application site shall take place until works to provide a satisfactory outfall for surface water have been completed in accordance with details to be submitted to and approved by the local planning authority before development commences.
(To ensure that the site is properly drained and surface water is not discharged to the foul sewerage system which will prevent overloading)

Surface water from vehicle parking and hardstanding areas shall be passed through an interceptor of adequate capacity prior to discharge. Roof drainage should not be passed through any interceptor.
(In the interest of satisfactory drainage)

OBSERVATIONS:

Waste Water

There is a Waste Water Treatment Works (Keighley Marley), under the control of Yorkshire Water, located near to the site.

On the Statutory Sewer Map, there is a 750mm, 900mm, 1200mm, 1350mm and 1400mm diameter and 990x660mm size and 915 x 610mm public foul/combined water sewer recorded to cross the red line site boundary. The presence of the pipes will affect the layout of the site and as such may be a material consideration in the determination of the application. A developer may, where it is reasonable to do so, require a sewerage undertaker to alter or remove a pipe where it is necessary to enable that person to carry out a proposed improvement of land. This provision is contained in section 185 of the Water Industry Act 1991 that also requires the developer to pay the full cost of carrying out the necessary works.

The applicant/agent is being contacted under separate cover on this matter and prior to determining this application you should be satisfied that due regard has been had to the impact the presence of infrastructure will have on the development. Owing to the repeal of section18 of the Building Act 1984, in this instance, Yorkshire Water feels that an appropriate planning condition is necessary to adequately protect the pipe(s) from being built over or near to. It is perceived that this will also be in the interests of future occupiers who may otherwise be dissatisfied. In this instance, a stand-off distance of 6.5 (six point) metres is required at each side of the sewer centre-line.

The development of the site should take place with separate systems for foul and surface water drainage.

Foul water domestic waste should discharge to the 900mm diameter public foul/combined water sewer recorded crossing the site. From the information supplied, it is not possible to determine if the whole site will drain by gravity to the public sewer network. If the site, or part of it, will not drain by gravity, then it is likely that a sewage pumping station will be required to facilitate connection to the public sewer network. If sewage pumping is required the rate should not exceed 8 (eight) litres per second.

On the Statutory Sewer Map, separate public surface water sewers are not recorded within the vicinity of the site and the local public sewer network does **not** have capacity to accept any discharge of surface water from the proposal site.

Sustainable Systems (SUDS), for example the use of soakaways and/or permeable hardstanding, may be a suitable solution for surface water disposal that is appropriate in this situation. The use of SUDS should be encouraged and the LPA's attention is drawn to NPPF. The developer and LPA are advised to seek comments on the suitability of SUDS from the appropriate authorities. The developer must contact the Highway Authority with regard to acceptability of highway drainage proposals.

The developer is advised to contact the relevant drainage authorities with a view to establishing a suitable watercourse for the disposal of surface water. **It is noted that the River Aire is 185 metres to the North of the site.**

Please note further restrictions on surface water disposal from the site may be imposed by other parties. You are strongly advised to seek advice/ comments from the Environment Agency/ Land Drainage Authority/ Internal Drainage Board, with regard to surface water disposal from the site.

An surface water sewer may be required. This may be provided by the developer and considered for adoption by means of a sewer adoption agreement under Section 104 of the Water Industry Act 1991. Alternatively, the developer may in certain circumstances be able to requisition off-site sewers under Section 98 of the Water Industry Act 1991.

The public sewer network is for domestic sewage purposes. This generally means foul water for domestic purposes and, where a suitable surface water or combined sewer is available, surface water from the roofs of buildings together with surface water from paved areas of land appurtenant to those buildings. Land and highway drainage have no right of connection to the public sewer network. Highway drainage, however, may be accepted under certain circumstances; for instance, if SUDS are not a viable option, there is no highway drain available, if there is available capacity, and if it is not detrimental to the public sewer network and the aquatic environment. In this event, the developer will be required to enter into a formal agreement with Yorkshire Water Services under Section 115 Water Industry Act 1991 to discharge non-domestic flows into the public sewer network.

Trade Effluent

Trade effluent may only be discharged to sewer with the prior consent of Yorkshire Water. A trade effluent is any liquid, other than domestic sewage, which is wholly or partly produced in the course of any business. The developer is required to consult with Yorkshire Water's Industrial Waste Section (telephone 0845 1242424) on any proposal to discharge a trade effluent to the public sewer network.

Water Supply

Company records indicate live 100mm / 4" water main cross the red line site boundary, as shown on the enclosed plan. The presence of the mains may affect the layout of the site and therefore I consider it to be a material consideration in the determination of this application. It is recommended that no obstruction encroaches within 3 metres on either side of the mains i.e. protected strip widths of 6 metres.

Further, no new tree planting will be permitted with 5 metres of a water main.

The exact line of the mains will have to be determined on site under Yorkshire Water Services supervision. It may be possible for the mains to be diverted under s.185 of the Water Industry Act 1991. These works would be carried out at the developer's expense. The cost of these works may be prohibitive.

If ground levels are to be significantly altered i.e. increased/ decreased by 500mm of cover, then Yorkshire Water must be consulted to avoid potential damage.

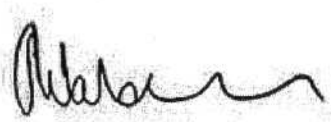
A water supply can be provided under the terms of the Water Industry Act, 1991.

There may be private mains within the site of which we hold no records.

It is important that Yorkshire Water is informed of the local planning authority's decision on this application.

Please send me a copy of the decision notice.

Yours faithfully



Stephanie Walden
Land Use Planning Manager

APPENDIX III

Hydraulic Calculations

Aire Valley EfW
Runoff and Attenuation Estimates

EXISTING SITE CHARACTERISTICS

Site Area: 34861.5m^2

Impermeable area: 24403.05m^2 (based on 70% of site area)

Greenfield Runoff rate: 24.4 litres/second

Brownfield Runoff rate: 64.8 litres/second (based on 100y-6h storm)

PROPOSED SITE CHARACTERISTICS

Impermeable area: 28765.5m^2 (= 24720.4m^2 EfW plant + 4045.1m^2 Offices)

Surface Water Discharge Rate: 24.4 litres/second (Greenfield equivalent)

52 litres/second (Brownfield equivalent less 20% for betterment)

ESTIMATED ATTENUATION REQUIREMENTS

@ Greenfield Rates

	Discharge Rate	**30y attenuation**	**100y+cc attenuation**
EfW Plant area	19.5 litres/sec	835 m^3	1490 m^3
Offices	5 litres/sec	112 m^3	206 m^3
Total	**24.5 litres/sec**	**947 m^3**	**1696 m^3**

@ Brownfield Rates:

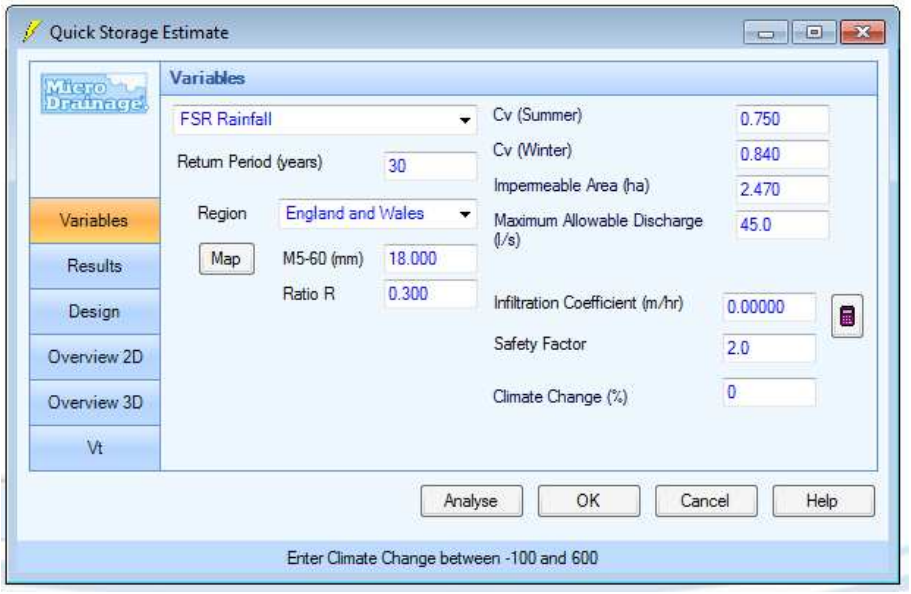
	Discharge Rate	**30y attenuation**	**100y+cc attenuation**
EfW Plant area	45 litres/sec	585 m^3	1100 m^3
Offices	7 litres/sec	97 m^3	182 m^3
Total	**52 litres/sec**	**682 m^3**	**1282 m^3**

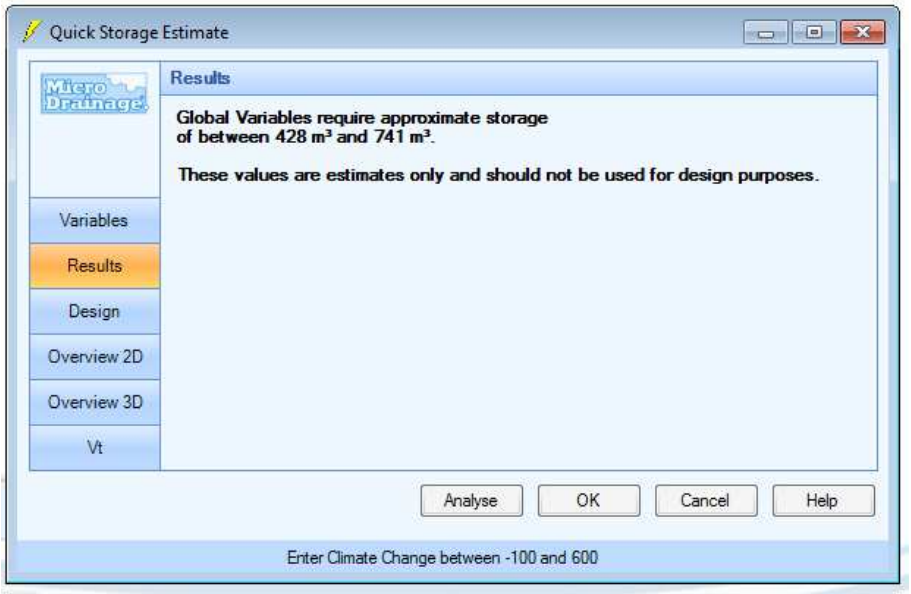
Aire Valley EfW
Attenuation - Quick Storage Estimates

ATTENUATION REQUIRED WITH DISCHARGE RATE RESTRICTED TO EXISTING BROWNFIELD RATES LESS 20%

30 YEAR

EfW Plant Area

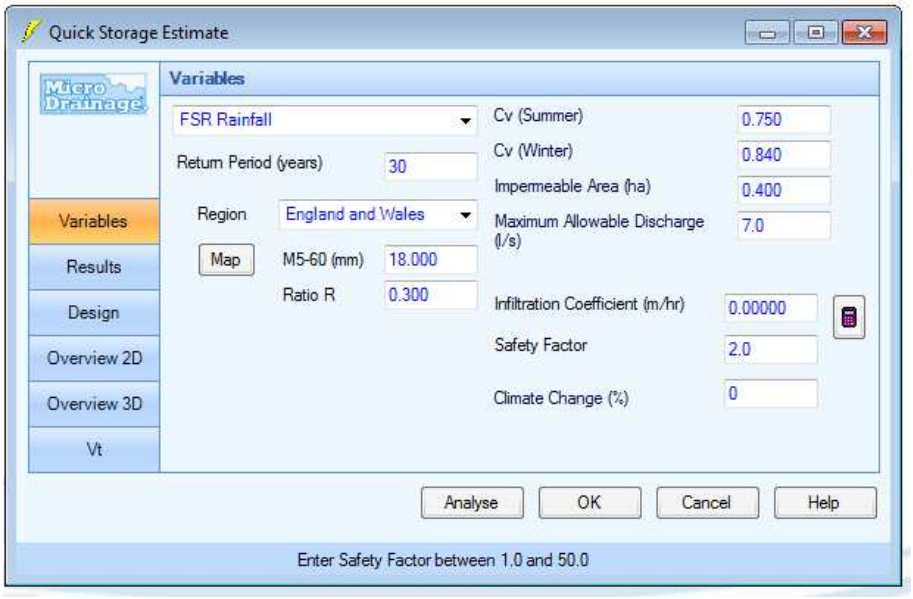


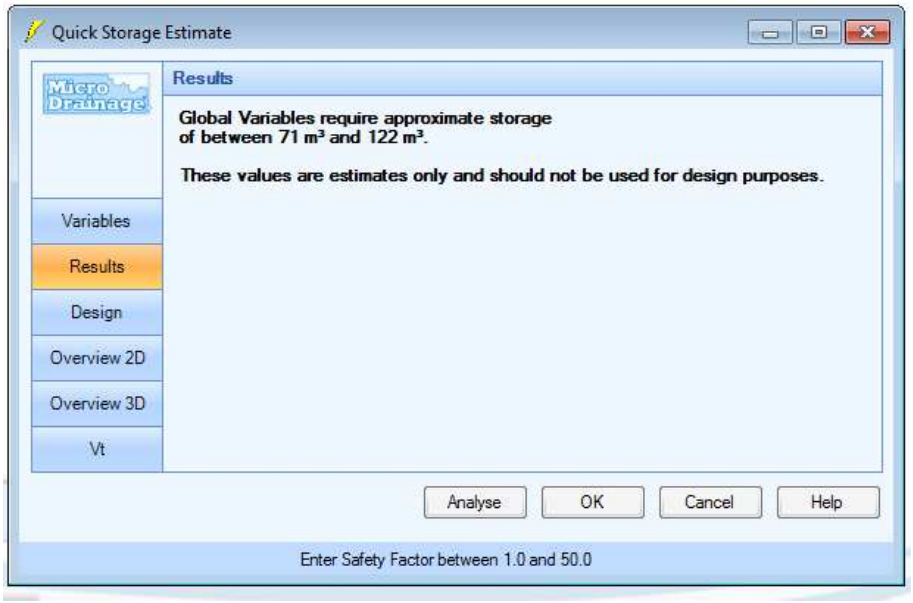


Aire Valley EfW
Attenuation - Quick Storage Estimates

30 YEAR

Offices

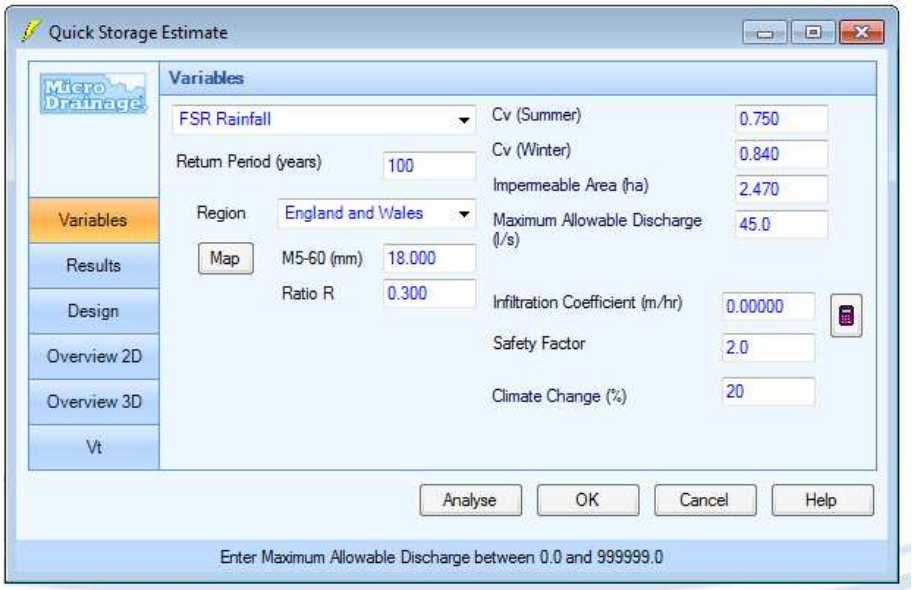


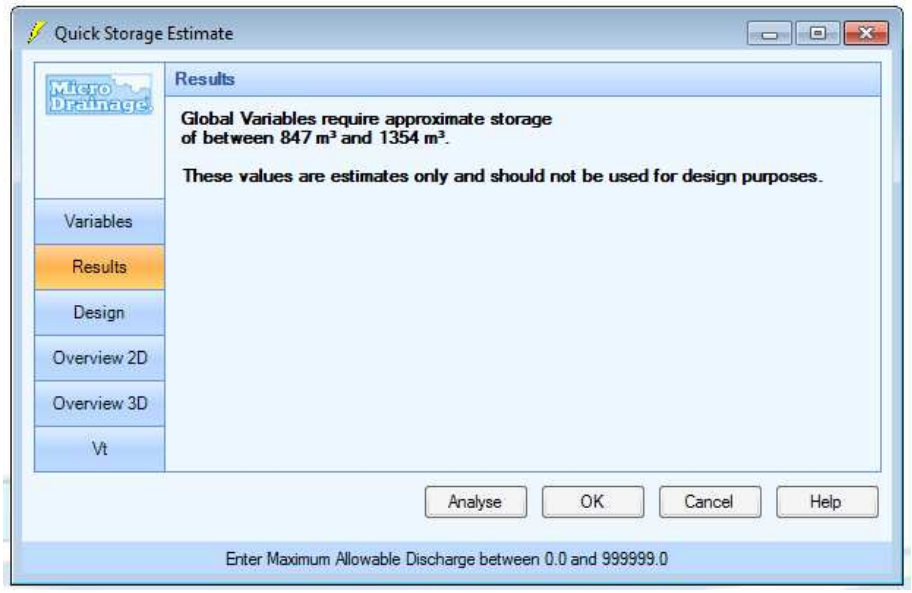


Aire Valley EfW
Attenuation - Quick Storage Estimates

100 YEAR+CC

EfW Plant Area

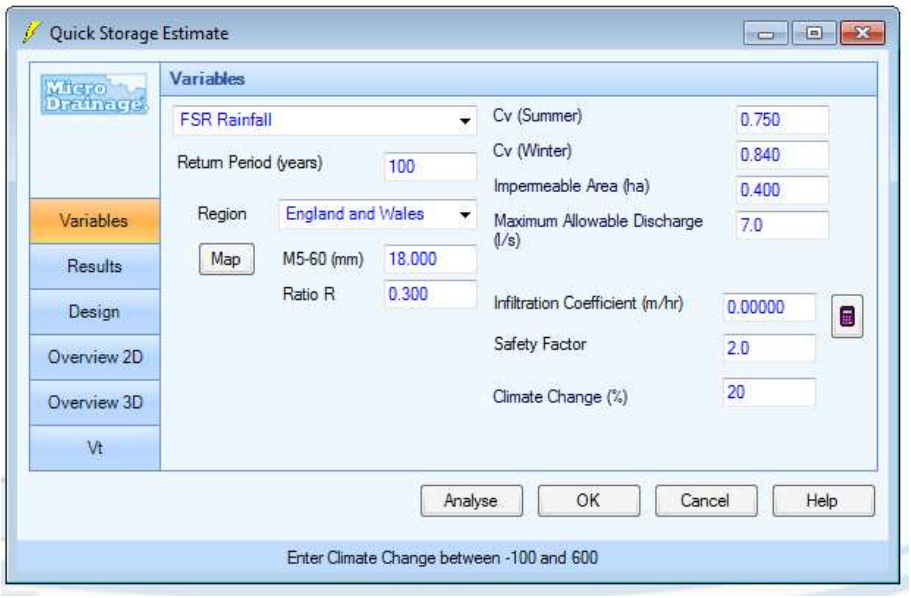


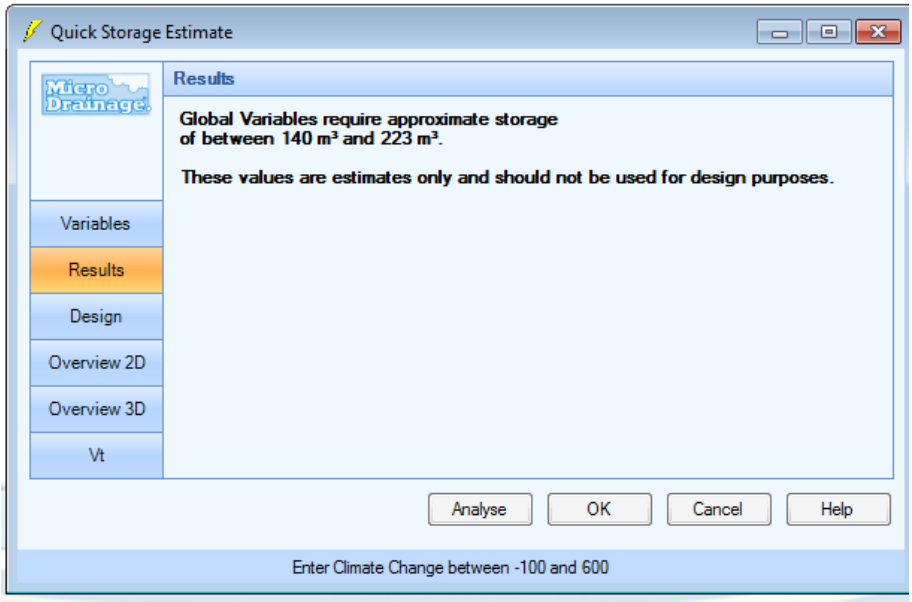


Aire Valley EfW
Attenuation - Quick Storage Estimates

100 YEAR+CC

Offices



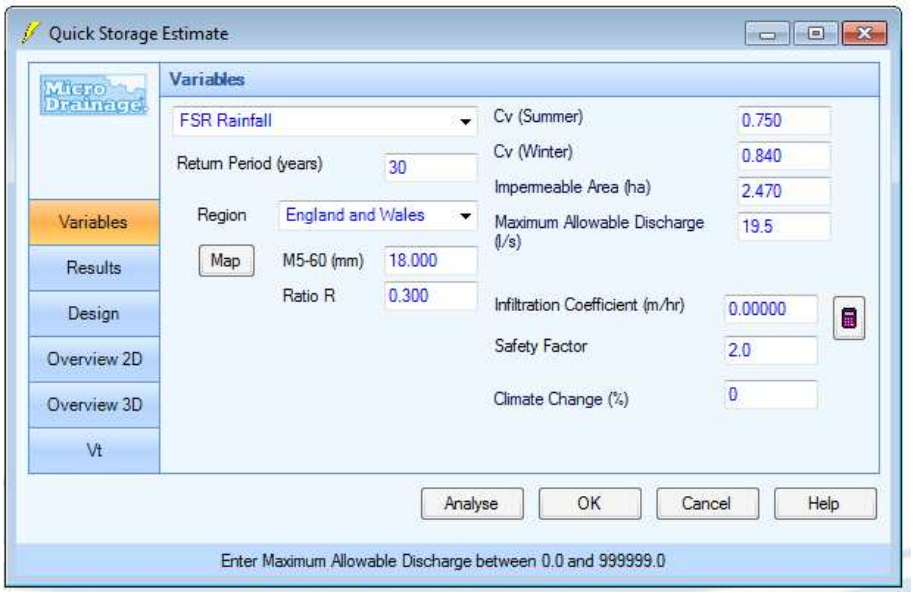


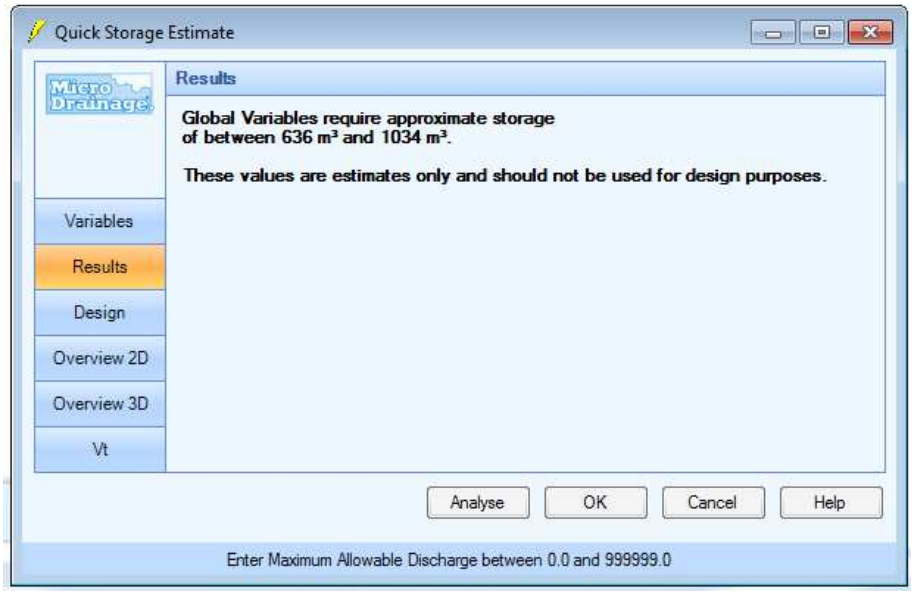
Aire Valley EfW
Attenuation - Quick Storage Estimates

ATTENUATION REQUIRED WITH DISCHARGE RATE RESTRICTED TO GREENFIELD RATES

30 YEAR

EfW Plant Area

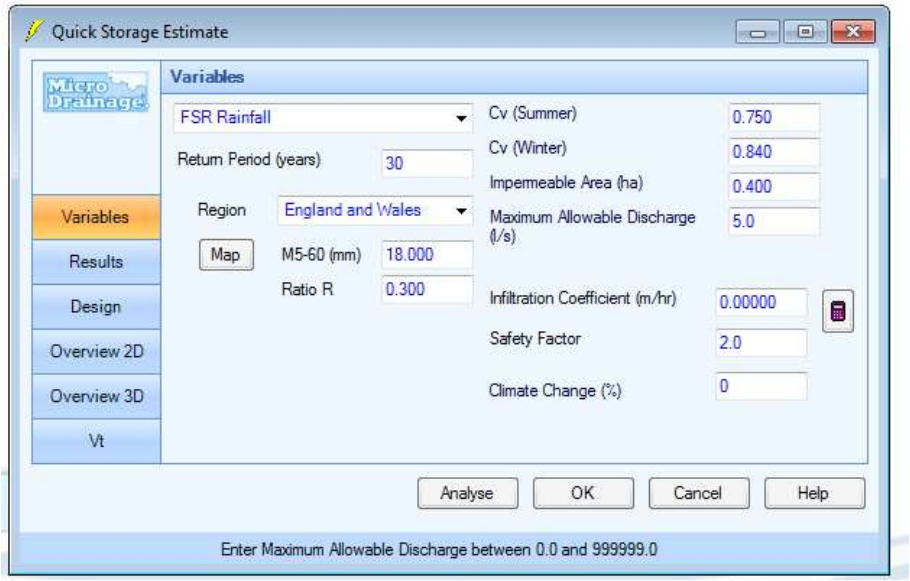


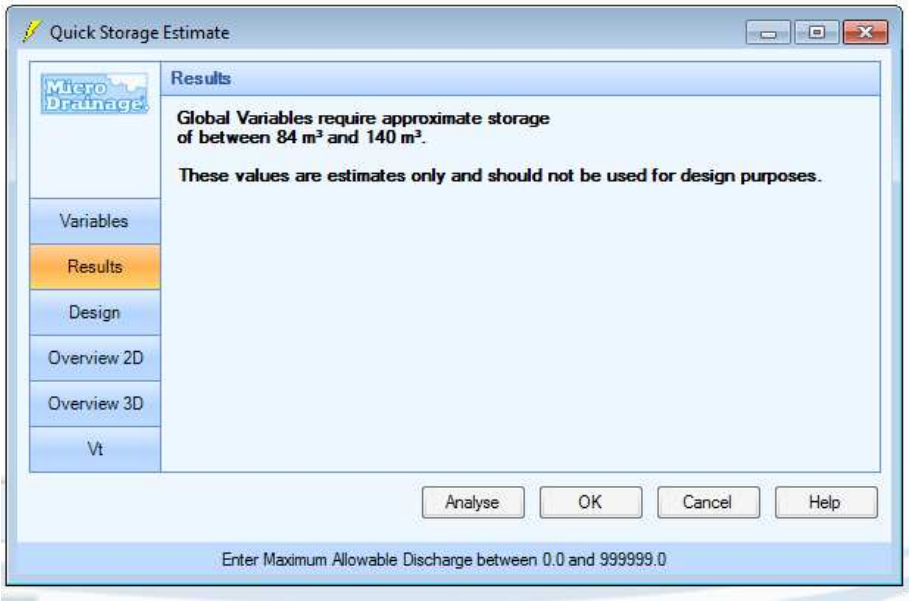


Aire Valley EfW
Attenuation - Quick Storage Estimates

30 YEAR

Offices

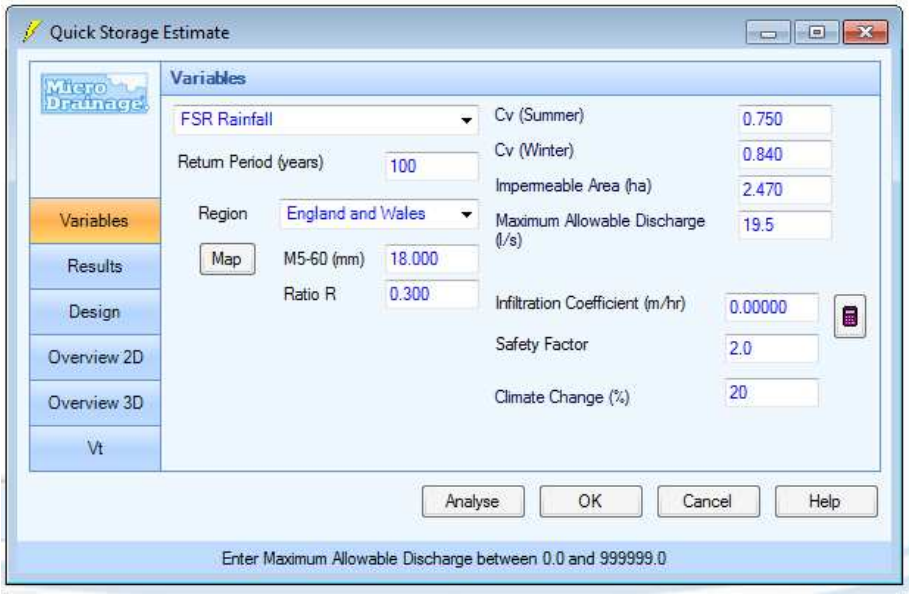


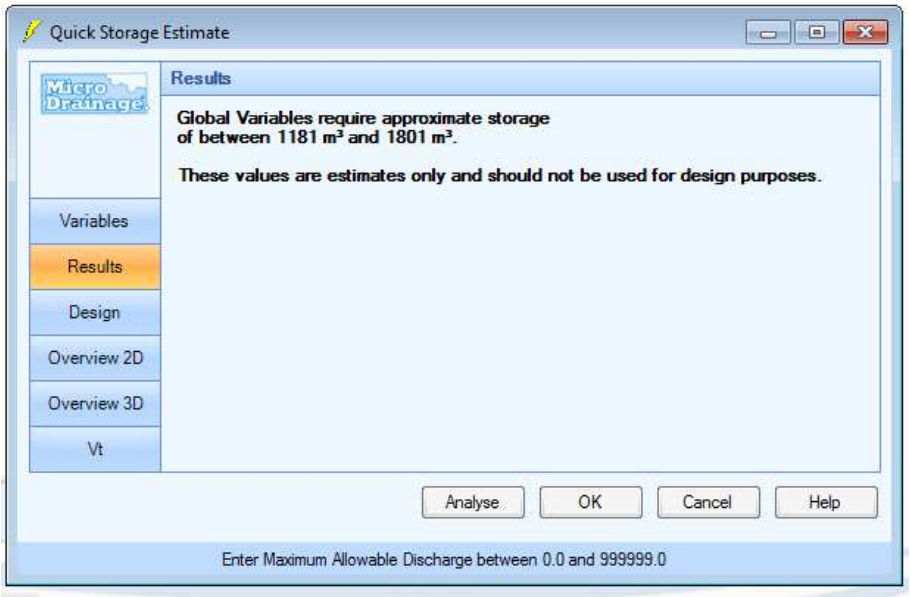


Aire Valley EfW
Attenuation - Quick Storage Estimates

100 YEAR +CC

EfW Plant Area

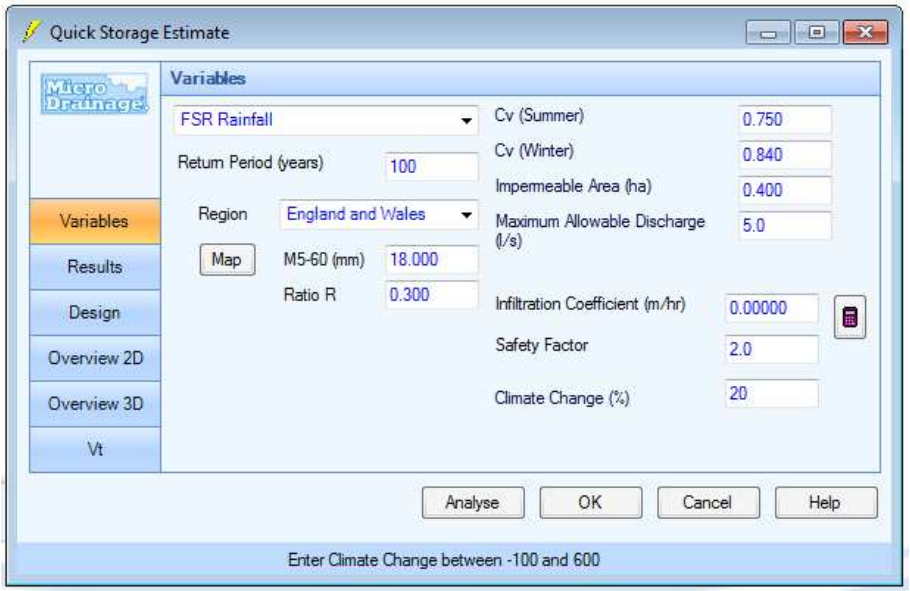


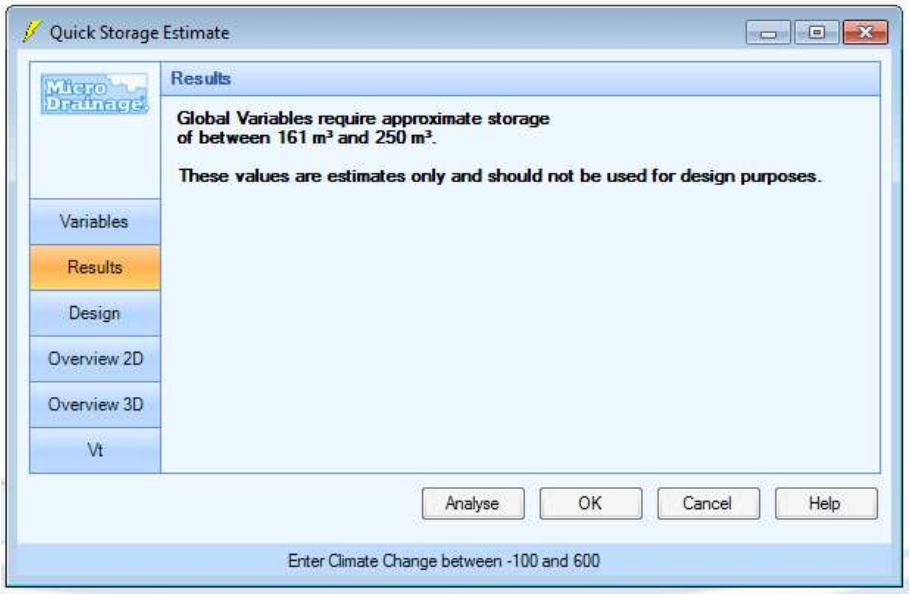


Aire Valley EfW
Attenuation - Quick Storage Estimates

100 YEAR+CC

Offices





Calculation Sheet

REF:

CLIENT:	PROJECT:	JOB NO.:	CALC. REF. NO.:
			PAGE: OF
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	DATE:	DATE:	DATE:

Following the Rationale Method as described by the Wallingford Procedure

Qp = C i A

Qp = runoff (litres/second)
C = runoff coefficient
i = rainfall intensity (mm/hr) = 9.8
A = area (hectares) = 2.44

If the units are as follows then the equation becomes **Qp = 2.78C i A**;

Runoff coefficient C = Cv Cr, as standard values of 0.75 and 1.30 are used for Cv and Cr respectively.

If the above values for C are used the equation becomes:

Qp = 3.61Cv i A

= 2.71 i A

= **2.71 x 9.8 x 2.44**

= **64.80 litres/second**

Calculation Sheet

REF:

CLIENT:	PROJECT:	JOB NO.:	CALC. REF. NO.:
			PAGE: OF
CALCULATION	CALC. BY:	CHECKED BY:	APPROVED BY:
Rainfall Intensity	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)	(NAME AND SIGNATURE)
	DATE:	DATE:	DATE:

Following the Wallingford Procedure

M5-60 = 18 mm
Ratio r = 0.3
Duration (D)= 360 minutes
Z1 = 1.79

M5- 360 = M5-60 x Z1
= 32.2 mm

Return Period = 100
Z2= 1.82

M100 360 = M5- 360 x Z2
= 32.2 x 1.82
= **58.7 mm**

Rainfall intensity (mm/hr) = $\frac{MT-D}{D/60}$

$= \frac{\mathbf{58.7}}{\mathbf{6.00}}$

= **9.78 mm/hr**

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	3.490	Urban	0.000
SAAR (mm)	1040	Region Number	Region 3

Results l/s

QBAR Rural	24.4
QBAR Urban	24.4
Q100 years	50.7
Q1 year	21.0
Q30 years	42.8
Q100 years	50.7

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STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

« - 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
S1.000	17.092	0.114	149.9	0.031	3.00	0.0	0.600	o	150	Pipe/Conduit	
S2.000	16.904	0.114	148.3	0.033	3.00	0.0	0.600	o	150	Pipe/Conduit	
S3.000	47.141	0.364	129.5	0.218	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	23.135	0.116	199.4	0.041	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.000	11.653	0.530	22.0	0.063	5.00	0.0	0.600	o	100	Pipe/Conduit	
S1.002	31.453	0.031	1000.0	0.000	0.00	0.0	0.600	[]	1	Pipe/Conduit	
S5.000	33.357	0.361	92.4	0.028	3.00	0.0	0.600	o	150	Pipe/Conduit	
S1.003	39.205	0.038	1031.7	0.038	0.00	0.0	0.600	[]	1	Pipe/Conduit	
S6.000	36.057	0.399	90.4	0.050	3.00	0.0	0.600	o	150	Pipe/Conduit	
S1.004	73.143	0.076	962.4	0.158	0.00	0.0	0.600	[]	1	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)
S1.000	46.44	3.35	86.900	0.031	0.0	0.0	0.0	0.82	14.5	3.9
S2.000	46.46	3.34	86.900	0.033	0.0	0.0	0.0	0.82	14.5	4.2
S3.000	38.32	5.68	87.075	0.218	0.0	0.0	0.0	1.15	45.6	22.6
S1.001	37.20	6.10	86.711	0.323	0.0	0.0	0.0	0.92	36.7	32.5
S4.000	39.99	5.12	87.250	0.063	0.0	0.0	0.0	1.65	13.0	6.8
S1.002	35.81	6.66	86.220	0.386	0.0	0.0	0.0	0.94	645.1	37.4
S5.000	45.66	3.53	87.000	0.028	0.0	0.0	0.0	1.05	18.5	3.5
S1.003	34.23	7.37	86.189	0.452	0.0	0.0	0.0	0.92	635.0	41.9
S6.000	45.51	3.57	87.000	0.050	0.0	0.0	0.0	1.06	18.7	6.2
S1.004	31.76	8.65	86.151	0.660	0.0	0.0	0.0	0.95	657.8	56.8

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STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

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
S1.005	66.903	0.067	998.6	0.308	0.00	0.0	0.600	[]	1	Pipe/Conduit	
S7.000	33.568	0.067	501.0	0.053	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.006	33.822	0.034	994.8	0.129	0.00	0.0	0.600	[]	1	Pipe/Conduit	
S8.000	23.664	0.023	1029.7	0.000	3.00	0.0	0.600	o	600	Pipe/Conduit	
S8.001	7.058	0.007	1000.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
S1.007	35.654	0.036	990.4	0.130	0.00	0.0	0.600	o	600	Pipe/Conduit	
S9.000	47.815	0.319	149.9	0.027	3.00	0.0	0.600	o	150	Pipe/Conduit	
S9.001	44.589	0.220	202.7	0.017	0.00	0.0	0.600	o	150	Pipe/Conduit	
S9.002	13.398	0.089	150.5	0.119	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.008	18.086	0.100	180.9	0.083	0.00	0.0	0.600	o	300	Pipe/Conduit	
S10.000	27.765	0.489	56.8	0.011	3.00	0.0	0.600	o	225	Pipe/Conduit	
S11.000	17.109	0.114	150.1	0.039	3.00	0.0	0.600	o	150	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)
S1.005	29.81	9.84	86.075	0.968	0.0	0.0	0.0	0.94	645.6	78.1
S7.000	36.79	6.26	87.600	0.053	0.0	0.0	0.0	0.44	7.8	5.3
S1.006	28.93	10.44	86.008	1.150	0.0	0.0	0.0	0.94	646.9	90.1
S8.000	45.68	3.53	86.000	0.000	0.0	0.0	0.0	0.75	212.2	0.0
S8.001	45.05	3.68	85.977	0.000	0.0	0.0	0.0	0.76	215.4	0.0
S1.007	27.88	11.22	85.970	1.280	0.0	0.0	0.0	0.77	216.4	96.7
S9.000	43.91	3.97	87.000	0.027	0.0	0.0	0.0	0.82	14.5	3.2
S9.001	40.26	5.03	86.681	0.044	0.0	0.0	0.0	0.70	12.4	4.8
S9.002	39.61	5.24	86.386	0.163	0.0	0.0	0.0	1.06	42.3	17.5
S1.008	27.55	11.47	85.929	1.526	0.0	0.0	0.0	1.17	82.4«	113.9
S10.000	46.79	3.27	87.300	0.011	0.0	0.0	0.0	1.74	69.2	1.4
S11.000	46.43	3.35	87.000	0.039	0.0	0.0	0.0	0.82	14.5	4.9

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STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

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
S10.001	32.790	0.033	993.6	0.011	0.00	0.0	0.600	[]	1	Pipe/Conduit	
S10.002	6.952	0.007	993.1	0.035	0.00	0.0	0.600	[]	1	Pipe/Conduit	
S12.000	28.147	0.154	182.8	0.037	3.00	0.0	0.600	o	150	Pipe/Conduit	
S10.003	12.011	0.012	1000.0	0.000	0.00	0.0	0.600	[]	1	Pipe/Conduit	
S10.004	19.457	0.019	1024.1	0.016	0.00	0.0	0.600	[]	1	Pipe/Conduit	
S13.000	52.909	0.353	149.9	0.050	3.00	0.0	0.600	o	150	Pipe/Conduit	
S13.001	37.767	0.218	173.2	0.045	0.00	0.0	0.600	o	150	Pipe/Conduit	
S13.002	8.829	0.059	149.6	0.021	0.00	0.0	0.600	o	225	Pipe/Conduit	
S10.005	17.343	0.017	1020.2	0.025	0.00	0.0	0.600	[]	1	Pipe/Conduit	
S10.006	36.039	0.036	1001.1	0.049	0.00	0.0	0.600	[]	1	Pipe/Conduit	
S10.007	66.221	0.102	649.2	0.030	0.00	0.0	0.600	[]	1	Pipe/Conduit	
S14.000	50.038	0.334	149.8	0.071	3.00	0.0	0.600	o	150	Pipe/Conduit	
S14.001	24.426	1.113	21.9	0.063	0.00	0.0	0.600	o	150	Pipe/Conduit	
S15.000	38.318	0.036	1064.4	0.024	3.00	0.0	0.600	o	600	Pipe/Conduit	
S15.001	26.079	0.026	1000.0	0.000	0.00	0.0	0.600	o	600	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)
S10.001	44.07	3.93	86.436	0.061	0.0	0.0	0.0	0.94	647.2	7.3
S10.002	43.61	4.05	86.403	0.096	0.0	0.0	0.0	0.94	647.4	11.3
S12.000	45.24	3.63	87.000	0.037	0.0	0.0	0.0	0.74	13.1	4.5
S10.003	42.83	4.27	86.396	0.133	0.0	0.0	0.0	0.94	645.1	15.4
S10.004	41.61	4.62	86.384	0.149	0.0	0.0	0.0	0.93	637.4	16.8
S13.000	43.52	4.08	87.300	0.050	0.0	0.0	0.0	0.82	14.5	5.9
S13.001	40.66	4.91	86.947	0.095	0.0	0.0	0.0	0.76	13.4	10.5
S13.002	40.22	5.04	86.730	0.116	0.0	0.0	0.0	1.07	42.4	12.6
S10.005	39.27	5.35	86.365	0.290	0.0	0.0	0.0	0.93	638.6	30.8
S10.006	37.48	6.00	86.348	0.339	0.0	0.0	0.0	0.94	644.8	34.4
S10.007	35.16	6.94	86.312	0.369	0.0	0.0	0.0	1.17	802.7	35.1
S14.000	43.74	4.02	87.000	0.071	0.0	0.0	0.0	0.82	14.5	8.4
S14.001	43.05	4.21	86.666	0.134	0.0	0.0	0.0	2.16	38.2	15.6
S15.000	44.32	3.87	85.990	0.024	0.0	0.0	0.0	0.74	208.7	2.9
S15.001	42.24	4.44	85.954	0.024	0.0	0.0	0.0	0.76	215.4	2.9

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STORM SEWER DESIGN by the Modified Rational Method

Network Design Table for Storm

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
S10.008	5.394	0.005	1078.8	0.067	0.00	0.0	0.600	o	600	Pipe/Conduit	
S16.000	26.869	0.134	200.5	0.027	3.00	0.0	0.600	o	150	Pipe/Conduit	
S16.001	13.366	0.687	19.5	0.030	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.009	4.770	0.057	83.7	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
S17.000	25.723	0.274	93.9	0.056	3.00	0.0	0.600	o	150	Pipe/Conduit	
S17.001	39.836	1.179	33.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.010	15.992	0.080	199.9	0.067	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.011	54.714	0.274	199.7	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.012	68.096	0.340	200.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.013	70.010	0.350	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.014	38.504	0.400	96.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.015	63.957	1.253	51.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.016	76.713	0.500	153.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.017	77.541	0.500	155.1	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.018	10.652	0.107	99.6	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)
S10.008	34.89	7.07	85.867	0.594	0.0	0.0	0.0	0.73	207.2	56.1
S16.000	45.24	3.63	87.000	0.027	0.0	0.0	0.0	0.71	12.5	3.3
S16.001	44.85	3.73	86.866	0.057	0.0	0.0	0.0	2.29	40.5	6.9
S1.009	27.50	11.52	85.829	2.177	0.0	0.0	0.0	1.72	121.6«	162.1
S17.000	46.16	3.41	87.300	0.056	0.0	0.0	0.0	1.04	18.3	7.0
S17.001	44.94	3.71	86.951	0.056	0.0	0.0	0.0	2.26	89.8	7.0
S1.010	27.14	11.81	85.772	2.300	0.0	0.0	0.0	0.92	36.6«	169.1
S1.011	26.01	12.80	85.692	2.300	0.0	0.0	0.0	0.92	36.6«	169.1
S1.012	24.74	14.03	85.418	2.300	0.0	0.0	0.0	0.92	36.6«	169.1
S1.013	23.59	15.30	85.078	2.300	0.0	0.0	0.0	0.92	36.6«	169.1
S1.014	23.18	15.78	84.728	2.300	0.0	0.0	0.0	1.33	53.0«	169.1
S1.015	22.74	16.36	84.328	2.300	0.0	0.0	0.0	1.84	73.0«	169.1
S1.016	21.88	17.58	83.075	2.300	0.0	0.0	0.0	1.05	41.9«	169.1
S1.017	21.08	18.81	82.575	2.300	0.0	0.0	0.0	1.05	41.6«	169.1
S1.018	21.00	18.95	82.075	2.300	0.0	0.0	0.0	1.31	52.1«	169.1

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Conduit Sections for Storm

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from user conduit table

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m^2)
1	[]	1200	600	90.0	125	0.833	0.689

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Manhole Schedules for Storm

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)
S1	87.900	1.000	Open Manhole	1050	S1.000	86.900	150				
S20	87.950	1.050	Open Manhole	1050	S2.000	86.900	150				
SCP1	88.000	0.925	Open Manhole	1050	S3.000	87.075	225				
S2	88.300	1.589	Open Manhole	1050	S1.001	86.711	225	S1.000	86.786	150	
								S2.000	86.786	150	
								S3.000	86.711	225	
SCP2	88.250	1.000	Open Manhole	1050	S4.000	87.250	100				
S3	88.300	2.080	Open Manhole		S1.002	86.220	1	S1.001	86.595	225	
								S4.000	86.720	100	
S21	88.300	1.300	Open Manhole		S5.000	87.000	150				
S3J	88.300	2.111	Junction	0	S1.003	86.189	1	S1.002	86.189	1	
								S5.000	86.639	150	
S22	88.300	1.300	Open Manhole	1050	S6.000	87.000	150				
S4	88.300	2.149	Open Manhole	3000	S1.004	86.151	1	S1.003	86.151	1	
								S6.000	86.601	150	
S5	88.300	2.225	Open Manhole	3000	S1.005	86.075	1	S1.004	86.075	1	
SCP3	88.600	1.000	Open Manhole	1050	S7.000	87.600	150				
S6	88.300	2.292	Open Manhole	3000	S1.006	86.008	1	S1.005	86.008	1	
								S7.000	87.533	150	1075
S24	88.400	2.400	Open Manhole	1500	S8.000	86.000	600				
S25	88.250	2.273	Open Manhole	1500	S8.001	85.977	600	S8.000	85.977	600	
S7	88.250	2.280	Open Manhole	3000	S1.007	85.970	600	S1.006	85.974	1	4
								S8.001	85.970	600	
S50	88.100	1.100	Open Manhole	1050	S9.000	87.000	150				
S51	88.000	1.319	Open Manhole	1050	S9.001	86.681	150	S9.000	86.681	150	
S46	88.000	1.614	Open Manhole	1050	S9.002	86.386	225	S9.001	86.461	150	
S8	88.300	2.371	Open Manhole	1500	S1.008	85.929	300	S1.007	85.934	600	305
								S9.002	86.297	225	293
S30	88.300	1.000	Open Manhole	1050	S10.000	87.300	225				
S31	88.250	1.250	Open Manhole	1050	S11.000	87.000	150				
S32	88.300	1.864	Open Manhole	3000	S10.001	86.436	1	S10.000	86.811	225	
								S11.000	86.886	150	
S33	88.300	1.897	Open Manhole		S10.002	86.403	1	S10.001	86.403	1	
S34	88.250	1.250	Open Manhole		S12.000	87.000	150				
S33J	88.300	1.904	Junction	0	S10.003	86.396	1	S10.002	86.396	1	
								S12.000	86.846	150	
S35	88.300	1.916	Open Manhole		S10.004	86.384	1	S10.003	86.384	1	
S39	88.200	0.900	Open Manhole	1050	S13.000	87.300	150				

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Manhole Schedules for Storm

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)
S36	88.350	1.403	Open Manhole	1050	S13.001	86.947	150	S13.000	86.947	150	
S37	88.350	1.621	Open Manhole		S13.002	86.730	225	S13.001	86.729	150	
S35J	88.000	1.635	Junction	0	S10.005	86.365	1	S10.004	86.365	1	
								S13.002	86.671	225	
S38	88.300	1.952	Open Manhole	3000	S10.006	86.348	1	S10.005	86.348	1	
S40	88.300	1.988	Open Manhole	3000	S10.007	86.312	1	S10.006	86.312	1	
S43	88.300	1.300	Open Manhole	1050	S14.000	87.000	150				
S44	88.300	1.634	Open Manhole	1050	S14.001	86.666	150	S14.000	86.666	150	
S41	88.000	2.010	Open Manhole	1500	S15.000	85.990	600				
S42	88.000	2.046	Open Manhole	1500	S15.001	85.954	600	S15.000	85.954	600	
S45	88.300	2.747	Open Manhole	3000	S10.008	85.867	600	S10.007	86.210	1	343
								S14.001	85.553	150	
								S15.001	85.928	600	61
S26	88.300	1.300	Open Manhole	1050	S16.000	87.000	150				
S27	88.100	1.234	Open Manhole	1050	S16.001	86.866	150	S16.000	86.866	150	
S9	88.300	2.471	Open Manhole	1500	S1.009	85.829	300	S1.008	85.829	300	
								S10.008	85.862	600	333
								S16.001	86.179	150	200
S28	88.350	1.050	Open Manhole	1050	S17.000	87.300	150				
S29	88.350	1.399	Open Manhole	1050	S17.001	86.951	225	S17.000	87.026	150	
S10	88.300	2.528	Open Manhole	1200	S1.010	85.772	225	S1.009	85.772	300	
								S17.001	85.772	225	
S11	87.500	1.808	Open Manhole	1200	S1.011	85.692	225	S1.010	85.692	225	
S12	87.000	1.582	Open Manhole	1050	S1.012	85.418	225	S1.011	85.418	225	
S13	87.000	1.922	Open Manhole	1200	S1.013	85.078	225	S1.012	85.078	225	
S14	86.800	2.072	Open Manhole	1200	S1.014	84.728	225	S1.013	84.728	225	
S15	85.800	1.472	Open Manhole	1050	S1.015	84.328	225	S1.014	84.328	225	
S16	84.500	1.425	Open Manhole	1050	S1.016	83.075	225	S1.015	83.075	225	
S17	84.000	1.425	Open Manhole	1050	S1.017	82.575	225	S1.016	82.575	225	
S18	83.500	1.425	Open Manhole	1050	S1.018	82.075	225	S1.017	82.075	225	
SS19	83.500	1.532	Open Manhole	3000		OUTFALL		S1.018	81.968	225	

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	150	S1	87.900	86.900	0.850	Open Manhole	1050
S2.000	o	150	S20	87.950	86.900	0.900	Open Manhole	1050
S3.000	o	225	SCP1	88.000	87.075	0.700	Open Manhole	1050
S1.001	o	225	S2	88.300	86.711	1.364	Open Manhole	1050
S4.000	o	100	SCP2	88.250	87.250	0.900	Open Manhole	1050
S1.002	[]	1	S3	88.300	86.220	1.480	Open Manhole	3000
S5.000	o	150	S21	88.300	87.000	1.150	Open Manhole	1050
S1.003	[]	1	S3J	88.300	86.189	1.511	Junction	
S6.000	o	150	S22	88.300	87.000	1.150	Open Manhole	1050
S1.004	[]	1	S4	88.300	86.151	1.549	Open Manhole	3000
S1.005	[]	1	S5	88.300	86.075	1.625	Open Manhole	3000

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	17.092	149.9	S2	88.300	86.786	1.364	Open Manhole	1050
S2.000	16.904	148.3	S2	88.300	86.786	1.364	Open Manhole	1050
S3.000	47.141	129.5	S2	88.300	86.711	1.364	Open Manhole	1050
S1.001	23.135	199.4	S3	88.300	86.595	1.480	Open Manhole	3000
S4.000	11.653	22.0	S3	88.300	86.720	1.480	Open Manhole	3000
S1.002	31.453	1000.0	S3J	88.300	86.189	1.511	Junction	
S5.000	33.357	92.4	S3J	88.300	86.639	1.511	Junction	
S1.003	39.205	1031.7	S4	88.300	86.151	1.549	Open Manhole	3000
S6.000	36.057	90.4	S4	88.300	86.601	1.549	Open Manhole	3000
S1.004	73.143	962.4	S5	88.300	86.075	1.625	Open Manhole	3000
S1.005	66.903	998.6	S6	88.300	86.008	1.692	Open Manhole	3000

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S7.000	o	150	SCP3	88.600	87.600	0.850	Open Manhole	1050
S1.006	[]	1	S6	88.300	86.008	1.692	Open Manhole	3000
S8.000	o	600	S24	88.400	86.000	1.800	Open Manhole	1500
S8.001	o	600	S25	88.250	85.977	1.673	Open Manhole	1500
S1.007	o	600	S7	88.250	85.970	1.680	Open Manhole	3000
S9.000	o	150	S50	88.100	87.000	0.950	Open Manhole	1050
S9.001	o	150	S51	88.000	86.681	1.169	Open Manhole	1050
S9.002	o	225	S46	88.000	86.386	1.389	Open Manhole	1050
S1.008	o	300	S8	88.300	85.929	2.071	Open Manhole	1500
S10.000	o	225	S30	88.300	87.300	0.775	Open Manhole	1050
S11.000	o	150	S31	88.250	87.000	1.100	Open Manhole	1050
S10.001	[]	1	S32	88.300	86.436	1.264	Open Manhole	3000
S10.002	[]	1	S33	88.300	86.403	1.297	Open Manhole	3000

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S7.000	33.568	501.0	S6	88.300	87.533	0.617	Open Manhole	3000
S1.006	33.822	994.8	S7	88.250	85.974	1.676	Open Manhole	3000
S8.000	23.664	1029.7	S25	88.250	85.977	1.673	Open Manhole	1500
S8.001	7.058	1000.0	S7	88.250	85.970	1.680	Open Manhole	3000
S1.007	35.654	990.4	S8	88.300	85.934	1.766	Open Manhole	1500
S9.000	47.815	149.9	S51	88.000	86.681	1.169	Open Manhole	1050
S9.001	44.589	202.7	S46	88.000	86.461	1.389	Open Manhole	1050
S9.002	13.398	150.5	S8	88.300	86.297	1.778	Open Manhole	1500
S1.008	18.086	180.9	S9	88.300	85.829	2.171	Open Manhole	1500
S10.000	27.765	56.8	S32	88.300	86.811	1.264	Open Manhole	3000
S11.000	17.109	150.1	S32	88.300	86.886	1.264	Open Manhole	3000
S10.001	32.790	993.6	S33	88.300	86.403	1.297	Open Manhole	3000
S10.002	6.952	993.1	S33J	88.300	86.396	1.304	Junction	

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S12.000	o	150	S34	88.250	87.000	1.100	Open Manhole	1050
S10.003	[]	1	S33J	88.300	86.396	1.304	Junction	
S10.004	[]	1	S35	88.300	86.384	1.316	Open Manhole	3000
S13.000	o	150	S39	88.200	87.300	0.750	Open Manhole	1050
S13.001	o	150	S36	88.350	86.947	1.253	Open Manhole	1050
S13.002	o	225	S37	88.350	86.730	1.395	Open Manhole	1050
S10.005	[]	1	S35J	88.000	86.365	1.035	Junction	
S10.006	[]	1	S38	88.300	86.348	1.352	Open Manhole	3000
S10.007	[]	1	S40	88.300	86.312	1.388	Open Manhole	3000
S14.000	o	150	S43	88.300	87.000	1.150	Open Manhole	1050
S14.001	o	150	S44	88.300	86.666	1.484	Open Manhole	1050
S15.000	o	600	S41	88.000	85.990	1.410	Open Manhole	1500
S15.001	o	600	S42	88.000	85.954	1.446	Open Manhole	1500
S10.008	o	600	S45	88.300	85.867	1.833	Open Manhole	3000

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S12.000	28.147	182.8	S33J	88.300	86.846	1.304	Junction	
S10.003	12.011	1000.0	S35	88.300	86.384	1.316	Open Manhole	3000
S10.004	19.457	1024.1	S35J	88.000	86.365	1.035	Junction	
S13.000	52.909	149.9	S36	88.350	86.947	1.253	Open Manhole	1050
S13.001	37.767	173.2	S37	88.350	86.729	1.471	Open Manhole	1050
S13.002	8.829	149.6	S35J	88.000	86.671	1.104	Junction	
S10.005	17.343	1020.2	S38	88.300	86.348	1.352	Open Manhole	3000
S10.006	36.039	1001.1	S40	88.300	86.312	1.388	Open Manhole	3000
S10.007	66.221	649.2	S45	88.300	86.210	1.490	Open Manhole	3000
S14.000	50.038	149.8	S44	88.300	86.666	1.484	Open Manhole	1050
S14.001	24.426	21.9	S45	88.300	85.553	2.597	Open Manhole	3000
S15.000	38.318	1064.4	S42	88.000	85.954	1.446	Open Manhole	1500
S15.001	26.079	1000.0	S45	88.300	85.928	1.772	Open Manhole	3000
S10.008	5.394	1078.8	S9	88.300	85.862	1.838	Open Manhole	1500

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S16.000	o	150	S26	88.300	87.000	1.150	Open Manhole	1050
S16.001	o	150	S27	88.100	86.866	1.084	Open Manhole	1050
S1.009	o	300	S9	88.300	85.829	2.171	Open Manhole	1500
S17.000	o	150	S28	88.350	87.300	0.900	Open Manhole	1050
S17.001	o	225	S29	88.350	86.951	1.174	Open Manhole	1050
S1.010	o	225	S10	88.300	85.772	2.303	Open Manhole	1200
S1.011	o	225	S11	87.500	85.692	1.583	Open Manhole	1200
S1.012	o	225	S12	87.000	85.418	1.357	Open Manhole	1050
S1.013	o	225	S13	87.000	85.078	1.697	Open Manhole	1200
S1.014	o	225	S14	86.800	84.728	1.847	Open Manhole	1200
S1.015	o	225	S15	85.800	84.328	1.247	Open Manhole	1050
S1.016	o	225	S16	84.500	83.075	1.200	Open Manhole	1050
S1.017	o	225	S17	84.000	82.575	1.200	Open Manhole	1050
S1.018	o	225	S18	83.500	82.075	1.200	Open Manhole	1050

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S16.000	26.869	200.5	S27	88.100	86.866	1.084	Open Manhole	1050
S16.001	13.366	19.5	S9	88.300	86.179	1.971	Open Manhole	1500
S1.009	4.770	83.7	S10	88.300	85.772	2.228	Open Manhole	1200
S17.000	25.723	93.9	S29	88.350	87.026	1.174	Open Manhole	1050
S17.001	39.836	33.8	S10	88.300	85.772	2.303	Open Manhole	1200
S1.010	15.992	199.9	S11	87.500	85.692	1.583	Open Manhole	1200
S1.011	54.714	199.7	S12	87.000	85.418	1.357	Open Manhole	1050
S1.012	68.096	200.3	S13	87.000	85.078	1.697	Open Manhole	1200
S1.013	70.010	200.0	S14	86.800	84.728	1.847	Open Manhole	1200
S1.014	38.504	96.3	S15	85.800	84.328	1.247	Open Manhole	1050
S1.015	63.957	51.0	S16	84.500	83.075	1.200	Open Manhole	1050
S1.016	76.713	153.4	S17	84.000	82.575	1.200	Open Manhole	1050
S1.017	77.541	155.1	S18	83.500	82.075	1.200	Open Manhole	1050
S1.018	10.652	99.6	SS19	83.500	81.968	1.307	Open Manhole	3000

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.031	0.031	0.031
2.000	-	-	100	0.033	0.033	0.033
3.000	-	-	100	0.218	0.218	0.218
1.001	-	-	100	0.041	0.041	0.041
4.000	-	-	100	0.063	0.063	0.063
1.002	-	-	100	0.000	0.000	0.000
5.000	-	-	100	0.028	0.028	0.028
1.003	-	-	100	0.038	0.038	0.038
6.000	-	-	100	0.050	0.050	0.050
1.004	-	-	100	0.158	0.158	0.158
1.005	-	-	100	0.308	0.308	0.308
7.000	-	-	100	0.053	0.053	0.053
1.006	-	-	100	0.129	0.129	0.129
8.000	-	-	100	0.000	0.000	0.000
8.001	-	-	100	0.000	0.000	0.000
1.007	-	-	100	0.130	0.130	0.130
9.000	-	-	100	0.027	0.027	0.027
9.001	-	-	100	0.017	0.017	0.017
9.002	-	-	100	0.119	0.119	0.119
1.008	-	-	100	0.083	0.083	0.083
10.000	-	-	100	0.011	0.011	0.011
11.000	-	-	100	0.039	0.039	0.039
10.001	-	-	100	0.011	0.011	0.011
10.002	-	-	100	0.035	0.035	0.035
12.000	-	-	100	0.037	0.037	0.037
10.003	-	-	100	0.000	0.000	0.000
10.004	-	-	100	0.016	0.016	0.016
13.000	-	-	100	0.050	0.050	0.050
13.001	-	-	100	0.045	0.045	0.045
13.002	-	-	100	0.021	0.021	0.021
10.005	-	-	100	0.025	0.025	0.025
10.006	-	-	100	0.049	0.049	0.049
10.007	-	-	100	0.030	0.030	0.030
14.000	-	-	100	0.071	0.071	0.071
14.001	-	-	100	0.063	0.063	0.063
15.000	-	-	100	0.024	0.024	0.024
15.001	-	-	100	0.000	0.000	0.000
10.008	-	-	100	0.067	0.067	0.067
16.000	-	-	100	0.027	0.027	0.027
16.001	-	-	100	0.030	0.030	0.030
1.009	-	-	100	0.000	0.000	0.000
17.000	-	-	100	0.056	0.056	0.056
17.001	-	-	100	0.000	0.000	0.000
1.010	-	-	100	0.067	0.067	0.067
1.011	-	-	100	0.000	0.000	0.000
1.012	-	-	100	0.000	0.000	0.000
1.013	-	-	100	0.000	0.000	0.000
1.014	-	-	100	0.000	0.000	0.000
1.015	-	-	100	0.000	0.000	0.000
1.016	-	-	100	0.000	0.000	0.000
1.017	-	-	100	0.000	0.000	0.000

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.018	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				2.300	2.300	2.300

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Online Controls for Storm

Hydro-Brake Optimum® Manhole: S10, DS/PN: S1.010, Volume (m³): 4.6

Unit Reference	MD-SHE-0201-2400-2000-2400
Design Head (m)	2.000
Design Flow (l/s)	24.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	201
Invert Level (m)	85.772
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1800

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	24.0	Kick-Flo®	1.248	19.2
Flush-Flo™	0.583	24.0	Mean Flow over Head Range	-	20.9

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)	Depth (m)	Flow (l/s)
0.100	6.9	0.800	23.6	2.000	24.0	4.000	33.4	7.000	43.8
0.200	19.0	1.000	22.5	2.200	25.1	4.500	35.4	7.500	45.3
0.300	22.3	1.200	20.1	2.400	26.2	5.000	37.2	8.000	46.7
0.400	23.4	1.400	20.2	2.600	27.2	5.500	39.0	8.500	48.1
0.500	23.9	1.600	21.6	3.000	29.1	6.000	40.7	9.000	49.5
0.600	24.0	1.800	22.8	3.500	31.4	6.500	42.3	9.500	50.8

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Offline Controls for Storm

Weir Manhole: S6, DS/PN: S1.006, Loop to PN: S8.000

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 86.610

Weir Manhole: S40, DS/PN: S10.007, Loop to PN: S15.000

Discharge Coef 0.544 Width (m) 1.000 Invert Level (m) 86.610

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Storage Structures for Storm

Porous Car Park Manhole: SCP1, DS/PN: S3.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	40.0
Membrane Percolation (mm/hr)	1000	Length (m)	54.0
Max Percolation (l/s)	600.0	Slope (1:X)	1000.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	87.700	Membrane Depth (mm)	100

Porous Car Park Manhole: SCP2, DS/PN: S4.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	24.0
Membrane Percolation (mm/hr)	1000	Length (m)	25.0
Max Percolation (l/s)	166.7	Slope (1:X)	1000.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	87.750	Membrane Depth (mm)	0

Complex Manhole: SCP3, DS/PN: S7.000

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	25.0
Membrane Percolation (mm/hr)	1000	Length (m)	20.0
Max Percolation (l/s)	138.9	Slope (1:X)	1000.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	87.600	Membrane Depth (mm)	0

Infiltration Trench

Infiltration Coefficient Base (m/hr)	0.00000	Trench Width (m)	1.0
Infiltration Coefficient Side (m/hr)	0.00000	Trench Length (m)	2.0
Safety Factor	2.0	Slope (1:X)	0.0
Porosity	0.30	Cap Volume Depth (m)	0.000
Invert Level (m)	86.900	Cap Infiltration Depth (m)	0.000

Cellular Storage Manhole: S25, DS/PN: S8.001

Invert Level (m)	85.977	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	200.0	0.0	0.660	200.0	0.0	0.661	0.0	0.0

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Cellular Storage Manhole: S42, DS/PN: S15.001

Invert Level (m) 85.954 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	150.0	0.0	0.660	150.0	0.0	0.661	0.0	0.0

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

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 Offline Controls 2 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 5 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	17.000
Region	England and Wales	Ratio R	0.300
Cv (Summer)	0.750		
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, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	15 Summer	1	+0%	30/15 Summer	100/240 Winter			86.957
S2.000	S20	15 Summer	1	+0%	30/15 Summer				86.959
S3.000	SCP1	60 Winter	1	+0%	30/15 Summer				87.156
S1.001	S2	60 Winter	1	+0%	30/15 Summer				86.824
S4.000	SCP2	60 Summer	1	+0%	30/15 Summer				87.290
S1.002	S3	60 Winter	1	+0%	100/60 Summer				86.305
S5.000	S21	15 Summer	1	+0%	100/60 Winter				87.046
S1.003	S3J	60 Winter	1	+0%					86.282
S6.000	S22	15 Summer	1	+0%	100/15 Summer				87.063
S1.004	S4	60 Winter	1	+0%	100/60 Summer				86.263
S1.005	S5	60 Winter	1	+0%	100/30 Winter				86.241
S7.000	SCP3	360 Winter	1	+0%	100/120 Winter				87.629
S1.006	S6	60 Winter	1	+0%	30/120 Winter		30/120 Winter	20	86.230
S8.000	S24	240 Winter	1	+0%	30/120 Winter				86.224
S8.001	S25	240 Winter	1	+0%	30/120 Winter				86.224
S1.007	S7	120 Winter	1	+0%	30/120 Winter				86.224
S9.000	S50	15 Summer	1	+0%	100/15 Summer				87.051
S9.001	S51	15 Summer	1	+0%	100/15 Summer	100/240 Winter			86.746
S9.002	S46	15 Winter	1	+0%	30/15 Summer	100/240 Winter			86.487
S1.008	S8	120 Winter	1	+0%	30/15 Summer				86.223
S10.000	S30	15 Summer	1	+0%	100/120 Summer				87.323
S11.000	S31	15 Summer	1	+0%	100/15 Summer				87.065

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.093	0.000	0.29		3.9	OK	2
S2.000	S20	-0.091	0.000	0.31		4.1	OK	
S3.000	SCP1	-0.144	0.000	0.26		11.5	OK	
S1.001	S2	-0.112	0.000	0.50		16.7	OK	
S4.000	SCP2	-0.060	0.000	0.31		3.7	OK	
S1.002	S3	-0.515	0.000	0.05		19.2	OK	
S5.000	S21	-0.104	0.000	0.20		3.6	OK	
S1.003	S3J	-0.506	0.000	0.04		21.4	OK*	
S6.000	S22	-0.087	0.000	0.36		6.4	OK	
S1.004	S4	-0.487	0.000	0.05		27.7	OK	
S1.005	S5	-0.433	0.000	0.06		35.7	OK	
S7.000	SCP3	-0.121	0.000	0.08		0.6	OK	
S1.006	S6	-0.378	0.000	0.09	0.0	38.0	OK	
S8.000	S24	-0.376	0.000	0.00		0.1	OK	
S8.001	S25	-0.353	0.000	0.04		7.0	OK	
S1.007	S7	-0.345	0.000	0.10		14.8	OK	
S9.000	S50	-0.099	0.000	0.23		3.2	OK	
S9.001	S51	-0.085	0.000	0.36		4.4	OK	2
S9.002	S46	-0.124	0.000	0.41		15.1	OK	2
S1.008	S8	-0.006	0.000	0.25		17.8	OK	
S10.000	S30	-0.202	0.000	0.02		1.4	OK	
S11.000	S31	-0.085	0.000	0.36		4.9	OK	

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S10.001	S32	15 Winter	1	+0%	100/60 Winter				86.476
S10.002	S33	15 Winter	1	+0%	100/60 Winter				86.465
S12.000	S34	15 Summer	1	+0%	100/15 Summer				87.065
S10.003	S33J	15 Winter	1	+0%					86.461
S10.004	S35	15 Winter	1	+0%	100/60 Winter				86.456
S13.000	S39	15 Summer	1	+0%	30/15 Summer	100/15 Winter			87.373
S13.001	S36	15 Winter	1	+0%	30/15 Summer				87.045
S13.002	S37	15 Winter	1	+0%	100/60 Winter				86.819
S10.005	S35J	15 Winter	1	+0%					86.446
S10.006	S38	15 Winter	1	+0%	100/60 Winter				86.428
S10.007	S40	15 Winter	1	+0%	100/60 Winter		30/240 Winter	17	86.370
S14.000	S43	15 Summer	1	+0%	30/15 Summer	100/15 Winter			87.090
S14.001	S44	15 Winter	1	+0%	30/15 Summer				86.730
S15.000	S41	120 Winter	1	+0%	30/240 Winter	100/240 Winter			86.207
S15.001	S42	120 Winter	1	+0%	30/120 Winter	100/240 Winter			86.207
S10.008	S45	120 Winter	1	+0%	30/60 Winter				86.210
S16.000	S26	15 Summer	1	+0%	100/15 Summer				87.056
S16.001	S27	15 Summer	1	+0%	100/60 Winter				86.906
S1.009	S9	240 Winter	1	+0%	1/15 Summer				86.220
S17.000	S28	15 Summer	1	+0%	100/15 Summer				87.368
S17.001	S29	15 Summer	1	+0%	100/60 Winter				86.996
S1.010	S10	240 Winter	1	+0%	1/15 Summer				86.234
S1.011	S11	120 Winter	1	+0%					85.824
S1.012	S12	120 Winter	1	+0%					85.549
S1.013	S13	120 Winter	1	+0%					85.209
S1.014	S14	120 Winter	1	+0%					84.834
S1.015	S15	120 Winter	1	+0%					84.415
S1.016	S16	120 Winter	1	+0%					83.195
S1.017	S17	120 Winter	1	+0%					82.695
S1.018	S18	120 Winter	1	+0%					82.190

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S10.001	S32	-0.560	0.000	0.02		6.3	OK	
S10.002	S33	-0.538	0.000	0.02		7.8	OK	
S12.000	S34	-0.085	0.000	0.38		4.8	OK	
S10.003	S33J	-0.535	0.000	0.02		10.7	OK*	
S10.004	S35	-0.528	0.000	0.04		11.4	OK	
S13.000	S39	-0.077	0.000	0.41		5.8	OK	1
S13.001	S36	-0.052	0.000	0.72		9.4	OK	
S13.002	S37	-0.136	0.000	0.32		11.1	OK	
S10.005	S35J	-0.519	0.000	0.05		23.5	OK*	
S10.006	S38	-0.520	0.000	0.06		26.6	OK	
S10.007	S40	-0.542	0.000	0.04	0.0	28.0	OK	
S14.000	S43	-0.060	0.000	0.59		8.3	OK	1
S14.001	S44	-0.086	0.000	0.38		13.7	OK	

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S15.000	S41	-0.383	0.000	0.01		0.8	OK	1
S15.001	S42	-0.347	0.000	0.05		6.7	OK	1
S10.008	S45	-0.257	0.000	0.05		10.5	OK	
S16.000	S26	-0.094	0.000	0.28		3.4	OK	
S16.001	S27	-0.110	0.000	0.16		6.0	OK	
S1.009	S9	0.091	0.000	0.38		23.0	SURCHARGED	
S17.000	S28	-0.082	0.000	0.40		7.1	OK	
S17.001	S29	-0.180	0.000	0.08		7.2	OK	
S1.010	S10	0.237	0.000	0.70		22.7	SURCHARGED	
S1.011	S11	-0.093	0.000	0.64		22.7	OK	
S1.012	S12	-0.094	0.000	0.64		22.7	OK	
S1.013	S13	-0.094	0.000	0.64		22.7	OK	
S1.014	S14	-0.119	0.000	0.45		22.7	OK	
S1.015	S15	-0.138	0.000	0.32		22.7	OK	
S1.016	S16	-0.105	0.000	0.56		22.7	OK	
S1.017	S17	-0.105	0.000	0.56		22.7	OK	
S1.018	S18	-0.110	0.000	0.52		22.7	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

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 Offline Controls 2 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 5 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model		FSR M5-60 (mm) 17.000	Cv (Summer) 0.750
Region England and Wales		Ratio R 0.300	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, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	30 Winter	30	+0%	30/15 Summer	100/240 Winter			87.157
S2.000	S20	30 Winter	30	+0%	30/15 Summer				87.158
S3.000	SCP1	30 Summer	30	+0%	30/15 Summer				87.471
S1.001	S2	30 Winter	30	+0%	30/15 Summer				87.136
S4.000	SCP2	15 Winter	30	+0%	30/15 Summer				87.502
S1.002	S3	240 Winter	30	+0%	100/60 Summer				86.652
S5.000	S21	15 Summer	30	+0%	100/60 Winter				87.076
S1.003	S3J	240 Winter	30	+0%					86.652
S6.000	S22	15 Summer	30	+0%	100/15 Summer				87.111
S1.004	S4	240 Winter	30	+0%	100/60 Summer				86.652
S1.005	S5	240 Winter	30	+0%	100/30 Winter				86.651
S7.000	SCP3	120 Winter	30	+0%	100/120 Winter				87.656
S1.006	S6	240 Winter	30	+0%	30/120 Winter		30/120 Winter	20	86.650
S8.000	S24	240 Winter	30	+0%	30/120 Winter				86.650
S8.001	S25	240 Winter	30	+0%	30/120 Winter				86.650
S1.007	S7	240 Winter	30	+0%	30/120 Winter				86.651
S9.000	S50	15 Summer	30	+0%	100/15 Summer				87.086
S9.001	S51	15 Summer	30	+0%	100/15 Summer	100/240 Winter			86.823
S9.002	S46	240 Winter	30	+0%	30/15 Summer	100/240 Winter			86.647
S1.008	S8	240 Winter	30	+0%	30/15 Summer				86.654
S10.000	S30	15 Summer	30	+0%	100/120 Summer				87.334
S11.000	S31	15 Summer	30	+0%	100/15 Summer				87.115

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.107	0.000	0.49		6.6	SURCHARGED	2
S2.000	S20	0.108	0.000	0.52		7.0	SURCHARGED	
S3.000	SCP1	0.171	0.000	0.95		41.4	SURCHARGED	
S1.001	S2	0.200	0.000	1.67		56.2	SURCHARGED	
S4.000	SCP2	0.152	0.000	1.13		13.8	SURCHARGED	
S1.002	S3	-0.168	0.000	0.06		22.8	OK	
S5.000	S21	-0.074	0.000	0.49		8.7	OK	
S1.003	S3J	-0.137	0.000	0.04		22.5	OK*	
S6.000	S22	-0.039	0.000	0.87		15.6	OK	
S1.004	S4	-0.099	0.000	0.05		28.8	OK	
S1.005	S5	-0.023	0.000	0.06		36.0	OK	
S7.000	SCP3	-0.094	0.000	0.30		2.2	OK	
S1.006	S6	0.042	0.000	0.08	0.1	34.9	SURCHARGED	
S8.000	S24	0.050	0.000	0.00		0.1	SURCHARGED	
S8.001	S25	0.073	0.000	0.05		8.8	SURCHARGED	
S1.007	S7	0.081	0.000	0.12		17.9	SURCHARGED	
S9.000	S50	-0.064	0.000	0.55		7.8	OK	
S9.001	S51	-0.008	0.000	0.90		10.9	OK	2
S9.002	S46	0.036	0.000	0.27		10.0	SURCHARGED	2
S1.008	S8	0.425	0.000	0.33		23.6	SURCHARGED	
S10.000	S30	-0.191	0.000	0.05		3.4	OK	
S11.000	S31	-0.035	0.000	0.88		11.9	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S10.001	S32	240 Winter	30	+0%	100/60 Winter				86.625
S10.002	S33	240 Winter	30	+0%	100/60 Winter				86.625
S12.000	S34	15 Summer	30	+0%	100/15 Summer				87.117
S10.003	S33J	240 Winter	30	+0%					86.625
S10.004	S35	240 Winter	30	+0%	100/60 Winter				86.626
S13.000	S39	15 Winter	30	+0%	30/15 Summer	100/15 Winter			87.580
S13.001	S36	15 Winter	30	+0%	30/15 Summer				87.404
S13.002	S37	15 Winter	30	+0%	100/60 Winter				86.869
S10.005	S35J	240 Winter	30	+0%					86.626
S10.006	S38	240 Winter	30	+0%	100/60 Winter				86.626
S10.007	S40	240 Winter	30	+0%	100/60 Winter		30/240 Winter	17	86.626
S14.000	S43	15 Summer	30	+0%	30/15 Summer	100/15 Winter			87.459
S14.001	S44	15 Winter	30	+0%	30/15 Summer				87.031
S15.000	S41	240 Winter	30	+0%	30/240 Winter	100/240 Winter			86.626
S15.001	S42	240 Winter	30	+0%	30/120 Winter	100/240 Winter			86.627
S10.008	S45	240 Winter	30	+0%	30/60 Winter				86.627
S16.000	S26	15 Summer	30	+0%	100/15 Summer				87.096
S16.001	S27	15 Summer	30	+0%	100/60 Winter				86.937
S1.009	S9	240 Winter	30	+0%	1/15 Summer				86.642
S17.000	S28	15 Summer	30	+0%	100/15 Summer				87.437
S17.001	S29	15 Summer	30	+0%	100/60 Winter				87.020
S1.010	S10	240 Winter	30	+0%	1/15 Summer				86.644
S1.011	S11	240 Winter	30	+0%					85.828
S1.012	S12	240 Winter	30	+0%					85.554
S1.013	S13	240 Winter	30	+0%					85.214
S1.014	S14	240 Winter	30	+0%					84.837
S1.015	S15	240 Winter	30	+0%					84.418
S1.016	S16	240 Winter	30	+0%					83.199
S1.017	S17	240 Winter	30	+0%					82.700
S1.018	S18	240 Winter	30	+0%					82.194

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S10.001	S32	-0.411	0.000	0.01		3.7	OK	
S10.002	S33	-0.378	0.000	0.01		5.7	OK	
S12.000	S34	-0.033	0.000	0.93		11.7	OK	
S10.003	S33J	-0.371	0.000	0.01		7.9	OK*	
S10.004	S35	-0.358	0.000	0.03		8.8	OK	
S13.000	S39	0.130	0.000	0.82		11.5	SURCHARGED	1
S13.001	S36	0.307	0.000	1.51		19.6	SURCHARGED	
S13.002	S37	-0.086	0.000	0.69		23.5	OK	
S10.005	S35J	-0.339	0.000	0.04		17.3	OK*	
S10.006	S38	-0.322	0.000	0.05		19.9	OK	
S10.007	S40	-0.286	0.000	0.03	0.0	20.5	OK	
S14.000	S43	0.309	0.000	1.18		16.7	SURCHARGED	1
S14.001	S44	0.215	0.000	0.76		27.7	SURCHARGED	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S15.000	S41	0.036	0.000	0.01		1.2	SURCHARGED	1
S15.001	S42	0.073	0.000	0.05		5.7	SURCHARGED	1
S10.008	S45	0.160	0.000	0.08		16.5	SURCHARGED	
S16.000	S26	-0.054	0.000	0.68		8.2	OK	
S16.001	S27	-0.079	0.000	0.45		16.6	OK	
S1.009	S9	0.513	0.000	0.45		27.7	SURCHARGED	
S17.000	S28	-0.013	0.000	0.99		17.3	OK	
S17.001	S29	-0.156	0.000	0.20		17.3	OK	
S1.010	S10	0.647	0.000	0.74		24.0	SURCHARGED	
S1.011	S11	-0.089	0.000	0.68		24.0	OK	
S1.012	S12	-0.089	0.000	0.68		24.0	OK	
S1.013	S13	-0.089	0.000	0.67		24.0	OK	
S1.014	S14	-0.116	0.000	0.48		24.0	OK	
S1.015	S15	-0.135	0.000	0.34		24.0	OK	
S1.016	S16	-0.101	0.000	0.59		24.0	OK	
S1.017	S17	-0.100	0.000	0.59		24.0	OK	
S1.018	S18	-0.106	0.000	0.55		24.0	OK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

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 Offline Controls 2 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 5 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model		FSR M5-60 (mm) 17.000	Cv (Summer) 0.750
Region England and Wales		Ratio R 0.300	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, 240, 360, 480, 960, 1440
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	360 Winter	100	+20%	30/15 Summer	100/240 Winter			87.902
S2.000	S20	240 Winter	100	+20%	30/15 Summer				87.929
S3.000	SCP1	360 Winter	100	+20%	30/15 Summer				87.887
S1.001	S2	240 Winter	100	+20%	30/15 Summer				87.928
S4.000	SCP2	240 Winter	100	+20%	30/15 Summer				87.904
S1.002	S3	240 Winter	100	+20%	100/60 Summer				87.993
S5.000	S21	240 Winter	100	+20%	100/60 Winter				87.997
S1.003	S3J	120 Winter	100	+20%					86.789
S6.000	S22	240 Winter	100	+20%	100/15 Summer				88.007
S1.004	S4	240 Winter	100	+20%	100/60 Summer				87.998
S1.005	S5	240 Winter	100	+20%	100/30 Winter				87.998
S7.000	SCP3	240 Winter	100	+20%	100/120 Winter				87.919
S1.006	S6	240 Winter	100	+20%	30/120 Winter		30/120 Winter	20	87.997
S8.000	S24	240 Winter	100	+20%	30/120 Winter				87.999
S8.001	S25	240 Winter	100	+20%	30/120 Winter				87.999
S1.007	S7	240 Winter	100	+20%	30/120 Winter				87.999
S9.000	S50	240 Winter	100	+20%	100/15 Summer				88.011
S9.001	S51	240 Winter	100	+20%	100/15 Summer	100/240 Winter			88.002
S9.002	S46	240 Winter	100	+20%	30/15 Summer	100/240 Winter			88.002
S1.008	S8	240 Winter	100	+20%	30/15 Summer				88.020
S10.000	S30	240 Winter	100	+20%	100/120 Summer				88.017
S11.000	S31	240 Winter	100	+20%	100/15 Summer				88.016

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.852	1.809	0.17		2.2	FLOOD	2
S2.000	S20	0.879	0.000	0.23		3.2	FLOOD RISK	
S3.000	SCP1	0.587	0.000	0.37		16.2	FLOOD RISK	
S1.001	S2	0.992	0.000	0.92		31.0	SURCHARGED	
S4.000	SCP2	0.554	0.000	0.50		6.1	SURCHARGED	
S1.002	S3	1.173	0.000	0.09		35.6	SURCHARGED	
S5.000	S21	0.847	0.000	0.15		2.7	SURCHARGED	
S1.003	S3J	0.000	0.000	0.10		56.6	SURCHARGED*	
S6.000	S22	0.857	0.000	0.27		4.8	FLOOD RISK	
S1.004	S4	1.247	0.000	0.08		43.8	SURCHARGED	
S1.005	S5	1.323	0.000	0.10		54.2	SURCHARGED	
S7.000	SCP3	0.169	0.000	0.95		7.1	SURCHARGED	
S1.006	S6	1.389	0.000	0.14	3.3	58.2	SURCHARGED	
S8.000	S24	1.399	0.000	0.02		2.0	SURCHARGED	
S8.001	S25	1.422	0.000	0.01		2.0	FLOOD RISK	
S1.007	S7	1.429	0.000	0.41		62.9	FLOOD RISK	
S9.000	S50	0.861	0.000	0.18		2.6	FLOOD RISK	
S9.001	S51	1.171	1.877	0.41		4.9	FLOOD	2
S9.002	S46	1.391	1.828	0.41		15.2	FLOOD	2
S1.008	S8	1.791	0.000	1.09		77.1	FLOOD RISK	
S10.000	S30	0.492	0.000	0.02		1.1	FLOOD RISK	
S11.000	S31	0.866	0.000	0.28		3.8	FLOOD RISK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S10.001	S32	240 Winter	100	+20%	100/60 Winter				88.012
S10.002	S33	240 Winter	100	+20%	100/60 Winter				88.012
S12.000	S34	240 Winter	100	+20%	100/15 Summer				88.015
S10.003	S33J	120 Winter	100	+20%					86.996
S10.004	S35	240 Winter	100	+20%	100/60 Winter				88.011
S13.000	S39	15 Winter	100	+20%	30/15 Summer	100/15 Winter			88.200
S13.001	S36	240 Winter	100	+20%	30/15 Summer				88.036
S13.002	S37	240 Winter	100	+20%	100/60 Winter				88.017
S10.005	S35J	120 Winter	100	+20%					86.965
S10.006	S38	240 Winter	100	+20%	100/60 Winter				88.013
S10.007	S40	240 Winter	100	+20%	100/60 Winter		30/240 Winter	17	88.014
S14.000	S43	15 Winter	100	+20%	30/15 Summer	100/15 Winter			88.300
S14.001	S44	240 Winter	100	+20%	30/15 Summer				88.043
S15.000	S41	240 Winter	100	+20%	30/240 Winter	100/240 Winter			88.004
S15.001	S42	240 Winter	100	+20%	30/120 Winter	100/240 Winter			88.003
S10.008	S45	240 Winter	100	+20%	30/60 Winter				88.027
S16.000	S26	240 Winter	100	+20%	100/15 Summer				88.023
S16.001	S27	240 Winter	100	+20%	100/60 Winter				88.026
S1.009	S9	240 Winter	100	+20%	1/15 Summer				88.026
S17.000	S28	240 Winter	100	+20%	100/15 Summer				88.019
S17.001	S29	240 Winter	100	+20%	100/60 Winter				88.012
S1.010	S10	240 Winter	100	+20%	1/15 Summer				88.019
S1.011	S11	240 Winter	100	+20%					85.832
S1.012	S12	240 Winter	100	+20%					85.557
S1.013	S13	240 Winter	100	+20%					85.216
S1.014	S14	240 Winter	100	+20%					84.839
S1.015	S15	240 Winter	100	+20%					84.420
S1.016	S16	240 Winter	100	+20%					83.202
S1.017	S17	240 Winter	100	+20%					82.702
S1.018	S18	240 Winter	100	+20%					82.196

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S10.001	S32	0.976	0.000	0.01		5.1	FLOOD RISK	
S10.002	S33	1.009	0.000	0.01		7.2	FLOOD RISK	
S12.000	S34	0.865	0.000	0.28		3.6	FLOOD RISK	
S10.003	S33J	0.000	0.000	0.03		16.6	SURCHARGED*	
S10.004	S35	1.027	0.000	0.04		11.0	FLOOD RISK	
S13.000	S39	0.750	0.153	0.95		13.5	FLOOD	1
S13.001	S36	0.939	0.000	0.70		9.1	SURCHARGED	
S13.002	S37	1.062	0.000	0.33		11.2	SURCHARGED	
S10.005	S35J	0.000	0.000	0.08		34.7	SURCHARGED*	
S10.006	S38	1.065	0.000	0.06		24.7	FLOOD RISK	
S10.007	S40	1.102	0.000	0.04	27.3	24.3	FLOOD RISK	
S14.000	S43	1.150	0.225	1.35		19.0	FLOOD	1
S14.001	S44	1.227	0.000	0.36		12.9	FLOOD RISK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
S15.000	S41	1.414	3.989	0.13		20.6	FLOOD	1
S15.001	S42	1.449	3.242	0.18		22.8	FLOOD	1
S10.008	S45	1.560	0.000	0.12		24.8	FLOOD RISK	
S16.000	S26	0.873	0.000	0.22		2.6	FLOOD RISK	
S16.001	S27	1.010	0.000	0.15		5.5	FLOOD RISK	
S1.009	S9	1.897	0.000	0.42		25.7	FLOOD RISK	
S17.000	S28	0.569	0.000	0.31		5.4	SURCHARGED	
S17.001	S29	0.836	0.000	0.06		5.4	SURCHARGED	
S1.010	S10	2.022	0.000	0.76		24.7	FLOOD RISK	
S1.011	S11	-0.085	0.000	0.70		24.7	OK	
S1.012	S12	-0.086	0.000	0.70		24.7	OK	
S1.013	S13	-0.087	0.000	0.70		24.7	OK	
S1.014	S14	-0.114	0.000	0.49		24.7	OK	
S1.015	S15	-0.133	0.000	0.35		24.7	OK	
S1.016	S16	-0.098	0.000	0.61		24.7	OK	
S1.017	S17	-0.098	0.000	0.61		24.7	OK	
S1.018	S18	-0.104	0.000	0.56		24.7	OK	

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FOUL SEWERAGE DESIGN

Design Criteria for 151029.FWS

Pipe Sizes 151029 Manhole Sizes 151029

Industrial Flow (l/s/ha)	0.10	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	6.00	Minimum Backdrop Height (m)	0.200
Flow Per Person (l/per/day)	0.00	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 151029.FWS

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
1.000	30.257	0.378	80.0	0.500	0	0.0	1.500	o	150	
1.001	31.455	0.315	100.0	0.500	0	0.0	1.500	o	150	
1.002	56.823	0.568	100.0	0.500	0	0.0	1.500	o	150	
1.003	12.793	0.128	100.0	0.500	0	0.0	1.500	o	150	
1.004	43.331	0.433	100.0	0.000	0	0.0	1.500	o	150	
1.005	20.441	0.204	100.0	0.000	0	0.0	1.500	o	150	
1.006	37.774	0.378	100.0	0.000	0	0.0	1.500	o	150	
1.007	16.687	0.167	100.0	0.500	0	0.0	1.500	o	150	
1.008	21.650	0.217	100.0	0.000	0	0.0	1.500	o	150	
1.009	29.214	0.292	100.0	0.000	0	0.0	1.500	o	150	
2.000	21.629	0.433	50.0	0.500	0	0.0	1.500	o	150	
2.001	11.510	0.471	24.4	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)
1.000	86.500	0.500	0.0	0	0.0	14	0.36	0.98	17.3	0.3
1.001	86.122	1.000	0.0	0	0.0	20	0.41	0.88	15.5	0.6
1.002	85.807	1.500	0.0	0	0.0	25	0.47	0.88	15.5	0.9
1.003	85.239	2.000	0.0	0	0.0	29	0.51	0.88	15.5	1.2
1.004	85.111	2.000	0.0	0	0.0	29	0.51	0.88	15.5	1.2
1.005	84.678	2.000	0.0	0	0.0	29	0.51	0.88	15.5	1.2
1.006	84.474	2.000	0.0	0	0.0	29	0.51	0.88	15.5	1.2
1.007	84.096	2.500	0.0	0	0.0	32	0.55	0.88	15.5	1.5
1.008	83.929	2.500	0.0	0	0.0	32	0.55	0.88	15.5	1.5
1.009	83.712	2.500	0.0	0	0.0	32	0.55	0.88	15.5	1.5
2.000	86.500	0.500	0.0	0	0.0	13	0.42	1.24	21.9	0.3
2.001	86.067	0.500	0.0	0	0.0	11	0.54	1.78	31.4	0.3

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Free Flowing Outfall Details for 151029.FWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.009	11	88.000	83.420	0.000	0	0

Free Flowing Outfall Details for 151029.FWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
2.001	14	87.000	85.596	0.000	0	0

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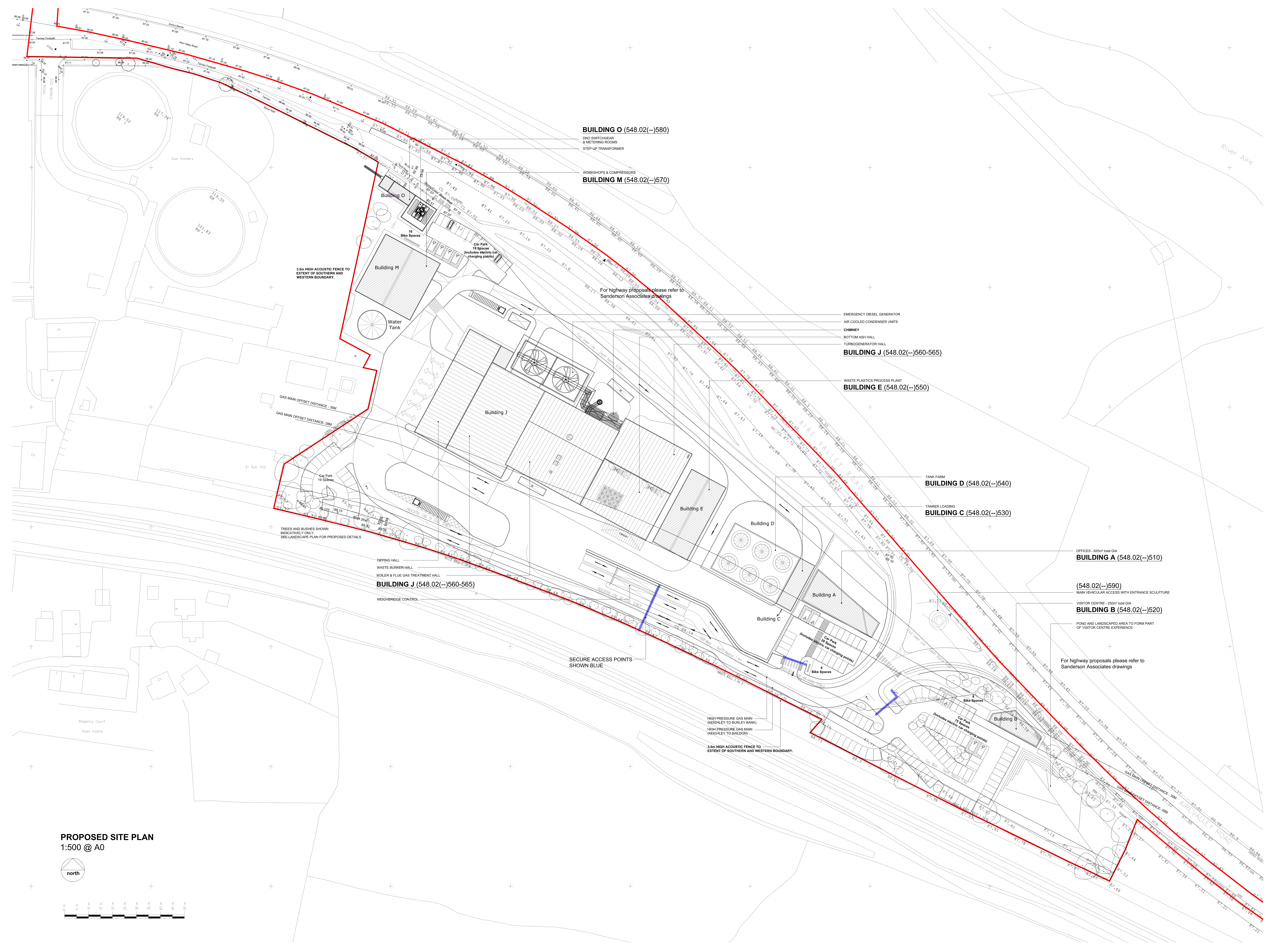
D R A W I N G S



PROPOSED SITE PLAN
1:500 @ A0

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NOTES

This drawing is for planning purposes only and no dimensions should be read or taken from it. Grid lines and levels are indicative only and are not based on survey datum.

For highway proposals please refer to Sanderson Associates drawings.

For landscape proposals please refer to .... drawings.

REV E 10.08.2016 NP
Remaining cycle parking provision added to plan (8no. adjacent to Building A and 8no. adjacent to building B - to provide 32no. total)

REV D 08.08.2016 NP
Line of secure access points added for clarity.
Height of acoustic fence amended.

REV C 03.08.2016 NP
Kerb radius increased to the north west of building J to accommodate swept path analysis by Sanderson Associates.
Also, additional access ramps included to provide shallower approach to tipping hall.

REV B 01.08.2016 NP
Car parking spaces updated and increased following completion of latest reports by highways consultants.

REV A 12.07.2016 NP
North point corrected

PLANNING ISSUE

AIRE VALLEY ENERGY FROM WASTE DEVELOPMENT
AIRE VALLEY ROAD
KEIGHLEY
FOR
ENDLESS ENERGY LTD

PROPOSED SITE PLAN
OVERALL LAYOUT

Date	JUNE 2016		
Scale	1:500 @ A0		
Drawn	NP	Checked	

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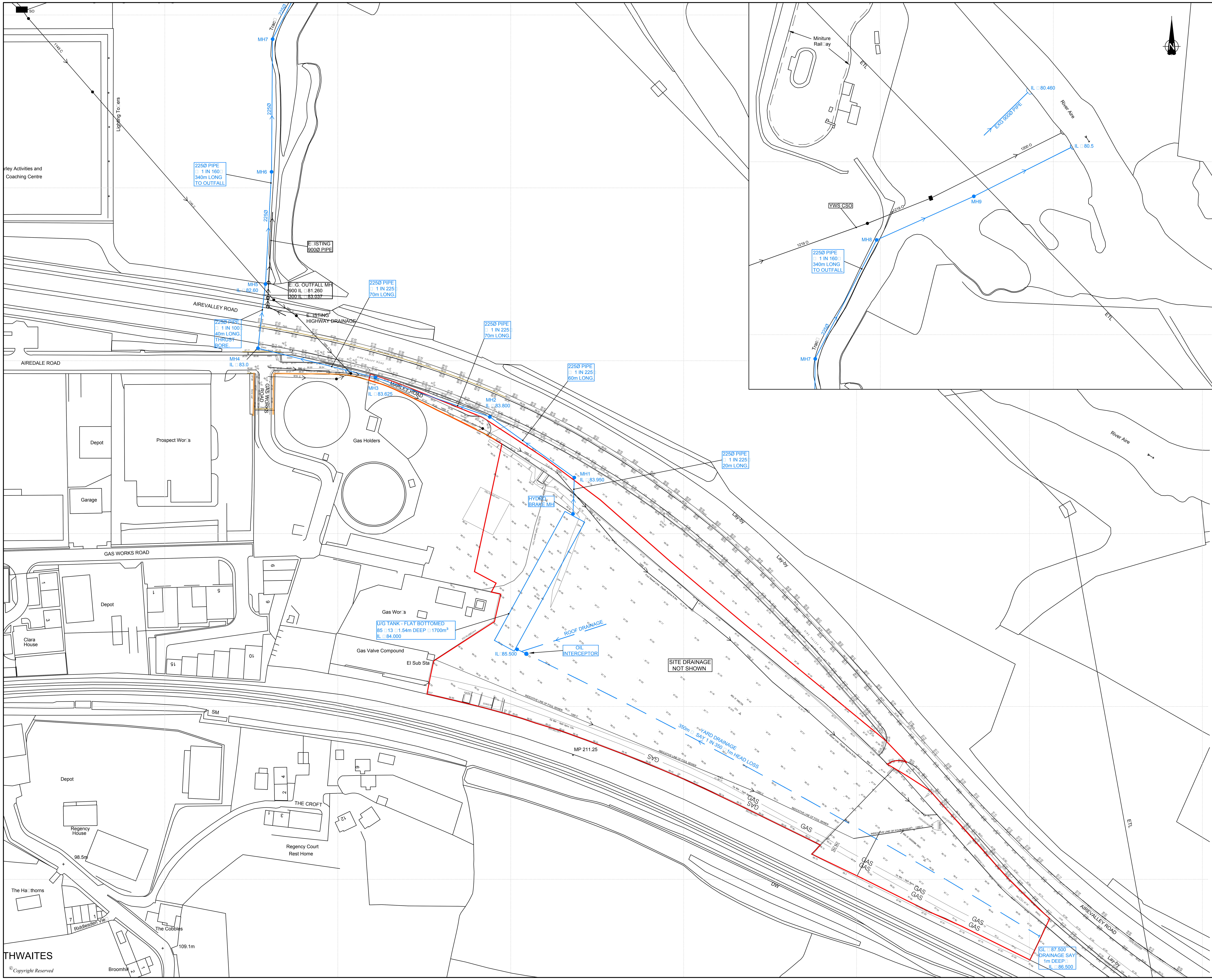

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REVISION	DETAILS	DATE	DRAWN	CHK'D	APP'D
B	Updated to suit scheme changes. Client name change.	12/07/16	DP	JR	SR
A	First Issue	23/01/14	DP	SR	SR

CLIENT
ENDLESS ENERGY

PROJECT
KEIGHLEY CLEAN ENERGY PROJECT

DRAWING TITLE
SURFACE WATER DRAINAGE STRATEGY

DRG No.	SCALE	DATE
SH11087-010	1:1000 □ A1	23/01/14
DRAWN BY	CHECKED BY	APPROVED BY
DP	SR	SR

☐ STOKE-ON-TRENT (HEAD OFFICE)	TEL 0845 111 7777	☐ CARDIFF	TEL 029 2072 9191
		☐ LEIGH	TEL 01942 260101
☐ NEWCASTLE UPON TYNE	TEL 0191 232 0943	■ SHEFFIELD	TEL 0114 245 6244
☐ WEST BROMWICH	TEL 0121 580 0909	☐ EDINBURGH	TEL 0131 555 3311
☐ LONDON	TEL 020 7287 2872	☐ LIVERPOOL	TEL 0151 494 5431

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NOTES

1. ALL LEVELS ARE SHOWN INDICATIVELY ONLY AND ARE SUBJECT TO CONFIRMATION BY THE CLIENT/ARCHITECT.
2. 1 IN 100 YEAR □20□ CLIMATE CHANGE ATTENUATION TO BE RETAINED ON-SITE.
3. CLEAN ROOF WATER TO BE DISCHARGED DIRECTLY TO ATTENUATION TANK.
4. RUNOFF FROM YARDS AND ROADS TO BE DISCHARGED VIA OIL INTERCEPTOR.
5. PERMEABLE PAVING SYSTEMS TO PROVIDE INFILTRATION AND ATTENUATION FOR 1 IN 100 YEAR □20□ CLIMATE CHANGE STORM EVENT.
6. ATTENUATION STORAGE LAYER IN PERMEABLE PAVING TO BE 4/20 STONE WITH APPRO□ 0.3 VOID RATIO. DEPTH OF STORAGE SUBJECT TO DETAILED DESIGN AND DEPENDANT ON ANTICIPATED LOADINGS

KEY

- Proposed roo□ drainage
- Proposed sur□ace □ater drainage
- Stormbloc□ geocellular storage/attenuation tan□
- Permeable bloc□ paving on voided sub-base
- Hydrocarbon Interceptor
- 88.25 Proposed □inished levels
- Proposed □oul drainage

Not □or construction on site unless stated belo□

Marley Activities and Coaching Centre

Danger Live Services

AIREVALLEY ROAD

SW out all pipe to pass under the A650

Hydrobra□e flo□ control to restrict discharge to 25 l/sec (ma□) □ 2m head HB Invert 85.722m type: Hydrobra□e Optimum re□ MD-SHE-0200-2400-2000-2400

150m2 stormbloc□ cellular storage. 0.66m thic□ness. Base level 85.954m

Manhole □ith over flo□ pi□e □ 86.61m and 600mmØ pipe connection to stormbloc

Runo□ □rom hardstandings to drain via a □ull retention hydrocarbon interceptor. SPEL Puraceptor class 1 model: P250/1CSC or similar approved

200m2 stormbloc□ cellular storage. 0.66m thic□ness. Base level 85.977m

Manhole □ith over flo□ pi□e □ 86.61m and 600mmØ pipe connection to stormbloc

Gas Valve Compound

Permeable bloc□ paving 60mm concrete bloc□ (marshalls priora osa) on 60mm o□ 5mm single size agg on 300mm o□ 4/20 agg on terram 1000 permeable geote□tile osa

Roo□ □ater □rom Visitor Centre to discharge into sub-base □or permeable paving

Permeable bloc□ paving 60mm concrete bloc□ (marshalls priora osa) on 60mm o□ 5mm single size agg on 300mm o□ 4/20 agg on terram 1000 permeable geote□tile osa

OUTFALL TO RIVER AIRE

River Aire

Miniture Rail□ay

Ris□ Assessment & mitigation

1. Live services: locate identi□y & isolate/divert be□ore commencing □or□.
2. E□cavations: support steep □aces and trenches. Barrier access to edge o□ e□cavations.
3. Slips□ trips □alls: □eep site clear as possible.
4. Biological□chemical hazard in ground: use o□ PPE.
5. Danger □rom □alling materials: de□ine sa□ety zones□ permit to □or□□PPE.
6. Tra□ic on site: permit to □or□□high vis clothing
7. Danger to 3rd parties: □ence site securely

REVISION	DETAILS	DATE	DRAWN	CHK'D	APP'D
B	Layout updated and data revised.	04/08/16	DP	JR	SR
A	First Issue	20/07/16	DP	SR	SR

CLIENT: ENDLESS ENERGY

PROJECT: KEIGHLEY CLEAN ENERGY FACILITY

DRAWING TITLE: DRAINAGE LAYOUT

DRG No.	SCALE	DATE
SH11087-020	1:1000 □ A1	20/07/16
DRAWN BY: DP	CHECKED BY: SR	APPROVED BY: SR

□ STOKE-ON-TRENT (HEAD OFFICE) TEL 01782 276700
□ NEWCASTLE UPON TYNE TEL 0191 232 0943
□ BIRMINGHAM TEL 0121 580 0909
□ LONDON TEL 020 7287 2872
□ CARDIFF TEL 029 2072 8191
□ LEIGH TEL 01942 260101
■ SHEFFIELD TEL 0114 245 6244
□ EDINBURGH TEL 0131 555 3311
□ TAUNTON TEL 01823 703100

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N:\SH\SH11087 - KEIGHLEY CLEAN ENERGY PROJECT\03 - DESIGN\AUTOCAD\SH11087-020.DWG

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Manhole Shedule

Manhole Number	Easting	Northing	Cover Level	Connected Pipes	Depth To Invert	Manhole Size	Manhole & Cover Type
S1	408123.372	441345.937	87.625	S 1.000 IL:86.900 DIA:0.250	0.725	1.050	E; D400
S2	408107.136	441340.597	88.300	S 1.000 IL:86.786 DIA:0.250 S 2.000 IL:86.786 DIA:0.250 S 3.000 IL:86.711 DIA:0.250 S 1.001 IL:86.711 DIA:0.250	1.589	1.050	E; D400
S3	408084.160	441337.887	88.345	S 1.001 IL:86.595 DIA:0.250 S 4.000 IL:86.720 DIA:0.250 S 1.002 IL:86.220 DIA:1.250	2.125	3.060	B; D400
S3J	408057.089	441353.887	87.009	S 1.002 IL:86.189 DIA:1.250 S 5.000 IL:86.639 DIA:0.250 S 1.003 IL:86.189 DIA:1.250	2.111	???	???
S4	408023.286	441373.617	90.175	S 1.003 IL:86.151 DIA:1.250 S 6.000 IL:86.601 DIA:0.250 S 1.004 IL:86.151 DIA:1.250	4.024	1.800	B; D400
S5	407957.127	441404.807	90.175	S 1.004 IL:86.075 DIA:1.250 S 1.005 IL:86.075 DIA:1.250	4.100	3.060	B; D400
S6	407897.736	441435.608	91.033	S 1.005 IL:86.008 DIA:1.250 S 7.000 IL:87.533 DIA:0.250 S 1.006 IL:86.008 DIA:1.250	5.025	3.060	B; D400
S7	407911.885	441466.328	90.125	S 1.006 IL:85.974 DIA:1.250 S 8.001 IL:85.970 DIA:0.600 S 1.007 IL:85.970 DIA:0.600	4.155	3.060	B; D400
S8	407926.509	441498.845	88.300	S 1.007 IL:85.934 DIA:0.600 S 9.002 IL:86.297 DIA:0.250 S 1.008 IL:85.929 DIA:0.300	2.371	1.500	B; D400
S9	407935.027	441514.800	88.300	S 1.008 IL:85.829 DIA:0.300 S 10.008 IL:85.862 DIA:0.600 S 16.001 IL:86.179 DIA:0.250 S 1.009 IL:85.829 DIA:0.300	2.471	1.500	B; D400
S10	407937.212	441519.040	88.300	S 1.009 IL:85.772 DIA:0.300 S 17.001 IL:85.772 DIA:0.250 S 1.010 IL:85.772 DIA:0.250	2.528	1.800	B; D400
S11	407928.768	441532.622	87.517	S 1.010 IL:85.692 DIA:0.250 S 1.011 IL:85.692 DIA:0.250	1.825	1.200	B; D400
S12	407885.162	441565.669	87.243	S 1.011 IL:85.418 DIA:0.250 S 1.012 IL:85.418 DIA:0.250	1.825	1.200	B; D400
S13	407821.755	441590.500	87.000	S 1.012 IL:85.078 DIA:0.250 S 1.013 IL:85.078 DIA:0.250	1.922	1.200	B; D400
S14	407753.766	441607.202	86.800	S 1.013 IL:84.728 DIA:0.250 S 1.014 IL:84.728 DIA:0.250	2.072	1.200	B; D400
S15	407757.904	441645.482	86.153	S 1.014 IL:84.328 DIA:0.250 S 1.015 IL:84.328 DIA:0.250	1.825	1.200	B; D400
S16	407761.599	441709.333	84.900	S 1.015 IL:83.075 DIA:0.250 S 1.016 IL:83.075 DIA:0.250	1.825	1.200	B; D400
S17	407762.338	441786.042	84.400	S 1.016 IL:82.575 DIA:0.250 S 1.017 IL:82.575 DIA:0.250	1.825	1.200	B; D400
S18	407797.958	441854.918	83.900	S 1.017 IL:82.075 DIA:0.250 S 1.018 IL:82.075 DIA:0.250	1.825	1.200	B; D400
S20	408112.376	441356.668	87.950	S 2.000 IL:86.900 DIA:0.250	1.050	1.050	E; D400

Manhole Shedule

Manhole Number	Easting	Northing	Cover Level	Connected Pipes	Depth To Invert	Manhole Size	Manhole & Cover Type
S21	408073.416	441382.975	88.300	S 5.000 IL:87.000 DIA:0.250	1.300	1.050	E; D400
S22	408040.166	441405.366	88.300	S 6.000 IL:87.000 DIA:0.250	1.300	1.050	E; D400
S24	407895.207	441442.152	88.400	S 8.000 IL:86.000 DIA:0.600	2.400	1.500	B; D400
S25	407905.419	441463.499	88.250	S 8.000 IL:85.977 DIA:0.600 S 8.001 IL:85.977 DIA:0.600	2.273	1.500	B; D400
S26	407910.238	441486.223	88.300	S 16.000 IL:87.000 DIA:0.250	1.300	1.050	E; D400
S27	407922.504	441510.129	88.100	S 16.000 IL:86.866 DIA:0.250 S 16.001 IL:86.866 DIA:0.250	1.234	1.050	E; D400
S28	407885.359	441500.723	88.350	S 17.000 IL:87.300 DIA:0.250	1.050	1.050	E; D400
S29	407897.609	441523.342	88.350	S 17.000 IL:87.026 DIA:0.250 S 17.001 IL:86.951 DIA:0.250	1.399	1.050	E; D400
S30	408098.609	441370.377	88.300	S 10.000 IL:87.300 DIA:0.250	1.000	1.050	E; D400
S31	408069.067	441371.745	88.250	S 11.000 IL:87.000 DIA:0.250	1.250	1.050	E; D400
S32	408076.490	441387.159	90.386	S 10.000 IL:86.811 DIA:0.250 S 11.000 IL:86.886 DIA:0.250 S 10.001 IL:86.436 DIA:1.250	3.950	3.060	B; D400
S33	408047.879	441403.177	90.328	S 10.001 IL:86.403 DIA:1.250 S 10.002 IL:86.403 DIA:1.250	3.925	3.060	B; D400
S33J	408046.502	441409.992	87.216	S 10.002 IL:86.396 DIA:1.250 S 12.000 IL:86.846 DIA:0.250 S 10.003 IL:86.396 DIA:1.250	4.275	???	???
S34	408033.281	441385.143	88.250	S 12.000 IL:87.000 DIA:0.250	1.250	1.050	E; D400
S35	408044.192	441421.778	90.309	S 10.003 IL:86.384 DIA:1.250 S 10.004 IL:86.384 DIA:1.250	3.925	3.060	B; D400
S35J	408029.041	441433.986	87.159	S 10.004 IL:86.365 DIA:1.250 S 13.002 IL:86.671 DIA:0.250 S 10.005 IL:86.365 DIA:1.250	4.131	???	???
S36	408007.281	441392.742	88.350	S 13.000 IL:86.947 DIA:0.250 S 13.001 IL:86.947 DIA:0.250	1.403	1.050	E; D400
S37	408025.041	441426.073	88.350	S 13.001 IL:86.729 DIA:0.250 S 13.002 IL:86.730 DIA:0.250	1.621	1.050	E; D400
S38	408015.262	441444.517	90.273	S 10.005 IL:86.348 DIA:1.250 S 10.006 IL:86.348 DIA:1.250	3.925	3.060	B; D400
S39	407958.525	441413.291	88.200	S 13.000 IL:87.300 DIA:0.250	0.900	1.050	E; D400

Manhole Shedule

Manhole Number	Easting	Northing	Cover Level	Connected Pipes	Depth To Invert	Manhole Size	Manhole & Cover Type
S40	407988.466	441468.616	90.237	S 10.006 IL:86.312 DIA:1.250 S 10.007 IL:86.312 DIA:1.250	3.925	3.060	B; D400
S41	407985.668	441468.120	88.215	S 15.000 IL:85.990 DIA:0.600	2.225	1.500	B; D400
S42	407955.727	441492.033	88.179	S 15.000 IL:85.954 DIA:0.600 S 15.001 IL:85.954 DIA:0.600	2.225	1.500	B; D400
S43	407910.813	441441.225	88.300	S 14.000 IL:87.000 DIA:0.250	1.300	1.050	E; D400
S44	407934.614	441485.240	88.300	S 14.000 IL:86.666 DIA:0.250 S 14.001 IL:86.666 DIA:0.250	1.634	1.050	E; D400
S45	407936.449	441509.597	90.225	S 10.007 IL:86.210 DIA:1.250 S 14.001 IL:85.553 DIA:0.250 S 15.001 IL:85.928 DIA:0.600 S 10.008 IL:85.867 DIA:0.600	4.672	3.060	B; D400
S46	407939.394	441502.518	88.000	S 9.001 IL:86.461 DIA:0.250 S 9.002 IL:86.386 DIA:0.250	1.614	1.050	E; D400
S50	408014.967	441450.123	88.100	S 9.000 IL:87.000 DIA:0.250	1.100	1.050	E; D400
S51	407978.852	441481.635	88.000	S 9.000 IL:86.681 DIA:0.250 S 9.001 IL:86.681 DIA:0.250	1.319	1.050	E D400
SCP1	408137.580	441304.604	88.000	S 3.000 IL:87.075 DIA:0.250	0.925	1.050	E; D400
SCP2	408088.508	441348.698	88.250	S 4.000 IL:87.250 DIA:0.250	1.000	1.050	E; D400
SCP3	407869.156	441418.002	88.600	S 7.000 IL:87.600 DIA:0.250	1.000	1.050	E; D400
SS19	407792.785	441864.229	83.500	S 1.018 IL:81.968 DIA:0.250	1.532	2.300	???

Manhole Shedule

Manhole Number	Easting	Northing	Cover Level	Connected Pipes	Depth To Invert	Manhole Size	Manhole & Cover Type
F1	407930.927	441493.939	88.200	F 1.000 IL:86.500 DIA:0.150	1.700	1.200	B; D400
F2	407916.378	441467.410	88.200	F 1.000 IL:86.122 DIA:0.150 F 1.001 IL:86.122 DIA:0.150	2.078	1.200	B; D400
F3	407902.239	441439.312	88.200	F 1.001 IL:85.807 DIA:0.150 F 1.002 IL:85.807 DIA:0.150	2.393	1.200	B; D400
F4	407951.843	441411.594	88.250	F 1.002 IL:85.239 DIA:0.150 F 1.003 IL:85.239 DIA:0.150	3.011	1.200	B; D400
F5	407963.071	441405.462	88.250	F 1.003 IL:85.111 DIA:0.150 F 1.004 IL:85.111 DIA:0.150	3.139	1.200	B; D400
F6	408001.827	441386.084	88.150	F 1.004 IL:84.678 DIA:0.150 F 1.005 IL:84.678 DIA:0.150	3.472	1.200	B; D400
F7	408020.060	441376.845	88.250	F 1.005 IL:84.474 DIA:0.150 F 1.006 IL:84.474 DIA:0.150	3.776	1.200	B; D400
F8	408053.992	441360.247	88.150	F 1.006 IL:84.096 DIA:0.150 F 1.007 IL:84.096 DIA:0.150	4.054	1.200	B; D400
F9	408070.672	441359.756	88.250	F 1.007 IL:83.929 DIA:0.150 F 1.008 IL:83.929 DIA:0.150	4.321	1.200	B; D400
F10	408089.886	441349.781	88.250	F 1.008 IL:83.712 DIA:0.150 F 1.009 IL:83.712 DIA:0.150	4.538	1.200	B; D400
F11	408103.504	441323.934	88.000	F 1.009 IL:83.420 DIA:0.150	4.580	1.200	B; D400
F12	408166.290	441307.996	88.155	F 2.000 IL:86.500 DIA:0.150	1.655	1.200	B; D400
F13	408147.514	441318.734	87.800	F 2.000 IL:86.067 DIA:0.150 F 2.001 IL:86.067 DIA:0.150	1.733	1.200	B; D400
F14	408145.064	441329.980	87.251	F 2.001 IL:85.596 DIA:0.150	1.655	1.200	B; D400

REVISION	DETAILS	DATE	DRAWN	CHK'D	APP'D

CLIENT
HALTON GROUP

PROJECT
KEIGHLEY CLEAN ENERGY PROJECT

DRAWING TITLE
MANHOLE SCHEDULES

PRELIMINARY

DRG No.	SCALE	DATE
SH11087-021	NTS	09/08/16
DRAWN BY	CHECKED BY	APPROVED BY

☐ STOKE-ON-TRENT (HEAD OFFICE) TEL 0845 111 7777
☐ NEWCASTLE UPON TYNE TEL 0191 232 0943
☐ WEST BROMWICH TEL 0121 580 0909
☐ LONDON TEL 020 7287 2872
☐ CARDIFF TEL 029 2072 9191
☐ LEIGH TEL 01942 260101
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