coopers

chartered consulting engineers

Our ref: 7843FRA

Flood Risk Assessment Report

for

Edgehill, Phase 4

at

Whitehaven, Cumbria

For : Story Homes
Story House
Lords Way
Kingmoor Business Park
Carlisle
Cumbria
CA6 4SL

29th July 2022

Park House, Sandpiper Court,
Chester Business Park,
Chester, CH4 9QU

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Flood Risk Assessment Report for Edgehill Phase 4
Whitehaven, Cumbria.

Document Verification

Project Title	Edgehill, Phase 4, Whitehaven, Cumbria
Project Number	7843
Document Title	Flood Risk Assessment
Document Number	7843FRA
This document is not to be used for contractual or engineering purposes unless the document verification sheet is signed where indicated by the approver of the document.	

Prepared by

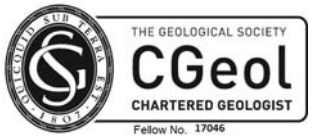
A Jones

Senior Infrastructure Engineer

Checked and Approved

P R Sykes

BSc (Hons), MSc (Eng), CGeol, FGS



Document Revision

Report Reference	Date	Description	Prepared	Checked and Approved
7843FRA	29/07/2022	Flood Risk Assessment	A Jones	P R Sykes

This report has been prepared for and on behalf of our client, in accordance with the terms and conditions of the appointment agreement with Coopers. Other than where specifically allowed for in the said appointment agreement, any other party using this report for any purpose whatsoever does so at their own risk and any duty of care to that party is specifically excluded.

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List of Appendices

1.0 Introduction

Coopers Consulting Engineers (Coopers) have been appointed by Story Homes to assess the risk of flooding and to provide a Flood Risk Assessment (FRA) for a site at Edgehill Phase 4 (Demense Farm), Whitehaven. Story Homes are proposing a new housing development, comprising of approximately 109 units.

Story Homes are planning the construction of a mixture of semi-detached and detached residential properties with associated access road, parking, vehicular access and landscaping subject to conditions.

This FRA evaluates the proposals with regard to flood risk, identifying and appraising potential flood risk both to and from the whole site. Coopers have carried out the following:

i. Assessment of the development potential of the site in line with the National Planning Policy Framework (NPPF)
ii. Local Planning Policy (LPP) and;
iii. An assessment of surface water runoff.

A summary of the NPPF and LPP are provided in Appendix 6.

2.0 Site Characteristics

2.1 Site Location

The site is a parcel of agricultural land to the south of Whitehaven. The site is located at approximate grid reference NX973157 and is accessed off Gameriggs Road in the Greenbank residential estate to the east of the development.

Figure 1 – Site Location

2.2 Site Description

The site covered an area of 4.8 Hectares and consisted of one large grassed open agricultural field. To the north of the site is the Lowther Gardens development and to the east is the Greenbank estate which provides access into the site off Gameriggs Road. The Story Homes Edgehill Phase 3 development is under construction to the west and the SUDS Basin serving Edgehill Park Phases 2 and 3 is to the south of the site.

The topography of the site falls towards the south and eastern boundaries. The development platform is at gradients of between 1:50 and 1:20, but the existing levels do fall away steeply towards the eastern boundary (1:8) and southern boundary 1:6).

The site currently drains towards the southern boundary and will naturally drain towards the Mirehouse West catchment, ultimately converging and being culverted from the site to the Mirehouse ponds discharge into the southern arm of Pow Beck.

The previous Edgehill Park Phases 2 and 3 are under construction and will drain to a SUDS basin located to the south (lower end) of the Phase 4.

3.0 Sources of Flood Risk Information

3.1 Environment Agency

The Environment Agency consider the site to not be within an area potentially affected by flooding, or extreme flooding from rivers or sea without defences, which equates to less than 1:1000-year flooding (Zone 1 in accordance with NPPF). This assessment does not take into account appraisals of surface water drainage requirements.

It should be noted that the Flood Map only covers flooding from rivers and the sea. Flooding can occur at any time and in any place from sources such as rising groundwater levels, burst water mains, blocked road drains, run-off from hillsides, sewer overflows, etc.

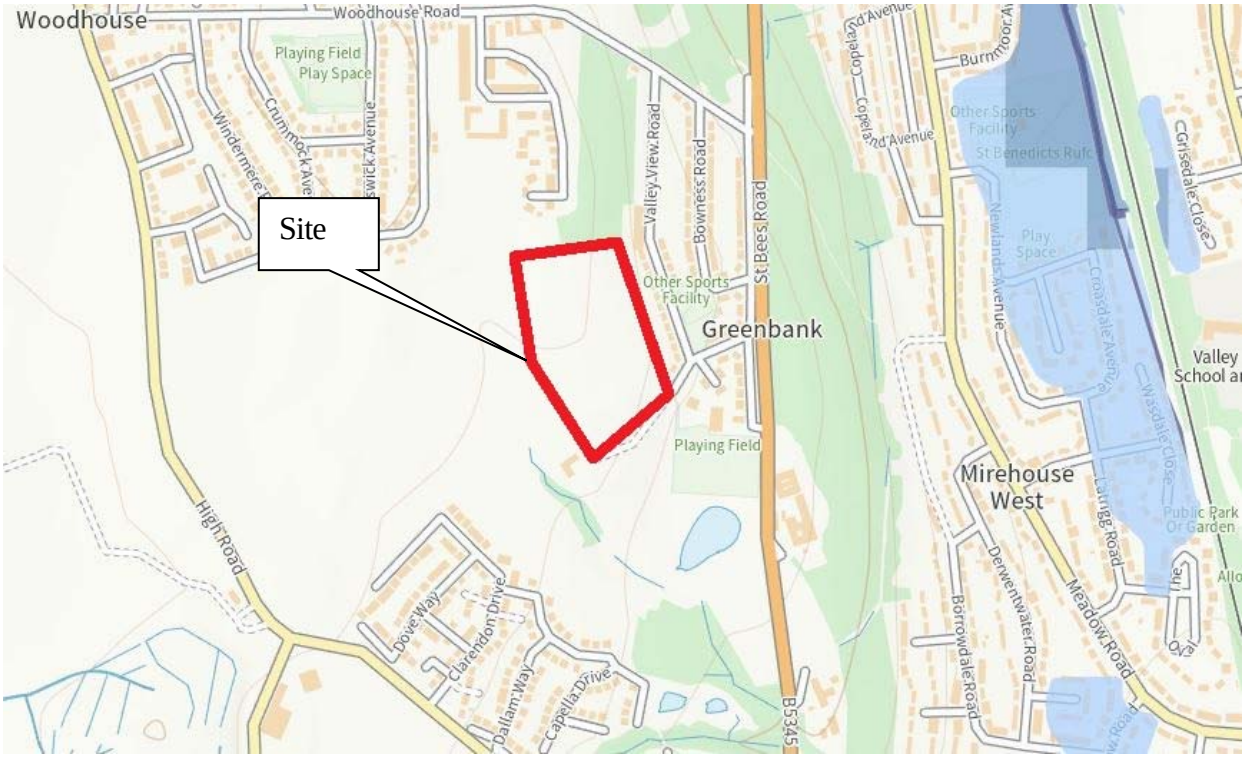

Figure 2 – EA Flood Map for Planning (River and Sea)

The EA Risk of Flooding from Surface Water map indicated the site is not at risk of flooding from surface water.

Figure 2 – EA Surface Water Flooding Map

The Environment Agency has been contacted to discuss the site. Correspondence with EA is provided in Appendix 1.

3.2 Local Authority

The Local Planning Authority (LPA) has been contacted to discuss the site. Correspondence with LLFA is provided in Appendix 1.

3.3 British Geological Survey

The site is not shown to be at risk of flooding at surface from groundwater flooding.

3.4 Water Company

The local water company for the site is United Utilities (UU). Correspondence with UU is provided in Appendix 1

3.4 Ground Investigation

A ground Investigation report and been undertaken by ID GeoEnvironmental Ltd dated December 2021. Refer to Appendix 3 for extracts. The site was found to be underlain by cohesive and granular made ground in the northwest of the site, and a thin 1.2m thickness of Glacial Till present in the west of

the site over residual mudstone (sandy silty clay) to 1.0-1.5m progressing into partially weathered mudstone, sandstone & siltstone bedrock. A thin 0.2-0.5m thick coal was also encountered locally at outcrop.

No groundwater was encountered during investigations and the report recommends ground conditions are not appropriate for infiltration to dispose of surface water flows.

3.5 Current Land Owner

During client discussions, the current landowner has indicated that he is not witnessed any flooding at the site and that he is not aware of any flooding issues.

4.0 Sources of Flood Risk

4.1 Fluvial

Extreme fluvial flood events have the potential to cause rapid inundation of the site whilst posing a threat to welfare and users. As outlined in Section 3.1; the site is within Flood Zone 1 and is therefore not at risk from extreme fluvial or tidal flooding. Therefore, the risk from extreme fluvial flooding to the site is considered to be low.

4.2 Infrastructure Failure (Existing and Proposed)

The failure of infrastructure such as culverts or bridges could increase the risk of flooding at the site. No such components require consideration and therefore the risk of flooding is considered very low.

4.3 Overland Flow

Overland flow occurs when the infiltration capacity of the ground is exceeded in a storm event. This can result in water travelling as a sheet flow overland or excess water being conveyed from location to another via local road networks. The site topography falls towards the east and south. There are no known flooding issues related to the existing properties to the east (Valley View Road) and flows in this direction will be reduced post development. The flows to the south will head towards the watercourse which again will be reduced post development so overland flow is not considered a significant risk.

The development is also subject to overland flows from the undeveloped land to the north of the site. Without mitigation this will potentially cause flooding issues to the properties at the northern end of the site. Therefore, a land drainage scheme is being proposed to intercept and direct all offsite flows along the western edge of the development and direct then to the existing ravine / watercourse. Refer to Appendix 2 for details of the proposed land drain.

4.4 Sewer Flooding

If the capacity of the sewers is exceeded in an extreme event, or a blockage occurs, surcharging of the network can result in surface flooding. UU sewer plans which are included in Appendix 4, indicate that there are currently no existing adopted sewers located within the site boundary.

UU have proposed that foul flows will be allowed to drain to the public combined/ foul sewer network to a 225mm diameter combined sewer located in St Bees Road to the east of the site at an unrestricted rate.

The risk from sewer flooding is considered as low.

4.5 Groundwater Flooding

Groundwater flooding occurs as a result of water rising up from the underlying superficial deposits, bedrock or from springs.

A ground Investigation report has been undertaken by ID GeoEnvironmental Ltd dated December 2021 and no groundwater was encountered during investigations. Consequently, the risks from groundwater flooding are considered as low.

4.6 Coastal Flooding

The site is not located in proximity of any tidal waterway or within close proximity to the Irish Sea and is therefore not at risk from tidal inundation.

4.7 Reservoirs

The site is not located in proximity of any reservoirs and is therefore not at risk from reservoirs.

5.0 Surface Water Drainage

5.1 General

The design for a surface water drainage system for the proposed development will be guided by the principles set out in the National Planning Policy Framework (NPPF) and the Building Regulations Approved Document H.

The NPPF provides the following advice with regards to drainage:

"Developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage systems. Sustainable drainage systems cover the whole range of sustainable approaches to surface drainage management. They are designed to control surface water run off close to where it falls and mimic natural drainage as closely as possible."

The Building Regulations Approved Document H states that rainwater shall discharge to one of the following, listed in order of priority:

1. An adequate soakaway or some other adequate infiltration system, or where this is not reasonably practical;
2. A watercourse, or where this is not reasonably practical;
3. A sewer.

5.2 Existing Surface Water Drainage

There is no existing surface water drainage within the proposed development site boundary.

5.3 Existing Site Runoff

The catchment surface area for the site and the proposed development is <50ha, therefore the

Greenfield runoff rates estimation tool from UKSUDS website has been used to calculation existing flow rates. The outputs are provided in Appendix 5.

The greenfield runoff rate has been calculated as QBAR 8.25 l/s per hectare. However, previous phases to Edgehill Park have been reduced to 80% of the existing greenfield run-off rate for the site to help reduce potential flooding issues further downstream, therefore we propose the same.

With the proposed developable area being 3.61 Ha, the proposed development will be restricted to **23.7 l/s** (*ie: 8.25 x 3.61 x 80%).*

5.4 Proposed Surface Water Drainage and Runoff Rates

The Ground Investigation has determined the ground conditions are not suitable for infiltration to dispose of surface water flows generated from the development. It is therefore proposed that surface water run-off from roofs highway and shared / private drives will discharge into the watercourse at the southern end of the site.

Surface water run-off is proposed to discharge into the watercourse via a dry SUDS basin providing approximately 1,250m^3 attenuation. Discharges from the basin are proposed to be limited to 23.7 l/s using a vortex flow control device (hydrobrake or similar). The combination of the attenuation pond and flow control is expected to limit the peak flow below the existing QBAR greenfield run off rate with a 20% betterment. This will significantly reduce the flow of water leaving the site in a storm event reducing flood risk further downstream.

Refer to Appendix 2 Reference Drawings for the proposed drainage strategy.

An allowance has been made for the effects of climate change in accordance with the guidance provided in NPPF. Based on the design life of the proposed development an increase of 40% has been used for climate change.

An allowance for urban creep has also been incorporated into the design with a 10% increase in impermeable areas throughout the development.

5.5 Foul Drainage

United Utilities have proposed that foul flows will be allowed to drain to the public combined/ foul sewer network to a 225mm diameter combined sewer located in St Bees Road to the east of the development site at an unrestricted rate.

6.0 Conclusions and Recommendations

The site is located in Flood Zone 1 and has been shown to be at low risk of flooding from rivers, groundwater, surface water, sewers and climate change. Therefore, mitigation measures are not considered necessary for any future development at the site.

The results from the Ground Investigation indicated that the underlying soils have inadequate infiltration characteristics for soakaways. Therefore, surface water run-off from roof, highways and shared / private drives will discharge into the watercourse.

Surface water run off is proposed to discharge into the watercourse via a 1250m^3 dry SUDS basin. Discharges from the basin are proposed to be limited to 23.7 l/s using a vortex flow control device (hydrobrake or similar). The combination of the attenuation pond and flow control is expected to limit the peak flow below the existing QBAR greenfield run off rate with a 20% betterment. This will significantly reduce the flow of water leaving the site in a storm event reducing flood risk further downstream.

United Utilities have proposed that foul flows will be allowed to drain to the public combined/ foul sewer network to a 225mm diameter combined sewer located in St Bees Road to the east of the site at an unrestricted rate.

The possible effects of climate change and urban creep have been considered by acknowledging the requirements to make allowance for increased rainfall in the calculation of surface water discharge rates over the lifespan of the development in line with NPPF.

The surface water drainage network, SUDS basin and flow control will be offered to United Utilities for adoption via a S104 Adoption Agreement. Story Homes will be responsible for the all components until the final certificates have been issued at the end of the maintenance period.

Appendix 1

Correspondence

United Utilties

Envirnonment Agency

Local Lead Flood Authority

Andy Jones

From: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Sent: 22 February 2022 12:41
To: Andy Jones
Subject: Historical Flooding Information - UU Ref. 4200047492

Good Afternoon Andy,

Thank you for contacting United Utilities.

I can confirm that we have no current record of sewer flooding within the vicinity of the proposed development.

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

Our response does not include:

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

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

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

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

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

Kind regards,

United Utilities
Water for the North West

Louise Dack
Customer Advisor Advanced
Developer Services & Metering
Customer Services
T: 01925 233063 (33063 internal)
unitedutilities.com

Did you know we now have a live chat facility available to you Mon to Friday 8 -5pm. You just click on the orange live chat box on our webpage and one of our advisors will be ready to chat to you and help you with your enquiry https://www.unitedutilities.com/builders-developers/ or you can email us at WastewaterDeveloperServices@uuplc.co.uk

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From: Andy Jones [mailto:ajones@coopers.co.uk]
Sent: 16 February 2022 16:39
To: Wastewater Developer Services <WastewaterDeveloperServices@uuplc.co.uk>
Subject: Historical Flooding Information

7843 Edgehill Phase 4, Whitehaven

To whom it may concern

We are undertaking a Flood Risk Assessment and Drainage Strategy for the above site (see location plan below) and request any information you may have in relation to historical flooding or any information you may consider relevant to assist with the production of the FRA report.

Please let me know if you require any further information or please contact me on the details below should you want to discuss further.

NX 97381 15791
Grid Reference (6 figure)
NX973157
X (Easting) , Y (Northing)
297381 , 515791
Latitude , Longitude (decimal)
54.526972 , -3.5871381
Latitude , Longitude (degs, mins, secs)
54°31'37"N , 003°35'14"W
What3Words :
happening.holidays.crumbles
Address (near) :
Lowther Gardens, Greenbank,
Whitehaven, Sandwith, Copeland
Postcode (nearest) :
CA28 9LE

Regards

Andy Jones
Senior Infrastructure Engineer
COOPERS
Park House, Sandpiper Court, Chester Business Park, Chester, CH4 9QU

☎: (01244) 684910 ☎: Direct Dial No. (01244) 684933
🖷: (01244) 684911
✉: ajones@coopers.co.uk
Web: http://www.coopers.co.uk

Andy Jones

From: CMBLNC Info Requests <Inforequests.cmblnc@environment-agency.gov.uk>
Sent: 28 February 2022 13:10
To: Andy Jones
Subject: CL251155KR: Historical Flooding Information
Attachments: CL251155 - Flood Zone Map.pdf

Dear Andy

Enquiry regarding any historial flooding information we hold.

Thank you for your enquiry received on 16 February 2022.

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

We hold no detailed modelling for the area requested and therefore we are unable to provide modelled information required for a Product 4.

The Environment Agency holds no records of flooding for the site of interest. Please be aware, however, that this does not necessarily mean that flooding has not occurred here in the past.

You may wish to view Flood Zones on the Flood Map for Planning. This map shows areas that could be affected by flooding from rivers and/or sea. To view the Flood Zones on the Flood Map for Planning, please navigate to the following website:
https://flood-map-for-planning.service.gov.uk/

For all queries relating to flooding from surface water, ordinary watercourses and groundwater flooding, please contact the Lead Local Flood Authority Cumbria County Council.
Surface Water Maps can be viewed online at https://flood-warning-information.service.gov.uk/long-term-flood-risk/map

Please refer to the Open Government Licence which explains ther permitted use for this information.

Please get in touch if you have any further queries.

Kind regards.

Helen Reynolds
Customer Engagement officer
Cumbria and Lancashire

From: CMBLNC Info Requests
Sent: 16 February 2022 22:01
To: ajones@coopers.co.uk
Subject: CL251155KR: Historical Flooding Information

Dear Andy

Thank you for contacting the Environment Agency regarding historical flooding data.

As your request for information falls under either the Freedom of Information Act or Environmental Information Regulations we respond within 20 working days.

Unfortunately our Flood Risk Management Team are currently managing an extremely high workload and we are experiencing delays in responding to requests. We expect this to improve as we move through February.

We appreciate that this is not an ideal situation and can only apologise for any inconvenience this may cause you. We assure you that your request will be dealt with as soon as possible and we thank you in advance for your patience in this matter.

In the meantime you may wish to look at www.data.gov.uk to see if the data you have requested is available for you online.

For further information on what you can expect from us and our full service commitment to you, please click this link; https://www.gov.uk/government/publications/environment-agency-customer-service-commitment

Kind regards.

Karen Rooke
Customer and Engagement Officer
Cumbria and Lancashire

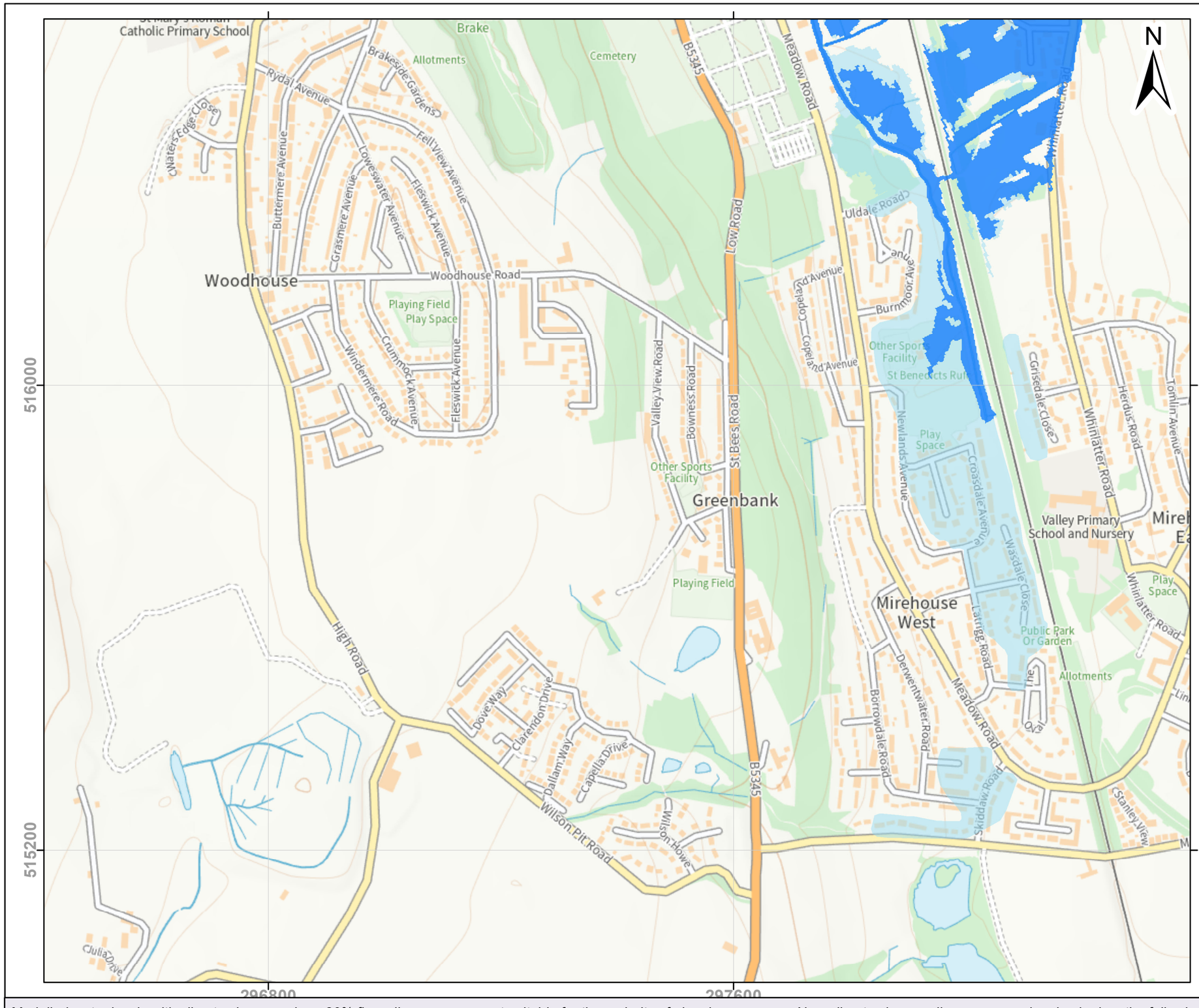
From: Andy Jones <ajones@coopers.co.uk>
Sent: 16 February 2022 16:39
To: NWNorthPlanning <CLPlanning@environment-agency.gov.uk>
Subject: Historical Flooding Information

> You don't often get email from ajones@coopers.co.uk. Learn why this is important

To whom it may concern

We are undertaking a Flood Risk Assessment and Drainage Strategy for the above site (see location plan below) and request any information you may have in relation to historical flooding or any information you may consider relevant to assist with the production of the FRA report.

Please let me know if you require any further information or please contact me on the details below should you want to discuss further.



Modelled water levels with climate change using +20% flow allowances are not suitable for the majority of planning purposes. New climate change allowances can be checked on the following website; www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances.

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

Environment Agency

Flood Zones Map:
Lowther Gardens, Greenbank, Whitehaven, CA28 9LE
Produced: 25/02/2022
Our Ref: CL251155
NGR: NX9739015795

Key

- Areas Benefitting from Defences
- Flood Zone 3
- Flood Zone 2

Flood Zone 3 shows the area that could be affected by flooding:
- from the sea with a 0.5% or greater chance of happening each year
- or from a river with a 1.0% 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 0.1% chance of occurring each year.

ABDs (Areas Benefiting from Defences) show the area benefiting from defences during a 0.5% tidal, or 1.0% fluvial flood event.

Andy Jones

From: Andy Jones
Sent: 13 April 2022 16:36
To: DMandLLFA_west@cumbria.gov.uk
Subject: FW: Historical Flooding Information

7843 Edgehill Phase 4, Whitehaven

We are still waiting for a response regarding the below historical flood enquiry submitted 16th Feb 2022.

Can you please provide a response?

Regards

Andy Jones
Senior Infrastructure Engineer
COOPERS
Park House, Sandpiper Court, Chester Business Park, Chester, CH4 9QU

☎: (01244) 684910 ☎: Direct Dial No. (01244) 684933
🖷: (01244) 684911
✉: ajones@coopers.co.uk
Web: http://www.coopers.co.uk

From: Andy Jones
Sent: 16 February 2022 16:39
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Subject: Historical Flooding Information

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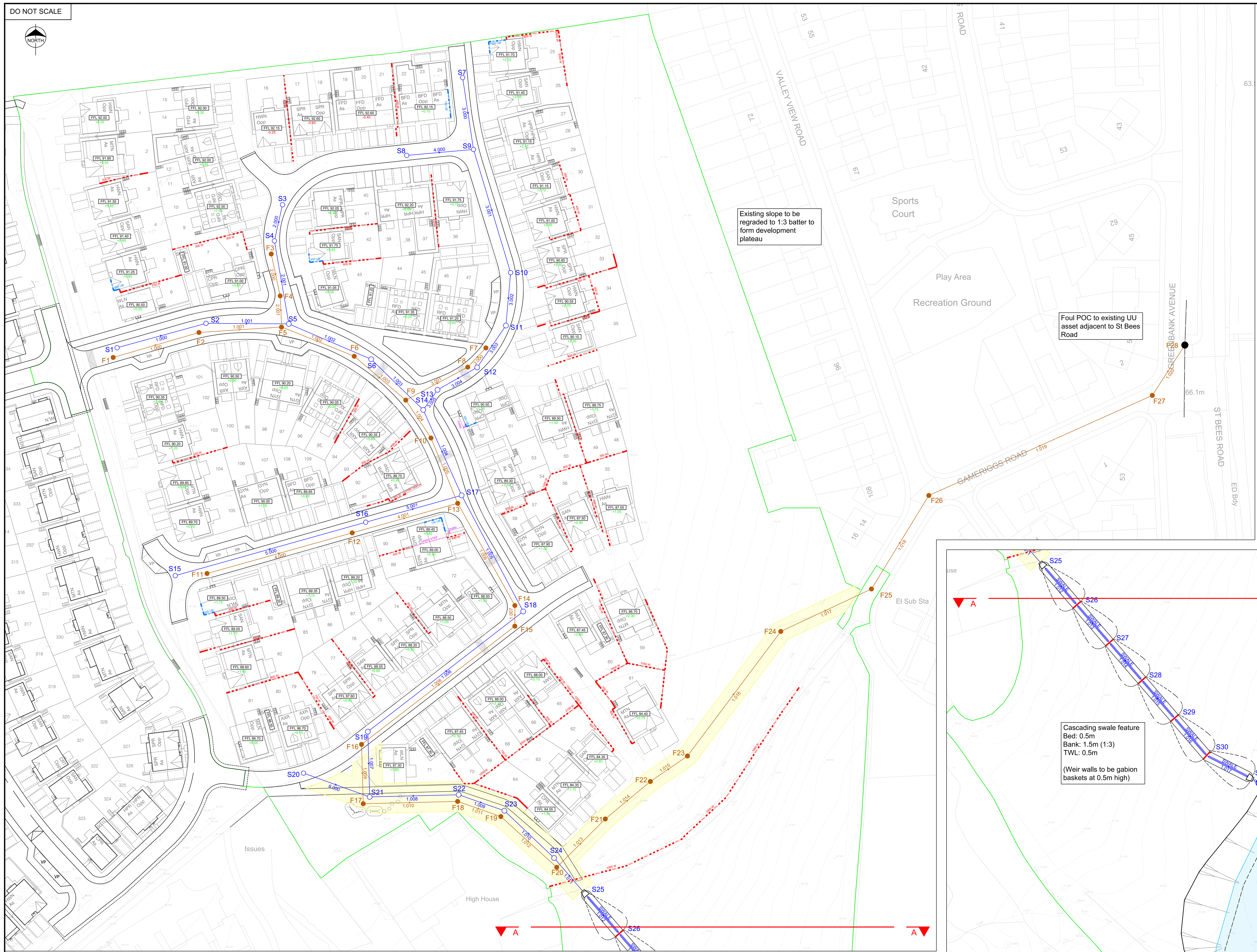
Please let me know if you require any further information or please contact me on the details below should you want to discuss further.

Appendix 2

Reference Drawings

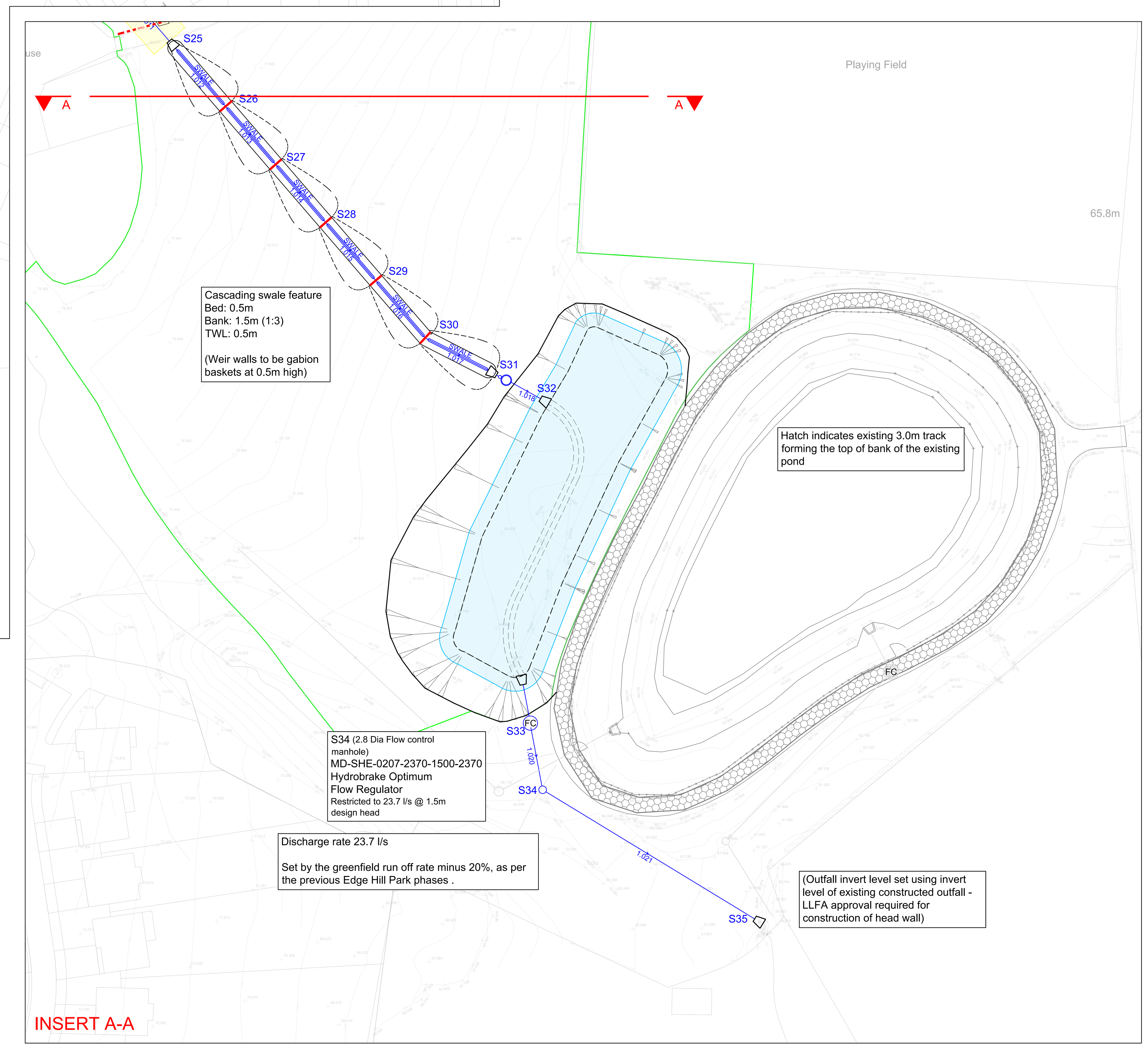
Drawing No.	Revision	Title
7843 SK04	G	Proposed Drainage Strategy
7843 SK06	C	Proposed Land Drainage Scheme

DO NOT SCALE



Legend

(green line)	Site Boundary
Existing	
(line with manhole)	Existing Sewer
Proposed	
(line with open manhole)	Adoptable Surface Water Sewer
(line with filled manhole)	Adoptable Foul Sewer
(dashed line)	Attenuation Pond base
FFL 47.40	Slab Level
(red dashed line)	Retaining Wall
(blue dashed line)	Underbuild
	Retention below 300mm not indicated
+0.85 / -0.95	Depth of fill (Existing levels to proposed)



STORM Network 1

Pipe Code	Dimensions (mm)	Gradient (1:)	Section Type	Pipe Type	Pipe Length	Upstream Manhole Number	Upstream Manhole Invert	Upstream Manhole Cover	Downstream Manhole Number	Downstream Manhole Invert	Downstream Manhole Cover
1.000	225	90	Circular	CLAY	27.785	S101	89.106	90.531	S102	88.798	90.630
1.001	225	168	Circular	CLAY	24.933	S102	88.798	90.630	S105	88.650	90.531
1.002	300	239	Circular	CLAY	27.006	S105	88.575	90.531	S106	88.462	90.549
1.003	375	280	Circular	CONC	21.868	S106	88.387	90.549	S114	88.309	90.392
1.004	450	44	Circular	CONC	28.219	S114	87.117	90.392	S117	86.470	89.047
1.005	450	300	Circular	CONC	39.581	S117	86.470	89.047	S118	86.338	88.322
1.006	450	40	Circular	CONC	59.159	S118	86.338	88.322	S119	84.860	87.031
1.007	450	26	Circular	CONC	19.679	S119	84.860	87.031	S121	84.103	86.104
1.008	450	34	Circular	CONC	26.820	S121	84.103	86.104	S122	83.312	84.885
1.009	450	26	Circular	CONC	14.588	S122	81.813	84.885	S123	81.252	83.415
1.010	450	200	Circular	CONC	20.649	S123	81.252	83.415	S124	81.149	82.458
1.011	450	200	Circular	CONC	15.000	S124	79.537	82.458	S125	79.462	80.000
1.012	500x500	8	Swale 1:3		15.001	S125	79.412	80.000	S126	77.513	78.020
1.013	500x500	6	Swale 1:3		14.999	S126	77.513	78.020	S127	74.836	75.340
1.014	500x500	6	Swale 1:3		15.000	S127	74.836	75.340	S128	72.158	72.682
1.015	500x500	7	Swale 1:3		15.001	S128	72.158	72.682	S129	69.984	70.489
1.016	500x500	6	Swale 1:3		15.000	S129	69.984	70.489	S130	67.638	68.142
1.017	500x500	5	Swale 1:3		17.758	S130	67.638	68.142	S131	64.409	65.644
1.018	675	318	Circular	CONC	7.643	S131	62.900	65.644	S132	62.876	64.300
1.019	675	400	Circular	CONC	63.603	S132	62.876	64.300	S133	62.717	65.693
1.020	225	58	Circular	CLAY	13.293	S133	62.717	65.693	S134	62.488	65.416
1.021	225	15	Circular	CLAY	48.553	S134	62.488	65.416	S135	59.273	60.673
2.000	225	29	Circular	CLAY	11.170	S103	89.950	91.674	S104	89.559	91.285
2.001	225	28	Circular	CLAY	25.368	S104	89.559	91.285	S105	88.650	90.531
3.000	225	70	Circular	CLAY	21.876	S107	90.166	91.816	S109	89.852	91.544
3.001	225	103	Circular	CLAY	38.756	S109	89.852	91.544	S110	89.476	91.058
3.002	225	103	Circular	CLAY	15.995	S110	89.476	91.058	S111	89.321	90.861
3.003	300	103	Circular	CLAY	15.293	S111	89.246	90.861	S112	89.097	90.673
3.004	300	34	Circular	CLAY	13.706	S112	89.097	90.673	S113	88.697	90.500
3.005	375	24	Circular	CONC	7.430	S113	88.622	90.500	S114	88.308	90.392
4.000	225	25	Circular	CLAY	20.182	S108	90.647	92.297	S109	89.852	91.544
5.000	225	168	Circular	CLAY	59.579	S115	87.581	89.231	S116	87.226	89.297
5.001	225	56	Circular	CLAY	30.010	S116	87.226	89.297	S117	86.695	89.047
6.000	225	66	Circular	CLAY	21.171	S120	84.651	86.076	S121	84.329	86.104

FOUL Network 1

Pipe Code	Diameter (mm)	Gradient (1:)	Pipe Type	Pipe Length	Upstream Manhole Number	Upstream Manhole Invert	Upstream Manhole Cover	Downstream Manhole Number	Downstream Manhole Invert	Downstream Manhole Cover
1.000	150	70	CLAY	26.906	F1	88.800	90.608	F2	88.416	90.595
1.001	150	78	CLAY	24.962	F2	88.416	90.595	F5	88.094	90.584
1.002	150	150	CLAY	23.671	F5	88.094	90.584	F6	87.936	90.505
1.003	150	146	CLAY	20.385	F6	87.936	90.505	F9	87.797	90.553
1.004	150	150	CLAY	13.695	F9	87.797	90.553	F10	87.706	89.993
1.005	150	150	CLAY	21.267	F10	87.706	89.993	F13	87.564	88.969
1.006	150	150	CLAY	35.265	F13	86.727	88.969	F14	86.492	88.286
1.007	150	13	CLAY	6.228	F14	86.492	88.286	F15	86.000	88.324
1.008	150	108	CLAY	58.305	F15	86.000	88.324	F16	85.460	86.865
1.009	150	57	CLAY	17.870	F16	85.460	86.865	F17	85.148	86.100
1.010	150	24	CLAY	28.448	F17	84.300	86.100	F18	83.100	84.900
1.011	150	20	CLAY	13.793	F18	83.100	84.900	F19	82.410	83.400
1.012	150	25	CLAY	22.747	F19	81.600	83.400	F20	80.700	82.500
1.013	150	150	CLAY	20.646	F20	80.700	82.500	F21	80.562	82.647
1.014	150	150	CLAY	17.652	F21	80.562	83.647	F22	80.444	82.400
1.015	150	10	CLAY	13.556	F22	80.444	83.406	F23	79.088	80.375
1.016	150	20	CLAY	46.885	F23	77.562	82.375	F24	75.218	77.418
1.017	150	9	CLAY	30.155	F24	73.595	77.418	F25	70.207	72.015
1.018	150	30	CLAY	33.040	F25	70.207	72.015	F26	69.102	70.903
1.019	150	19	CLAY	73.734	F26	69.102	70.903	F27	65.282	67.094
1.020	150	28	CLAY	18.067	F27	65.282	67.094	F28	64.644	0.000
2.000	150	30	CLAY	12.902	F3	89.363	91.163	F4	88.934	90.735
2.001	150	11	CLAY	9.136	F4	88.934	90.735	F5	88.094	90.584
3.000	150	70	CLAY	7.966	F7	88.942	90.742	F8	88.828	90.644
3.001	150	20	CLAY	21.145	F8	88.828	90.644	F9	87.797	90.553
4.000	150	70	CLAY	45.414	F11	87.596	89.396	F12	86.947	89.351
4.001	150	150	CLAY	33.000	F12	86.947	89.351	F13	86.727	88.969

Notes

1. Setting out shall be undertaken using only the information given. Distances should not be scaled from this drawing.
2. All sewers shall be constructed in accordance with Design and Construction Guidance (DCG) Standards and United Utilities Details & Guidelines.
3. The minimum gravity pipe diameter under adoptable highways shall be 150mm
4. It is the responsibility of the Contractor to verify all information given with regards to existing services and drainage connections etc. prior to commencing the works. The rates shall include for hand dig around services where necessary. The Contractor shall adhere to the CDM Regulations at all times
8. All materials to bear the relevant B.S. Kitemark and comply fully with the specifications. All concrete & concrete products must use Sulphate resistant cement to withstand Class 3 condition (unless the site investigation report proves that sulphate attack from soils and groundwater will not occur).
9. All opening notices etc. as required under Highways Acts etc. are to be obtained prior to commencement of works. All works are to be inspected by L.A., NHBC or the Network Operator as applicable.
10. Where structured wall UPVC pipes (or similar approved) are used in adoptable drainage they shall be handled and laid in accordance with the manufacturers instructions and will be subject to post installation deformation testing prior to adoption.
A Class S Bed and Surround must be used for structured wall pipes
11. Trench backfill in highways to within 1m of highway shall, as directed by the Highway Authority be a suitable granular material all in accordance with Design and Construction Guidance (DCG) Standards.
12. Slab levels shall not be varied without reference to the Engineer for guidance.
13. Pipes have not been designed to accommodate construction traffic loading. The contractor is responsible for providing adequate protection to the pipes during construction.

STRATEGY

Rev.	Date	Revision	By	Appd.
G	27.07.22	Updated to suit revised planning layout	JAR	AJ
F	08.07.22	Updated to suit revised planning layout	JAR	AJ
E	16.06.22	Updated to suit revised planning layout	JAR	AJ
D	11.05.22	Updated to suit revised planning layout	JAR	AJ
C	27.04.22	Updated to suit revised planning layout	JAR	AJ
B	05.04.22	Revised outfall - Online pond added (draft)	JAR	AJ
A	10.02.22	Updated to suit revised planning layout	JAR	AJ

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Client

Story HOMES

Project

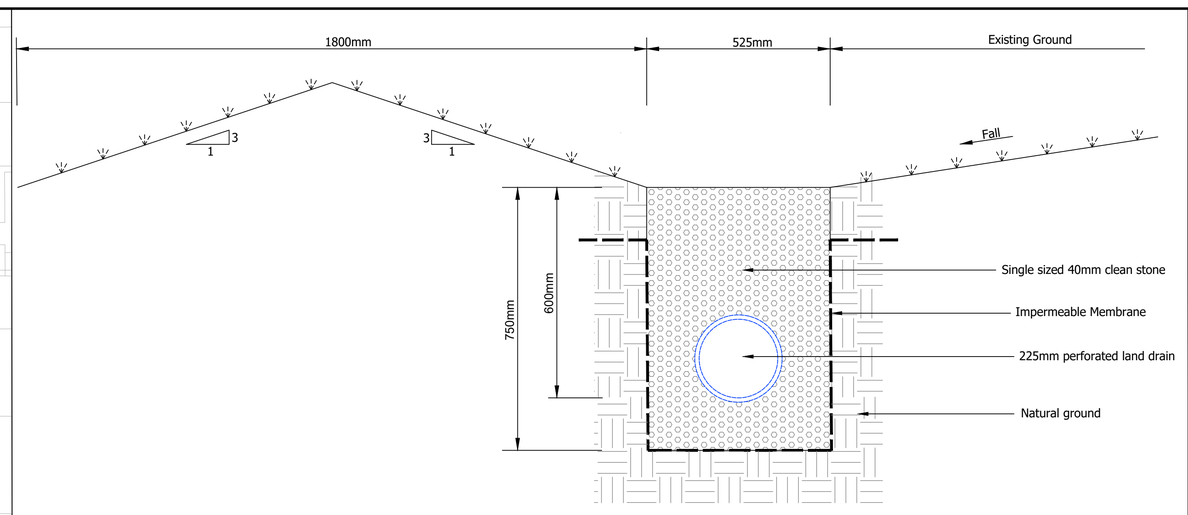
EDGEHILL PARK, CUMBRIA PHASE 4

Title

Drainage Strategy

DRAWING NUMBER	SCALE at A0	1:500	
7843 / SK04	DATE	30.11.21	REVISION
	DRAWN	JAR	G
	CHECKED	AJ	

DO NOT SCALE



Typical Land Drain Detail

Legend

- 225mmØ Land Drain
- 225mmØ Carrier Drain

North of development

Area = 17,650 m²

Qbar Greenfield
run-off rate: = 14.94 l/s

1yr: = 13.00 l/s
30yr: = 25.40 l/s
100yr: = 31.07 l/s

Land drain to be constructed with a 300mm high bund to tie in with garden levels formed using 1:3 batters

Existing slope to be regraded to 1:3 batter to form development plateau

Land drain to be constructed to avoid deep land drain at L9 - Hatched area indicates section of land that will not be drained into the land drain and will remain as the current situation

Cascading swale feature
Bed: 0.5m
Bank: 1.5m (1:3)
TWL: 0.5m

(Weir walls to be gabion baskets at 0.5m high)

S34 (2.8 Dia Flow control manhole)
MD-SHE-0207-2370-1500-2370
Hydrobrake Optimum
Flow Regulator
Restricted to 23.7 l/s @ 1.5m design head

Discharge rate 23.7 l/s

L1 CL:93.00 IL:92.60
L2 CL:91.80 IL:91.20
L3 CL:91.80 IL:90.60
L4 CL:91.00 IL:89.80
L5 CL:91.00 IL:89.70
L6 CL:90.80 IL:89.60
L7 CL:89.30 IL:88.10
L8 CL:86.55 IL:85.35
L9 CL:86.30 IL:85.10
L10 CL:86.20 IL:85.00
L10 CL:82.00 IL:81.60
L11 CL:81.50 IL:80.80
L12 CL:79.60 IL:79.00
L13 CL:77.70 IL:77.10
L14 CL:74.20 IL:73.60
L15 CL:69.10 IL:68.50

WASTWATER ROAD
VALLEY VIEW ROAD
Issues
High House

0 5 10 15 20 25 30 35 40 45 50
SCALEBAR (m)

STRATEGY

Rev.	Date	Revision	By	Appd.
C	08.07.22	Updated to suit revised planning layout	PW	AJ
B	13.05.22	Updated to suit planning comment	PW	AJ
A	11.05.22	Updated to suit revised planning layout	JAR	AJ

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Client: Story HOMES

Project: DEMENSE FARM, WORKINGTON, CUMBRIA.

Title: Indicative Land Drain Route

DRAWING NUMBER	SCALE at A0	1:500`	
7843 / SK06	DATE	27.04.22	REVISION
	DRAWN	JAR	C
	CHECKED	AJ	

Appendix 3

Site Investigation – Information for Infiltration Consideration

Extracts from:

ID Geoenvironmental Ltd Report 4046-G-R024 dated December 2021

12.7 Groundwater and Excavations

12.7.1 Based on the results of this investigation it is unlikely that major groundwater flows will be encountered in shallow excavations.

12.7.2 Weathered bedrock was encountered in all of the exploratory holes. Excavation to depths greater than 2.0-3.0 m is likely to prove difficult. It would therefore be prudent to allow for excavation of hard rock in any deep excavations such as those that may be required for service trenches.

12.7.3 Coal seams have been encountered at shallow depth during the ground investigation. Consequently, excavations (such as for foundations and services) may come into contact with coal. In order to minimise the likelihood of encountering coal, such excavations should be taken to the minimum depth required. Where foundation excavations come into contact with coal, the foundation should be taken through the coal seam into underlying rock strata of adequate bearing capacity. The full thickness of coal should then be sealed with concrete to create a trench fill foundation. To prevent the ingress of air, the mass concrete fill should be placed as soon as possible after exposing the seam.

12.8 Highways

12.8.1 The natural gravelly clay deposits and weathered mudstone will have a CBR value of at least 2% (as noted in Highways Agency Interim Advice Note 73/06 Rev 1 [2009] *Design Guidance for Road Pavement Foundations*). This estimate is based on visual inspection of the soils and the recorded plasticity index results; CBR values should be confirmed on site prior to road construction.

12.9 Flooding and Drainage

12.9.1 Based on the ground conditions encountered, it is not considered that soakaways would represent an effective method of surface water drainage. Story Homes Levels and SUDS drawing No. 7843/SK01 indicates drainage will comprise a combination of SUDS and SWALE features.

12.10 External Works

12.10.1 It will be necessary to remove topsoil, made ground and soft subsoil within the hollow and zone of hummocky ground in the northwest to create a level zone prior to infilling. Infilling will require placement of clean geotechnically suitable materials placed in engineered layers.

12.10.2 The site slopes steeply down to the eastern and south-eastern boundaries and it is considered likely that there will be a requirement for retaining walls in order to facilitate development.

13 SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

13.1 General

13.1.1 The conclusions below are summarised from the preceding sections of this report.

13.1.2 Redevelopment of the site with domestic dwellings is being considered. Story Homes Block Layout and Levels & SUDS Strategy Drawings indicate levels will be lifted on the fringes of the development where the site slopes steeply down to the east and southeast.

13.1.3 The site has not been previously developed. However clay and potentially coal excavation has taken place within the northwest of the site.

13.2 Ground Conditions

13.2.1 The site is surfaced with a nominal 0.3m thickness of topsoil/topsoil made ground. A thin (1.2m thick) deposit of Glacial Till is present in the west of the site.

13.2.2 Bedrock comprises residual mudstone, sandstone and siltstone up to 1.5m bgl. Partially weathered bedrock has been proven from 0.3m to 1.5m.

13.3 Mining and Quarrying

13.3.1 Rotary probing has encountered probable unrecorded abandoned mineworkings which potentially

influence development in the east and southeast of the site. An untreated mine shaft of unknown depth is present in the southwest of the site which will require treatment and capping. Proof drilling/treating of shallow mineworkings is recommended in the east of the site where the mineworkings are indicated to be within influencing distance of the proposed development depicted on Drawing 66D-ST0 005 Rev D.

13.3.2 Additional probing is needed in the southeast of the site to establish risks to the proposed development depicted on 66D-ST0 005 Rev D which extends beyond the initial site boundary.

13.4 Hazardous Gas

13.4.1 Hazardous ground gas monitoring to update the sites ground gas model is ongoing. Best case is CS1, worst case CS2.

13.5 Contamination and Remediation

13.5.1 No significant contamination has been detected and no remediation strategy is required.

13.6 Foundations

13.6.1 The majority of plots may be constructed with strip/trenchfill foundations. Piled foundations may be required in the northwest of the site, subject to infilling of the excavation and final site levels. Raft foundations are recommended in the east of the site where there is potential influence from shallow mine workings. However, the Structural Engineer may recommend bespoke foundation designs (subject to fill treatment of shallow mineworkings).

13.7 Groundwater and Excavations

13.7.1 Based on the results of this investigation it is unlikely that major groundwater flows will be encountered in shallow excavations.

13.7.2 Excavations to relatively shallow depth should remain stable in the short term; where excavations are to be left open for a significant period of time, these will require shoring to prevent collapse, especially in Made Ground and granular soils.

13.8 Highways

13.8.1 The natural clay deposits and weathered bedrock will have a CBR value of at least 2%.

13.9 Flooding and Drainage

13.9.1 The EA indicate that the site is not located within an indicative floodplain.

13.9.2 Soakaways are not considered to represent an effective method of surface water drainage, based on the ground conditions encountered during this investigation. Story Homes Levels and SUDS drawing indicates drainage will comprise a combination of SUDS and SWALE features.

13.10 Further Works

13.10.1 As noted above, further investigation comprising rotary probeholes and trial pits is required in the south east of the site to establish risks from shallow mining and to assess shallow ground conditions within the latest development layout.

13.10.2 A Foundation Zoning Plan has been provided to enable assessment of the influence of ground conditions and mineworkings upon the desired layout and development levels. A foundation schedule will be required once a final layout and levels are agreed. The foundation schedule will be subject to mines treatment and anticipated earthworks. Specifications for treatment of shallow workings and the known shaft and a specification for re-engineering of soils will also be required once the final layout has been agreed.

KEY

- Phase 4 CA Permit Boundary
- Proposed Development Area 2021
- PH900 — IDG Probehole 2021
- PH600 — IDG Probehole 2020
- TP750- — IDG Trial Pit 2021
- PH300 — IDG Probehole Dec 2016
- 72 — Base of Coal Contour (m AOD)
- Evidence of Surface Excavation
- Worked Coal <14m of Surface
- BGS Inferred Coal Seam Outcrop
- 296515-001 — CA Recorded Mine Shaft

Revision	Description	Date

iD GeoEnvironmental Limited

North West & Midlands: Caledonian House Tatton Street Knutsford, Cheshire WA16 6AG
Tel: 01565 755557 Fax: 01565 740263

North East & Yorkshire: The Stables, Aske Hall Aske, Richmond Yorkshire, DL10 5HG
Tel: 01748 889015 Fax: 01565 740263

CLIENT: Story Homes

JOB TITLE: Phase 4 Edgehill Park, Whitehaven

DRAWING TITLE: Mining Influence Plan

STATUS: Final

DRAWN BY	SIGNATURE	DATE
NW		26-10-21
APPROVED	SIGNATURE	DATE
BRB		15-12-21

SCALE: 1:500@A1

DWG No.: 4046-G-D055

A1 Border: 817 X 517

iD GeoEnvironmental Limited	Project Title: Rhodia, Whitehaven		TP750
	Project Number: 4046	Client: Story Homes	Sheet 1 Of 1
	GL (mAOD): 91.10	N Coord: 515865	E Coord: 297256
Date: 03/09/2020	Method: Tracked Excavator	Logged By: SD	Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.10	ES		90.90		0.20	MADE GROUND: Rough grass over brown, slightly gravelly sandy clayey topsoil. Sand is fine to coarse. Gravel is subrounded to angular fine to coarse of sandstone, quartzite, rare brick. Single whole brick. (MADE GROUND TOPSOIL)	
0.40	ES		90.60		0.50	MADE GROUND: Brown, slightly sandy slightly gravelly clay with thin band of sand and gravel of mudstone and pocket of clayey sand. (COHESIVE MADE GROUND)	
0.75	ES	V=117kPa				Stiff, blue-grey, slightly gravelly CLAY. Interpreted to be weathered (residual) mudstone. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
0.90 0.90	D J						
1.00	SV	V=117kPa	90.10		1.00		
			90.00		1.10	Blue-grey and orange, MUDSTONE. Interpreted as weathered (distinctly). Recovered as sandy gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			89.10		2.00	End Of Trial Pit At 2.00 m	
			88.10		3.00		

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered
Slight groundwater trickle at 1.7m bgl. Pit sides stable.

iD GeoEnvironmental Limited	Project Title: Rhodia, Whitehaven		TP751
	Project Number: 4046	Client: Story Homes	Sheet 1 Of 1
	GL (mAOD): 90.60	N Coord: 515832	E Coord: 297296
Date: 01/09/2021	Method: Tracked Excavator	Logged By: SD	Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.10	ES		90.45		0.15	MADE GROUND: Rough grass over brown, slightly gravelly sandy clayey topsoil. Sand is fine to coarse. Gravel is subrounded to angular fine to coarse of sandstone, quartzite, rare brick. Single fragment of ceramic sewer. (MADE GROUND TOPSOIL)	
0.75	D					Stiff, brown, slightly gravelly fine to coarse sandy CLAY with occasional pockets of orange fine to medium sand. Gravel is rounded fine to coarse of sandstone and quartzite. (GLACIAL TILL)	
0.75	J						
			89.60		1.00	Dark grey, MUDSTONE. Interpreted as weathered (distinctly). Recovered as sandy gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
1.10	J		89.40		1.20	Black COAL. Interpreted as weathered (partially). Recovered as gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			88.90		1.70	Grey, SILTSTONE. Interpreted as weathered (partially). Recovered as gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			88.70		1.90	End Of Trial Pit At 1.90 m	
			88.60		2.00		
			87.60		3.00		

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.

iD GeoEnvironmental Limited	Project Title: Rhodia, Whitehaven		TP752
	Project Number: 4046	Client: Story Homes	Sheet 1 Of 1
	GL (mAOD): 90.30	N Coord: 515871	E Coord: 297301
Date: 01/09/2021	Method: Tracked Excavator	Logged By: SD	Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.05	ES		90.20		0.10	MADE GROUND: Rough grass over brown, silty gravelly sandy topsoil. Sand is fine to coarse. Gravel is subrounded to angular fine to coarse of sandstone, quartzite, rare brick. (MADE GROUND TOPSOIL)	
0.25	ES		90.10		0.20		
			90.00		0.30	MADE GROUND: Orange, sand and gravel of brick with occasional half/whole brick. (GRANULAR MADE GROUND)	
			89.90		0.40		
						MADE GROUND: Dark grey, sandy gravel. Sand is fine to coarse. Gravel is subrounded fine to coarse of coal and sandstone. (GRANULAR MADE GROUND)	
						MADE GROUND: Brown, sandy gravelly clay. Sand is fine to coarse. Gravel is subrounded to angular fine to coarse of brick, coal and ceramics. (COHESIVE MADE GROUND)	
1.00	J		89.30		1.00	Grey and brown, SILTSTONE. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
						0.40 - 1.00 Interpreted as weathered (distinctly). Recovered as silty sandy gravel with low cobble content.	
			89.10		1.20	1.00 - 1.20 Interpreted as weathered (partially). Recovered as silty sandy gravel with low cobble and low boulder content.	
			88.30		2.00	End Of Trial Pit At 1.20 m	
			87.30		3.00		

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.

iD GeoEnvironmental Limited	Project Title: Rhodia, Whitehaven		TP753
	Project Number: 4046	Client: Story Homes	Sheet 1 Of 1
	GL (mAOD): 90.80	N Coord: 515837	E Coord: 297314
Date: 01/09/2021	Method: Tracked Excavator	Logged By: SD	Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.05	ES		90.70		0.10	MADE GROUND: Rough marsh grass over brown, silty gravelly sandy topsoil. Sand is fine to coarse. Gravel is subrounded to angular fine to coarse of sandstone and quartzite. (MADE GROUND TOPSOIL)	
0.20	ES		90.50		0.30	MADE GROUND: Orange and brown, silty sand and gravel of brick with high (>20%) cobble content of bricks, concrete and single masonry up to 0.4m in maximum dimension. (GRANULAR MADE GROUND)	
						Grey and orange-brown, SILTSTONE. Interpreted as weathered (distinctly). Recovered as silty sandy gravel sized particles with medium (5-20%) cobble content. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			89.80		1.00		
			89.30		1.50	End Of Trial Pit At 1.50 m	
			88.80		2.00		
			87.80		3.00		

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.

iD GeoEnvironmental Limited	Project Title: Rhodia, Whitehaven		**TP754**
	Project Number: 4046	Client: Story Homes	Sheet 1 Of 1
	GL (mAOD): 90.20	N Coord: 515798	E Coord: 297322
Date: 01/09/2021	Method: Tracked Excavator	Logged By: SD	Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.10	ES		90.00		0.20	Rough grass over brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is subrounded to angular fine to coarse of sandstone and quartzite. (TOPSOIL)	
0.75	SV	V=127kPa				Stiff, light brown mottled grey-orange and brown, slightly sandy slightly gravelly CLAY with rare sandstone cobble. Sand is fine to coarse. Gravel is subrounded to angular fine to coarse of sandstone, mudstone and coal. (GLACIAL TILL)	
0.90	SV	V=135kPa					
1.00 1.00	D J		89.20		1.00		
1.15	SV	V=122kPa					
			89.00		1.20	Grey and brown, SILTSTONE and fine SANDSTONE. (WEATHERED PENNINE MIDDLE COAL MEASURES) 1.20 - 1.60 Interpreted as weathered (residual/destructured). Recovered as clayey very gravel sand sized particles. 1.60 - 1.90 Interpreted as weathered (distinctly). Recovered as slightly sandy gravel sand sized particles with medium (5-20%) cobble content.	
			88.30		1.90		
			88.20		2.00	End Of Trial Pit At 1.90 m	
			87.20		3.00		

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.

iD GeoEnvironmental Limited	Project Title: Rhodia, Whitehaven		TP755
	Project Number: 4046	Client: Story Homes	Sheet 1 Of 1
	GL (mAOD): 89.10	N Coord: 515786	E Coord: 297280
Date: 01/09/2021	Method: Tracked Excavator	Logged By: SD	Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.10	ES					MADE GROUND: Rough marsh grass over very soft, brown, slightly fine to medium sandy silty clay. Many metal items (e.g. rods, pipes, wire) and occasional whole bricks and rubber tubes. Strong stagnant water odour. (COHESIVE MADE GROUND)	
						0.70 - 0.80 Land drain encountered with no water flow; broken during excavation.	
			88.20		0.90		
1.00	J		88.10		1.00	Grey and orange-brown, SILTSTONE. Interpreted as weathered (distinctly). (WEATHERED PENNINE MIDDLE COAL MEASURES)	
						0.90 - 1.20 Recovered as silty sand and gravel sized particles.	
						1.20 - 1.70 Recovered as silty sand and gravel sized particles and high (>20%) cobble content.	
			87.40		1.70		
						Grey and brown, MUDSTONE. Interpreted as weathered (partially). Recovered as sandy gravel sized particles and high (>20%) cobble content. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			87.10		2.00		
			87.00		2.10		
						End Of Trial Pit At 2.10 m	
			86.10		3.00		

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.

iD GeoEnvironmental Limited	Project Title: Rhodia, Whitehaven		**TP756**
	Project Number: 4046	Client: Story Homes	Sheet 1 Of 1
	GL (mAOD): 87.10	N Coord: 515720	E Coord: 297302
Date: 01/09/2021	Method: Tracked Excavator	Logged By: SD	Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.05	ES		86.90		0.20	Rough marsh grass over dark brown, slightly gravelly silty sandy clayey TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of sandstone and mudstone. (TOPSOIL)	
			86.70		0.40	Brown, silty clayey SAND. Sand is fine to medium. (GLACIAL TILL)	
						0.20 - 1.00 Historic drain running N-S in the centre of the pit, 1m in width. Backfill material contains dark grey, clayey sand and gravel with cobbles of mudstone and sandstone over thick red tiles. No water flow within the drain.	
						Firm, light brown, slightly sandy CLAY. (GLACIAL TILL)	
			86.10		1.00	Light brown, MUDSTONE. Interpreted as weathered (distinctly/destructured). Recovered as silty sandy gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
						1.20 - 1.30 Slow flow of water (only) underneath the location of the historic drain.	
			85.10		2.00	End Of Trial Pit At 2.00 m	
			84.10		3.00		

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

Slow flow of water (only) underneath the location of the historic drain at 1.2m bgl. Pit sides stable. Pit terminated due to difficulty excavating. No Shear Vane Tests taken due to initial concern over the historic drain.

iD GeoEnvironmental Limited	Project Title: Rhodia, Whitehaven		TP757
	Project Number: 4046	Client: Story Homes	Sheet 1 Of 1
	GL (mAOD): 88.90	N Coord: 515749	E Coord: 297292
Date: 01/09/2021	Method: Tracked Excavator	Logged By: SD	Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
			88.70		0.20	Rough marsh grass over dark brown, silty sandy clayey TOPSOIL. Sand is fine to coarse. (TOPSOIL)	
0.75	SV	V=31kPa				Soft locally firm, grey-brown, slightly silty slightly sandy CLAY. Sand is fine to medium. (GLACIAL TILL)	
0.90	SV	V=36kPa				0.50 - 1.10 Historic drain running N-S in the centre of the pit, 0.5m in width. Backfill material contains dark grey, clayey sand and gravel with cobbles of mudstone and sandstone over thick red tiles. No water flow within the drain.	
			87.90		1.00		
1.30	SV	V=22kPa					
			87.50		1.40	Light brown and grey, MUDSTONE. (WEATHERED PENNINE MIDDLE COAL MEASURES) 1.40 - 1.70 Interpreted as weathered (distinctly/destructured). Recovered as silty sand and gravel sized particles. 1.70 - 2.00 Becoming grey. Interpreted as weathered (distinctly). Recovered as sandy gravel sized particles.	
			86.90		2.00	End Of Trial Pit At 2.00 m	
			85.90		3.00		

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.

iD GeoEnvironmental Limited	Project Title: Rhodia, Whitehaven		TP758
	Project Number: 4046	Client: Story Homes	Sheet 1 Of 1
	GL (mAOD): 86.50	N Coord: 515695	E Coord: 297354
Date: 01/09/2021	Method: Tracked Excavator	Logged By: SD	Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.10	ES		86.10		0.40	Rough grass over dark brown, silty sandy clayey TOPSOIL. Sand is fine to coarse. (TOPSOIL)	
0.60	D					Firm, orange-brown mottled grey-brown, slightly sandy CLAY. Sand is fine to medium. Interpreted as weathered (residual) mudstone. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
0.60	J						
0.80	SV	V=82kPa	85.50		1.00	Brown and grey and orange-brown, MUDSTONE. Interpreted as weathered (distinctly) mudstone. Recovered as clayey silty sandy gravel sized particles with medium (5-20%) cobble content. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			85.00		1.50	End Of Trial Pit At 1.50 m	
			84.50		2.00		
			83.50		3.00		

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.

iD GeoEnvironmental Limited	Project Title: Rhodia, Whitehaven		TP759
	Project Number: 4046	Client: Story Homes	Sheet 1 Of 1
	GL (mAOD): 87.90	N Coord: 515726	E Coord: 297344
Date: 01/09/2021	Method: Tracked Excavator	Logged By: SD	Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
			87.65		0.25	Rough grass over brown, gravelly clayey sandy silty TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of coal and sandstone. (TOPSOIL)	
0.75	SV	V=135kPa				Stiff, orange-brown mottled grey, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of coal, quartzite and sandstone. (GLACIAL TILL)	
0.80	D						
0.90	SV	V=135kPa					
			86.90		1.00		
			86.70		1.20	Grey and orange-brown, fine SANDSTONE. Interpreted as weathered (distinctly) mudstone. Recovered as sandy gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			86.30		1.60	End Of Trial Pit At 1.60 m	
			85.90		2.00		
			84.90		3.00		

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.

iD GeoEnvironmental Limited	Project Title: Rhodia, Whitehaven		TP760
	Project Number: 4046	Client: Story Homes	Sheet 1 Of 1
	GL (mAOD): 88.80	N Coord: 515759	E Coord: 297332
Date: 01/09/2021	Method: Tracked Excavator	Logged By: SD	Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
			88.55		0.25	Rough grass over dark brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of coal and sandstone. (TOPSOIL)	
0.75	SV	V=123kPa				Stiff, orange-brown mottled grey, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of coal, quartzite and sandstone. (GLACIAL TILL)	
0.95	SV	V=*	87.80		1.00		
1.10	SV	V=133kPa	87.60		1.20		
						Brown and grey and orange-brown, fine SANDSTONE. Interpreted as weathered (distinctly/destructured) mudstone. Recovered as clayey very sandy gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			87.10		1.70		
						End Of Trial Pit At 1.70 m	
			86.80		2.00		
			85.80		3.00		

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating. *Hand Shear Vane Test not possible due to gravel content.

iD GeoEnvironmental Limited	Project Title: Rhodia, Whitehaven		TP761
	Project Number: 4046	Client: Story Homes	Sheet 1 Of 1
	GL (mAOD): 90.80	N Coord: 515811	E Coord: 297365
Date: 01/09/2021	Method: Tracked Excavator	Logged By: SD	Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.05	ES		90.60		0.20	Rough grass over dark brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of coal and sandstone. (TOPSOIL)	
						Stiff, orange-brown mottled grey, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of coal, quartzite and sandstone. (GLACIAL TILL)	
0.75	SV	V=123kPa					
0.80	D						
0.80	J						
			89.90		0.90	0.80 - 0.90 Land drain encountered with no water flow; broken during excavation.	
0.95	SV	V=113kPa	89.80		1.00	Stiff, grey and brown, silty CLAY. Interpreted to be weathered (residual) mudstone. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
1.15	SV	V=113kPa					
			89.20		1.60	Black, COAL with shale laminations. Interpreted as weathered (partially). Recovered as sandy gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			88.80		2.00		
			88.70		2.10	Grey, MUDSTONE. Interpreted as weathered (partially). Recovered as sandy gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			88.50		2.30	End Of Trial Pit At 2.30 m	
			87.80		3.00		

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.

iD GeoEnvironmental Limited	Project Title: Rhodia, Whitehaven	**TP762**
	Project Number: 4046 / Client: Story Homes	Sheet 1 Of 1
	GL (mAOD): 92.10 / N Coord: 515847	E Coord: 297355
Date: 01/09/2021	Method: Tracked Excavator / Logged By: SD	Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
			91.90		0.20	MADE GROUND: Rough grass over dark brown, slightly gravelly clayey silty sandy topsoil. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of coal and sandstone. (MADE GROUND TOPSOIL)	
						Stiff, orange-brown mottled grey, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of coal, quartzite and sandstone. (GLACIAL TILL)	
			91.40		0.70	Brown, MUDSTONE. Interpreted as weathered (distinctly/destructured). Recovered as clayey sand and gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			91.10		1.00		
			90.50		1.60	Brown, MUDSTONE and laminations of organic shale. Interpreted as weathered (distinctly). Recovered as clayey sandy gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			90.20		1.90	End Of Trial Pit At 1.90 m	
			90.10		2.00		
			89.10		3.00		

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.

iD GeoEnvironmental Limited	Project Title: Rhodia, Whitehaven		TP763
	Project Number: 4046	Client: Story Homes	Sheet 1 Of 1
	GL (mAOD): 93.00	N Coord: 515882	E Coord: 297342
Date: 01/09/2021	Method: Tracked Excavator	Logged By: SD	Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.10	ES		92.70		0.30	Rough grass over brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of coal and sandstone. Much gravel is suspected colliery spoil. (TOPSOIL)	
0.60 0.60	D J		92.30		0.70	Stiff, orange-brown mottled grey, slightly sandy slightly gravelly CLAY with low cobble sandstone. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of coal, quartzite and sandstone. Cobbles are tabular of sandstone and mudstone. (GLACIAL TILL)	
			92.00		1.00	Brown, MUDSTONE. (WEATHERED PENNINE MIDDLE COAL MEASURES) 0.70 - 1.30 Interpreted as weathered (distinctly). Recovered as clayey sand and gravel sized particles. 1.30 - 1.60 Interpreted as weathered (partially). Recovered as sandy gravel sized particles with low cobble content.	
			91.40		1.60	End Of Trial Pit At 1.60 m	
			91.00		2.00		
			90.00		3.00		

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.

iD GeoEnvironmental Limited	Project Title: Rhodia, Whitehaven		TP764
	Project Number: 4046	Client: Story Homes	Sheet 1 Of 1
	GL (mAOD): 91.20	N Coord: 515892	E Coord: 297379
Date: 02/09/2021	Method: Tracked Excavator	Logged By: SD	Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.10	ES		91.00		0.20	Rough grass over brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of coal and sandstone. (TOPSOIL)	
0.75	SV	V=73kPa				Stiff locally firm, orange-brown mottled grey, slightly sandy slightly gravelly CLAY. Sand is fine to coarse. Gravel is angular fine to coarse of siltstone. Interpreted to be weathered (residual) siltstone. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
0.80	D						
0.80	J						
0.90	SV	V=115kPa	90.20		1.00	Grey, MUDSTONE. Interpreted as weathered (distinctly). Recovered as sandy gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			89.20		2.00		
			89.10		2.10	End Of Trial Pit At 2.10 m	
			88.20		3.00		

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.

iD GeoEnvironmental Limited	Project Title: Rhodia, Whitehaven		TP765
	Project Number: 4046	Client: Story Homes	Sheet 1 Of 1
	GL (mAOD): 84.60	N Coord: 515893	E Coord: 297421
Date: 02/09/2021	Method: Tracked Excavator	Logged By: SD	Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
			84.35		0.25	Rough grass over brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of sandstone. Rare gravel of coal and brick. (TOPSOIL)	
						Firm becoming stiff, orange-brown and grey, slightly sandy silty CLAY. Sand is fine to coarse. Interpreted to be weathered (residual) mudstone. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
0.75	SV	V=56kPa					
0.90	SV	V=75kPa					
1.05	SV	V=123kPa	83.60		1.00		
			83.10		1.50	Grey, MUDSTONE. Interpreted as weathered (distinctly). Recovered as silty sandy gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
						1.50 - 2.00 Recovered materials becoming stiff, silty sandy gravelly clay.	
			82.60		2.00		
			82.10		2.50	End Of Trial Pit At 2.50 m	
			81.60		3.00		

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.

iD GeoEnvironmental Limited	Project Title: Rhodia, Whitehaven		TP766
	Project Number: 4046	Client: Story Homes	Sheet 1 Of 1
	GL (mAOD): 84.00	N Coord: 515864	E Coord: 297423
Date: 02/09/2021	Method: Tracked Excavator	Logged By: SD	Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.10	ES		83.75		0.25	Rough grass over brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of sandstone. (TOPSOIL)	
0.75	SV	V=67kPa				Firm becoming stiff, orange-brown and grey, slightly sandy silty CLAY. Sand is fine to coarse. Interpreted to be weathered (residual) mudstone. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
0.90	SV	V=89kPa				0.80 - 1.00 Becoming stiff.	
1.05	SV	V=135kPa	83.00		1.00	Orange-brown and grey, MUDSTONE. (WEATHERED PENNINE MIDDLE COAL MEASURES) 1.00 - 2.00 Interpreted as weathered (destructured). Recovered as clayey very silty gravelly sand sized particles.	
			82.00		2.00	2.00 - 2.50 Interpreted as weathered (distinctly). Recovered as clayey very silty very sandy gravel sized particles.	
			81.50		2.50	End Of Trial Pit At 2.50 m	
			81.00		3.00		

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.

iD GeoEnvironmental Limited	Project Title: Rhodia, Whitehaven		TP767
	Project Number: 4046	Client: Story Homes	Sheet 1 Of 1
	GL (mAOD): 84.20	N Coord: 515824	E Coord: 297431
Date: 02/09/2021	Method: Tracked Excavator	Logged By: SD	Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
			84.00		0.20	Rough grass over brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of sandstone. (TOPSOIL)	
0.75	SV	V=103kPa				Stiff, orange-brown and grey, slightly silty slightly sandy CLAY. Sand is fine to coarse. Interpreted to be weathered (residual) mudstone. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
0.90	SV	V=135kPa					
1.05	SV	V=135kPa	83.20		1.00		
			83.00		1.20	Orange-brown and grey, MUDSTONE. Interpreted to be weathered (distinctly/destructured) mudstone. Recovered as silty very sandy gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			82.20		2.00		
			82.10		2.10	End Of Trial Pit At 2.10 m	
			81.20		3.00		

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.

iD GeoEnvironmental Limited	Project Title: Rhodia, Whitehaven		TP768
	Project Number: 4046	Client: Story Homes	Sheet 1 Of 1
	GL (mAOD): 84.00	N Coord: 515778	E Coord: 297441
Date: 02/09/2021	Method: Tracked Excavator	Logged By: SD	Scale: 1:15

Depth (m)	Type	Test Result	Level	Depth (m)	Description	Water
			83.80	0.20	Rough grass over brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of sandstone. (TOPSOIL)	
					Stiff, orange-brown and grey, slightly silty slightly sandy CLAY. Sand is fine to coarse. Interpreted to be weathered (residual) mudstone. (WEATHERED PENNINE MIDDLE COAL MEASURES) 0.40 - 0.45 Bed of weathered coal.	
0.75	SV	V=76kPa				
0.90	SV	V=87kPa				
1.05	SV	V=89kPa	83.00	1.00		
			82.90	1.10	Orange-brown and grey, MUDSTONE. Interpreted to be weathered (distinctly) mudstone. Recovered as silty sandy gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			82.00	2.00		
			81.80	2.20	End Of Trial Pit At 2.20 m	
			81.00	3.00		

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.

iD GeoEnvironmental Limited	Project Title: Rhodia, Whitehaven		TP769
	Project Number: 4046	Client: Story Homes	Sheet 1 Of 1
	GL (mAOD): 86.10	N Coord: 515751	E Coord: 297417
Date: 02/09/2021	Method: Tracked Excavator	Logged By: SD	Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
			85.85		0.25	Rough grass over brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of sandstone. (TOPSOIL)	
0.75	SV	V=93kPa				Stiff, orange-brown and grey, silty sandy CLAY. Sand is fine to coarse. Interpreted to be weathered (residual) mudstone with occasional sandstone bed. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
0.90	SV	V=135kPa					
1.05	SV	V=135kPa	85.10		1.00		
			84.90		1.20	Orange-brown and grey, MUDSTONE and occasional sandstone bed. Interpreted to be weathered (distinctly). Recovered as silty very sandy gravel sized particles with low (<5%) cobble content. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			84.20		1.90		
			84.10		2.00	End Of Trial Pit At 1.90 m	
			83.10		3.00		

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.

iD GeoEnvironmental Limited	Project Title: Rhodia, Whitehaven		TP770
	Project Number: 4046	Client: Story Homes	Sheet 1 Of 1
	GL (mAOD): 83.50	N Coord: 515717	E Coord: 297433
Date: 02/09/2021	Method: Tracked Excavator	Logged By: SD	Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
			83.25		0.25	Rough grass over brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of sandstone. (TOPSOIL)	
0.75	SV	V=114kPa				Stiff, orange-brown and grey, silty sandy CLAY. Sand is fine to coarse. Interpreted to be weathered (residual) mudstone. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
0.90	SV	V=135kPa	82.50		1.00	Orange-brown and grey, MUDSTONE. (WEATHERED PENNINE MIDDLE COAL MEASURES) 0.95 - 1.30 Interpreted to be weathered (distinctly). Recovered as clayey silty sand and gravel sized particles. 1.30 - 1.80 Interpreted to be weathered (partially/distinctly). Recovered as sandy gravel sized particles.	
			81.70		1.80	End Of Trial Pit At 1.80 m	
			81.50		2.00		
			80.50		3.00		

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.

iD GeoEnvironmental Limited	Project Title: Rhodia, Whitehaven		TP771
	Project Number: 4046	Client: Story Homes	Sheet 1 Of 1
	GL (mAOD): 87.50	N Coord: 515737	E Coord: 297383
Date: 02/09/2021	Method: Tracked Excavator	Logged By: SD	Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.05	ES					Rough grass over brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of sandstone. (TOPSOIL)	
0.25 - 0.75	B		87.25		0.25	Stiff locally firm, orange-brown and grey, silty sandy CLAY. Sand is fine to coarse. Interpreted to be weathered (residual) mudstone. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
0.75	SV	V=95kPa					
0.90	SV	V=74kPa					
1.00	SV	V=67kPa	86.50		1.00	0.90 - 1.20 Locally firm.	
			86.30		1.20	Orange-brown and grey, MUDSTONE. Interpreted to be weathered (distinctly). Recovered as slightly clayey sandy gravel sized particles with low (<5%) cobble content. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			85.60		1.90		
2.00	J		85.50		2.00	Grey, fine SANDSTONE. Interpreted to be weathered (partially). Recovered as sandy gravel sized particles with low (<5%) cobble content. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			85.40		2.10	End Of Trial Pit At 2.10 m	
			84.50		3.00		

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.

iD GeoEnvironmental Limited	Project Title: Rhodia, Whitehaven		TP772
	Project Number: 4046	Client: Story Homes	Sheet 1 Of 1
	GL (mAOD): 89.30	N Coord: 515774	E Coord: 297374
Date: 02/09/2021	Method: Tracked Excavator	Logged By: SD	Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.10	ES					Rough grass over brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of sandstone. (TOPSOIL)	
0.20 - 0.70	B		89.10		0.20	Orange-brown and grey, MUDSTONE. (WEATHERED PENNINE MIDDLE COAL MEASURES) 0.20 - 0.90 Interpreted to be weathered (destructured). Recovered as very clayey very silty fine sand sized particles.	
			88.30		1.00	0.90 - 1.50 Interpreted to be weathered (distinctly). Recovered as clayey silty sand and gravel sized particles.	
			87.80		1.50	Grey, SILTSTONE. Interpreted to be weathered (distinctly). Recovered as silty sandy gravel sized particles with low (<5%) cobble content. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			87.30		2.00	End Of Trial Pit At 2.00 m	
			86.30		3.00		

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.

iD GeoEnvironmental Limited	Project Title: Rhodia, Whitehaven		TP773
	Project Number: 4046	Client: Story Homes	Sheet 1 Of 1
	GL (mAOD): 87.50	N Coord: 515787	E Coord: 297410
Date: 02/09/2021	Method: Tracked Excavator	Logged By: SD	Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.15	ES					Rough grass over brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of sandstone. (TOPSOIL)	
0.20 - 0.70	B		87.30		0.20	Orange-brown and grey MUDSTONE. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
0.50	J					0.20 - 0.90 Interpreted to be weathered (distinctly) recovered as clayey very silty fine sand particles.	
0.75	SV	V=119kPa					
0.90	SV	V=135kPa					
			86.50		1.00	0.90 - 1.50 Interpreted to be weathered (destructured) recovered as clayey silty sand & gravel particles.	
			86.20		1.30	Brown, fine sandy SILTSTONE. Interpreted to be weathered (distinctly/destructured). Recovered as silty very sandy gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			85.60		1.90	End Of Trial Pit At 1.90 m	
			85.50		2.00		
			84.50		3.00		

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.

iD GeoEnvironmental Limited	Project Title: Rhodia, Whitehaven		TP774
	Project Number: 4046	Client: Story Homes	Sheet 1 Of 1
	GL (mAOD): 88.30	N Coord: 515823	E Coord: 297402
Date: 02/09/2021	Method: Tracked Excavator	Logged By: SD	Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.20	ES		88.05		0.25	Rough grass over brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of sandstone. (TOPSOIL)	
0.75	SV	V=95kPa				Stiff locally firm, orange-brown and grey, slightly sandy silty CLAY. Sand is fine to coarse. Interpreted to be weathered (residual) mudstone. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
0.90	SV	V=120kPa	87.30		1.00	Brown, silty fine SANDSTONE. Interpreted to be weathered (partially). Recovered as silty sandy gravel sized particles with medium (5-20%) cobble content. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			86.60		1.70	End Of Trial Pit At 1.70 m	
			86.30		2.00		
			85.30		3.00		

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

AGS

REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.

iD GeoEnvironmental Limited	Project Title: Rhodia, Whitehaven		TP775
	Project Number: 4046	Client: Story Homes	Sheet 1 Of 1
	GL (mAOD): 89.30	N Coord: 515851	E Coord: 297391
Date: 02/09/2021	Method: Tracked Excavator	Logged By: SD	Scale: 1:15

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.10	ES		89.05		0.25	Rough grass over brown, slightly gravelly clayey silty sandy TOPSOIL. Sand is fine to coarse. Gravel is rounded to angular fine to coarse of sandstone. (TOPSOIL)	
0.75	SV	V=68kPa				Firm becoming stiff, orange-brown and grey, slightly sandy silty CLAY. Sand is fine to coarse. Interpreted to be weathered (residual) mudstone. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
0.90	SV	V=80kPa					
0.95	D					0.85 - 1.40 Becoming stiff.	
0.95	J		88.30		1.00		
			87.90		1.40		
			87.70		1.60	Orange-brown and grey, MUDSTONE. Interpreted to be weathered (distinctly). Recovered as silty sand and gravel sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			87.50		1.80	Orange-brown, very fine SANDSTONE. Interpreted to be weathered (partially). Recovered as cobble and boulder (0.4m, maximum dimension) sized particles. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			87.30		2.00	Weathered, grey-brown, SILTSTONE. Interpreted to be weathered (distinctly). Recovered as silty very sandy gravel sized particles and low (<5%) cobble content. (WEATHERED PENNINE MIDDLE COAL MEASURES)	
			87.20		2.10	End Of Trial Pit At 2.10 m	
			86.30		3.00		

KEY

D - Disturbed Sample
B - Bulk Sample
W - Water Sample
V - Hand Shear Vane kPa

▽ - Groundwater Strike
▼ - Groundwater Level

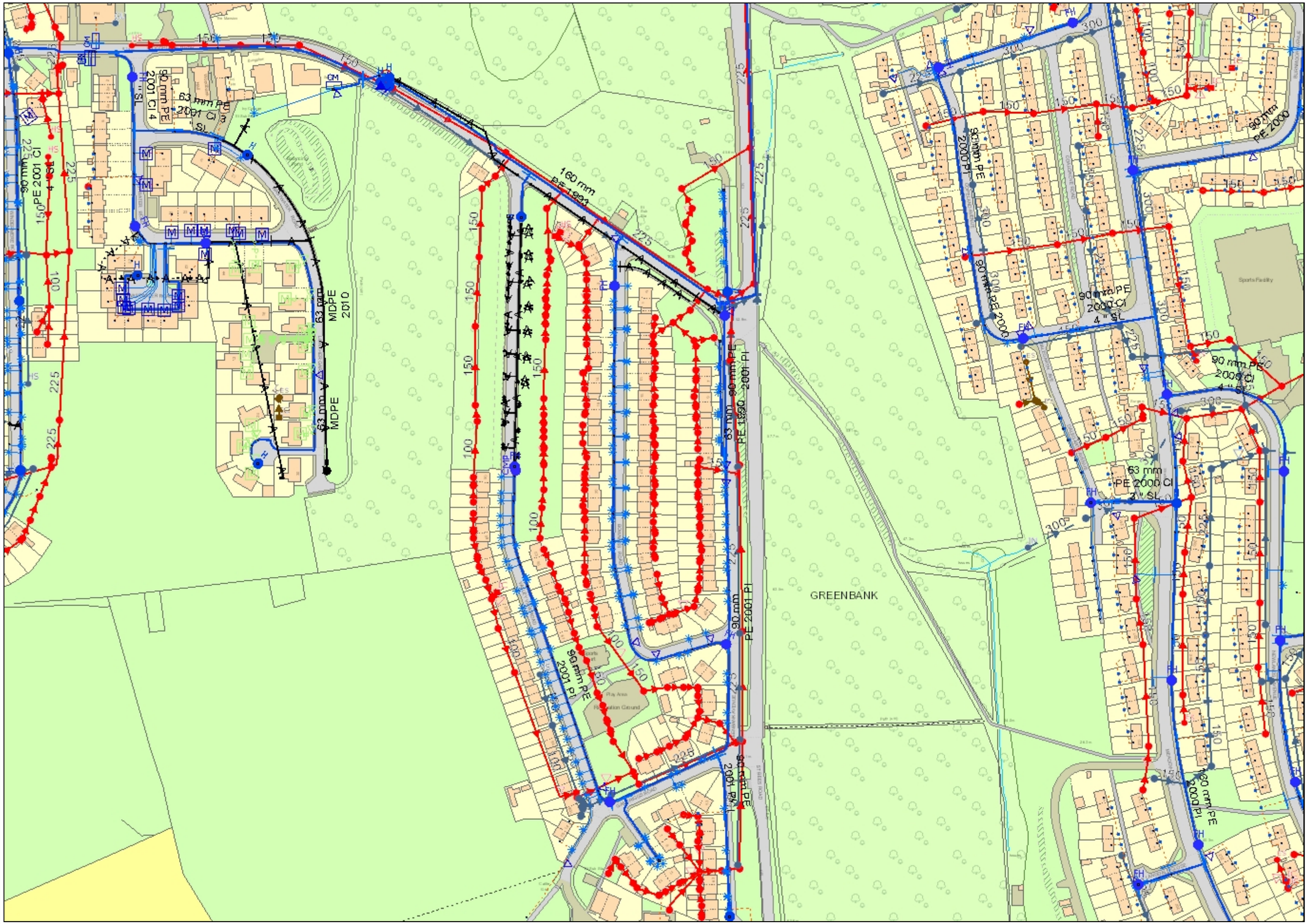
AGS

REMARKS

No Groundwater Encountered
Pit sides stable. Pit terminated due to difficulty excavating.

Appendix 4

United Utilities Sewer Records



United Utilities Maps for SafeDig

Date :	14/07/2021 11:56:15
Centre X:	297544
Centre Y:	515958
Scale :	2000
UserName:	BALB3A

Extract from maps of United Utilities' Underground Assets

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. The actual positions may be different from those shown on the plan and private service pipes may be shown by a blue broken line. United Utilities Water will not accept liability for any damage caused by the actual position being different from those shown.

United Utilities
Water for the North West

Appendix 5

Calculations

Greenfield Run-off Rate Estimation

MicroDrainage Surface Water Drainage Design

Print | Close Report

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Andy Jones
Site name:	Demense Farm
Site location:	Whitehaven

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	54.52681° N
Longitude:	3.58733° W
Reference:	3142901700
Date:	Apr 27 2022 10:27

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 1

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics	Default	Edited
SAAR (mm):	1107	1107
Hydrological region:	10	10
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	1.7	1.7
Growth curve factor 100 years:	2.08	2.08
Growth curve factor 200 years:	2.37	2.37

Notes

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

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

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

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	8.25	8.25
1 in 1 year (l/s):	7.18	7.18
1 in 30 years (l/s):	14.03	14.03
1 in 100 year (l/s):	17.17	17.17
1 in 200 years (l/s):	19.56	19.56

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for 7843 - SW 6A.SWS

Pipe Sizes 7843 - SW 6 Manhole Sizes 7843 - SW 6

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	16.000	Add Flow / Climate Change (%)	0
Ratio R	0.268	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	0.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	0.75
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for 7843 - SW 6A.SWS

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	27.785	0.308	90.2	0.227	5.00	0.0	0.600		o	225	Pipe/Conduit	
1.001	24.933	0.148	168.5	0.076	0.00	0.0	0.600		o	225	Pipe/Conduit	
2.000	11.170	0.391	28.6	0.207	5.00	0.0	0.600		o	225	Pipe/Conduit	
2.001	25.368	0.909	27.9	0.023	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.002	27.006	0.113	239.0	0.047	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.003	21.867	0.078	280.4	0.096	0.00	0.0	0.600		o	375	Pipe/Conduit	
3.000	21.876	0.314	69.7	0.069	5.00	0.0	0.600		o	225	Pipe/Conduit	
4.000	20.182	0.795	25.4	0.109	5.00	0.0	0.600		o	225	Pipe/Conduit	
3.001	38.756	0.376	103.1	0.069	0.00	0.0	0.600		o	225	Pipe/Conduit	
3.002	15.995	0.155	103.2	0.092	0.00	0.0	0.600		o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	44.64	5.34	89.106	0.227	0.0	0.0	0.0	1.38	54.8	27.4
1.001	43.39	5.75	88.798	0.303	0.0	0.0	0.0	1.00	39.9	35.6
2.000	45.48	5.08	89.950	0.207	0.0	0.0	0.0	2.46	97.7	25.5
2.001	44.93	5.25	89.559	0.230	0.0	0.0	0.0	2.49	98.9	28.0
1.002	42.14	6.19	88.575	0.580	0.0	0.0	0.0	1.01	71.6	66.2
1.003	41.25	6.53	88.387	0.676	0.0	0.0	0.0	1.08	119.0	75.5
3.000	44.97	5.23	90.166	0.069	0.0	0.0	0.0	1.57	62.4	8.4
4.000	45.30	5.13	90.647	0.109	0.0	0.0	0.0	2.61	103.7	13.4
3.001	43.44	5.73	89.852	0.247	0.0	0.0	0.0	1.29	51.2	29.1
3.002	42.84	5.94	89.476	0.339	0.0	0.0	0.0	1.29	51.2	39.3

Network Design Table for 7843 - SW 6A.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
3.003	15.293	0.149	102.6	0.167	0.00	0.0	0.600		o	300	Pipe/Conduit	
3.004	13.706	0.400	34.3	0.064	0.00	0.0	0.600		o	300	Pipe/Conduit	
3.005	7.430	0.314	23.7	0.092	0.00	0.0	0.600		o	375	Pipe/Conduit	
1.004	28.219	0.647	43.6	0.072	0.00	0.0	0.600		o	450	Pipe/Conduit	
5.000	59.579	0.355	168.0	0.143	5.00	0.0	0.600		o	225	Pipe/Conduit	
5.001	30.010	0.531	56.5	0.103	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.005	39.581	0.132	300.0	0.052	0.00	0.0	0.600		o	450	Pipe/Conduit	
1.006	59.159	1.478	40.0	0.057	0.00	0.0	0.600		o	450	Pipe/Conduit	
1.007	19.679	0.757	26.0	0.057	0.00	0.0	0.600		o	450	Pipe/Conduit	
6.000	21.171	0.322	65.7	0.057	5.00	0.0	0.600		o	225	Pipe/Conduit	
1.008	26.821	0.791	33.9	0.057	0.00	0.0	0.600		o	450	Pipe/Conduit	
1.009	14.587	0.561	26.0	0.057	0.00	0.0	0.600		o	450	Pipe/Conduit	
1.010	20.650	0.103	200.5	0.057	0.00	0.0	0.600		o	450	Pipe/Conduit	
1.011	15.000	0.075	200.0	0.060	0.00	0.0	0.600		o	450	Pipe/Conduit	
1.012	15.001	1.899	7.9	0.000	0.00	0.0	0.045	3 \=/		500	1:3 Swale	
1.013	14.990	2.677	5.6	0.000	0.00	0.0	0.045	3 \=/		500	1:3 Swale	
1.014	15.000	2.679	5.6	0.000	0.00	0.0	0.045	3 \=/		500	1:3 Swale	
1.015	15.000	2.174	6.9	0.000	0.00	0.0	0.045	3 \=/		500	1:3 Swale	
1.016	15.010	2.345	6.4	0.000	0.00	0.0	0.045	3 \=/		500	1:3 Swale	
1.017	17.758	3.229	5.5	0.000	0.00	0.0	0.045	3 \=/		500	1:3 Swale	
1.018	7.643	0.024	318.0	0.000	0.00	0.0	0.600		o	675	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
3.003	42.38	6.11	89.246	0.506	0.0	0.0	0.0	1.55	109.7	58.1
3.004	42.15	6.19	89.097	0.570	0.0	0.0	0.0	2.70	190.5	65.1
3.005	42.06	6.22	88.622	0.662	0.0	0.0	0.0	3.74	412.6	75.4
1.004	40.86	6.69	87.117	1.410	0.0	0.0	0.0	3.09	490.8	156.0
5.000	42.71	5.99	87.581	0.143	0.0	0.0	0.0	1.01	40.0	16.5
5.001	41.93	6.27	87.226	0.246	0.0	0.0	0.0	1.74	69.3	27.9
1.005	39.51	7.25	86.470	1.708	0.0	0.0	0.0	1.17	185.8	182.7
1.006	38.82	7.56	86.338	1.765	0.0	0.0	0.0	3.22	512.3	185.6
1.007	38.64	7.64	84.860	1.822	0.0	0.0	0.0	4.00	636.2	190.7
6.000	45.02	5.22	84.651	0.057	0.0	0.0	0.0	1.62	64.2	6.9
1.008	38.36	7.77	84.103	1.936	0.0	0.0	0.0	3.50	556.8	201.1
1.009	38.23	7.83	81.813	1.993	0.0	0.0	0.0	4.00	636.1	206.4
1.010	37.73	8.07	81.252	2.050	0.0	0.0	0.0	1.43	227.8	209.5
1.011	37.38	8.24	79.537	2.110	0.0	0.0	0.0	1.43	228.1	213.6
1.012	37.23	8.32	79.412	2.110	0.0	0.0	0.0	3.33	3327.8	213.6
1.013	37.11	8.38	77.513	2.110	0.0	0.0	0.0	3.95	3952.4	213.6
1.014	36.98	8.44	74.836	2.110	0.0	0.0	0.0	3.95	3952.4	213.6
1.015	36.85	8.51	72.158	2.110	0.0	0.0	0.0	3.56	3560.6	213.6
1.016	36.72	8.58	69.984	2.110	0.0	0.0	0.0	3.70	3697.1	213.6
1.017	36.57	8.65	67.638	2.110	0.0	0.0	0.0	3.99	3988.3	213.6
1.018	36.41	8.74	62.900	2.110	0.0	0.0	0.0	1.46	524.0	213.6

Network Design Table for 7843 - SW 6A.SWS

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.019	63.603	0.159	400.0	0.000	0.00	0.0	0.600		o	675	Pipe/Conduit	
1.020	13.293	0.229	58.0	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.021	48.552	3.215	15.1	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.019	34.96	9.55	62.876	2.110	0.0	0.0	0.0	1.30	466.7	213.6
1.020	34.75	9.68	62.717	2.110	0.0	0.0	0.0	1.72	68.4«	213.6
1.021	34.36	9.92	62.488	2.110	0.0	0.0	0.0	3.38	134.6«	213.6

Manhole Schedules for 7843 - SW 6A.SWS

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)
101	90.531	1.425	Open Manhole	1350	1.000	89.106	225				
102	90.630	1.832	Open Manhole	1350	1.001	88.798	225	1.000	88.798	225	
103	91.674	1.724	Open Manhole	1350	2.000	89.950	225				
104	91.285	1.726	Open Manhole	1350	2.001	89.559	225	2.000	89.559	225	
105	90.531	1.956	Open Manhole	1500	1.002	88.575	300	1.001	88.650	225	
								2.001	88.650	225	
106	90.549	2.162	Open Manhole	1500	1.003	88.387	375	1.002	88.462	300	
107	91.816	1.650	Open Manhole	1350	3.000	90.166	225				
108	92.297	1.650	Open Manhole	1350	4.000	90.647	225				
109	91.544	1.692	Open Manhole	1350	3.001	89.852	225	3.000	89.852	225	
								4.000	89.852	225	
110	91.058	1.582	Open Manhole	1350	3.002	89.476	225	3.001	89.476	225	
111	90.861	1.615	Open Manhole	1500	3.003	89.246	300	3.002	89.321	225	
112	90.673	1.576	Open Manhole	1500	3.004	89.097	300	3.003	89.097	300	
113	90.500	1.878	Open Manhole	1500	3.005	88.622	375	3.004	88.697	300	
114	90.392	3.275	Open Manhole	1500	1.004	87.117	450	1.003	88.309	375	1117
								3.005	88.308	375	1116
115	89.231	1.650	Open Manhole	1350	5.000	87.581	225				
116	89.297	2.071	Open Manhole	1350	5.001	87.226	225	5.000	87.226	225	
117	89.047	2.577	Open Manhole	1500	1.005	86.470	450	1.004	86.470	450	
								5.001	86.695	225	
118	88.322	1.984	Open Manhole	1500	1.006	86.338	450	1.005	86.338	450	
119	87.031	2.171	Open Manhole	1500	1.007	84.860	450	1.006	84.860	450	
120	86.076	1.425	Open Manhole	1350	6.000	84.651	225				
121	86.104	2.001	Open Manhole	1500	1.008	84.103	450	1.007	84.103	450	
								6.000	84.329	225	1
122	84.885	3.072	Open Manhole	1500	1.009	81.813	450	1.008	83.312	450	1499
123	83.415	2.163	Open Manhole	1500	1.010	81.252	450	1.009	81.252	450	
124	82.458	2.921	Open Manhole	1500	1.011	79.537	450	1.010	81.149	450	1612
125	80.000	0.588	Junction		1.012	79.412	500	1.011	79.462	450	
126	78.020	0.507	Junction		1.013	77.513	500	1.012	77.513	500	
127	75.340	0.504	Junction		1.014	74.836	500	1.013	74.836	500	
128	72.682	0.524	Junction		1.015	72.158	500	1.014	72.158	500	
129	70.489	0.505	Junction		1.016	69.984	500	1.015	69.984	500	
130	68.142	0.504	Junction		1.017	67.638	500	1.016	67.638	500	
131	65.644	2.744	Open Manhole	1800	1.018	62.900	675	1.017	64.409	500	1334
132	64.300	1.424	Open Manhole	1800	1.019	62.876	675	1.018	62.876	675	
133	65.693	2.976	Open Manhole	1800	1.020	62.717	225	1.019	62.717	675	
134	65.416	2.928	Open Manhole	1500	1.021	62.488	225	1.020	62.488	225	
135	60.673	1.400	Open Manhole	1500		OUTFALL		1.021	59.273	225	

Manhole Schedules for 7843 - SW 6A.SWS

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
101	297271.239	515807.692	297271.239	515807.692	Required	
102	297298.037	515815.030	297298.037	515815.030	Required	
103	297321.070	515850.766	297321.070	515850.766	Required	
104	297318.624	515839.867	297318.624	515839.867	Required	
105	297322.970	515814.874	297322.970	515814.874	Required	
106	297347.784	515804.216	297347.784	515804.216	Required	
107	297375.322	515889.042	297375.322	515889.042	Required	
108	297358.487	515865.624	297358.487	515865.624	Required	
109	297378.590	515867.411	297378.590	515867.411	Required	
110	297389.772	515830.303	297389.772	515830.303	Required	
111	297388.359	515814.371	297388.359	515814.371	Required	
112	297379.700	515801.766	297379.700	515801.766	Required	
113	297367.770	515795.018	297367.770	515795.018	Required	
114	297363.458	515788.967	297363.458	515788.967	Required	
115	297288.759	515739.048	297288.759	515739.048	Required	
116	297346.127	515755.127	297346.127	515755.127	Required	
117	297375.023	515763.227	297375.023	515763.227	Required	
118	297393.567	515728.259	297393.567	515728.259	Required	

Manhole Schedules for 7843 - SW 6A.SWS

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
119	297346.769	515692.069	297346.769	515692.069	Required	
120	297327.400	515679.566	297327.400	515679.566	Required	
121	297347.321	515672.398	297347.321	515672.398	Required	
122	297374.133	515673.055	297374.133	515673.055	Required	
123	297387.901	515668.234	297387.901	515668.234	Required	
124	297402.875	515654.015	297402.875	515654.015	Required	
125	297412.667	515642.652			No Entry	
126	297422.460	515631.289			No Entry	
127	297432.252	515619.927			No Entry	
128	297442.044	515608.564			No Entry	
129	297451.837	515597.201			No Entry	
130	297461.629	515585.838			No Entry	
131	297477.369	515577.616	297477.369	515577.616	Required	
132	297484.098	515573.992	297484.098	515573.992	Required	
133	297482.096	515510.421	297482.096	515510.421	Required	
134	297484.569	515497.360	297484.569	515497.360	Required	
135	297526.032	515472.098			No Entry	

PIPELINE SCHEDULES for 7843 - SW 6A.SWS

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)
1.000	o	225	101	90.531	89.106	1.200	Open Manhole	1350
1.001	o	225	102	90.630	88.798	1.607	Open Manhole	1350
2.000	o	225	103	91.674	89.950	1.499	Open Manhole	1350
2.001	o	225	104	91.285	89.559	1.501	Open Manhole	1350
1.002	o	300	105	90.531	88.575	1.656	Open Manhole	1500
1.003	o	375	106	90.549	88.387	1.787	Open Manhole	1500
3.000	o	225	107	91.816	90.166	1.425	Open Manhole	1350
4.000	o	225	108	92.297	90.647	1.425	Open Manhole	1350
3.001	o	225	109	91.544	89.852	1.467	Open Manhole	1350
3.002	o	225	110	91.058	89.476	1.357	Open Manhole	1350
3.003	o	300	111	90.861	89.246	1.315	Open Manhole	1500
3.004	o	300	112	90.673	89.097	1.276	Open Manhole	1500
3.005	o	375	113	90.500	88.622	1.503	Open Manhole	1500
1.004	o	450	114	90.392	87.117	2.825	Open Manhole	1500
5.000	o	225	115	89.231	87.581	1.425	Open Manhole	1350
5.001	o	225	116	89.297	87.226	1.846	Open Manhole	1350
1.005	o	450	117	89.047	86.470	2.127	Open Manhole	1500

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)
1.000	27.785	90.2	102	90.630	88.798	1.607	Open Manhole	1350
1.001	24.933	168.5	105	90.531	88.650	1.656	Open Manhole	1500
2.000	11.170	28.6	104	91.285	89.559	1.501	Open Manhole	1350
2.001	25.368	27.9	105	90.531	88.650	1.656	Open Manhole	1500
1.002	27.006	239.0	106	90.549	88.462	1.787	Open Manhole	1500
1.003	21.867	280.4	114	90.392	88.309	1.708	Open Manhole	1500
3.000	21.876	69.7	109	91.544	89.852	1.467	Open Manhole	1350
4.000	20.182	25.4	109	91.544	89.852	1.467	Open Manhole	1350
3.001	38.756	103.1	110	91.058	89.476	1.357	Open Manhole	1350
3.002	15.995	103.2	111	90.861	89.321	1.315	Open Manhole	1500
3.003	15.293	102.6	112	90.673	89.097	1.276	Open Manhole	1500
3.004	13.706	34.3	113	90.500	88.697	1.503	Open Manhole	1500
3.005	7.430	23.7	114	90.392	88.308	1.709	Open Manhole	1500
1.004	28.219	43.6	117	89.047	86.470	2.127	Open Manhole	1500
5.000	59.579	168.0	116	89.297	87.226	1.846	Open Manhole	1350
5.001	30.010	56.5	117	89.047	86.695	2.127	Open Manhole	1500
1.005	39.581	300.0	118	88.322	86.338	1.534	Open Manhole	1500

PIPELINE SCHEDULES for 7843 - SW 6A.SWS

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)
1.006	o	450	118	88.322	86.338	1.534	Open Manhole	1500
1.007	o	450	119	87.031	84.860	1.721	Open Manhole	1500
6.000	o	225	120	86.076	84.651	1.200	Open Manhole	1350
1.008	o	450	121	86.104	84.103	1.551	Open Manhole	1500
1.009	o	450	122	84.885	81.813	2.622	Open Manhole	1500
1.010	o	450	123	83.415	81.252	1.713	Open Manhole	1500
1.011	o	450	124	82.458	79.537	2.471	Open Manhole	1500
1.012	3 \=/	500	125	80.000	79.412	0.088	Junction	
1.013	3 \=/	500	126	78.020	77.513	0.007	Junction	
1.014	3 \=/	500	127	75.340	74.836	0.004	Junction	
1.015	3 \=/	500	128	72.682	72.158	0.024	Junction	
1.016	3 \=/	500	129	70.489	69.984	0.005	Junction	
1.017	3 \=/	500	130	68.142	67.638	0.004	Junction	
1.018	o	675	131	65.644	62.900	2.069	Open Manhole	1800
1.019	o	675	132	64.300	62.876	0.749	Open Manhole	1800
1.020	o	225	133	65.693	62.717	2.751	Open Manhole	1800
1.021	o	225	134	65.416	62.488	2.703	Open Manhole	1500

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)
1.006	59.159	40.0	119	87.031	84.860	1.721	Open Manhole	1500
1.007	19.679	26.0	121	86.104	84.103	1.551	Open Manhole	1500
6.000	21.171	65.7	121	86.104	84.329	1.550	Open Manhole	1500
1.008	26.821	33.9	122	84.885	83.312	1.123	Open Manhole	1500
1.009	14.587	26.0	123	83.415	81.252	1.713	Open Manhole	1500
1.010	20.650	200.5	124	82.458	81.149	0.859	Open Manhole	1500
1.011	15.000	200.0	125	80.000	79.462	0.088	Junction	
1.012	15.001	7.9	126	78.020	77.513	0.007	Junction	
1.013	14.990	5.6	127	75.340	74.836	0.004	Junction	
1.014	15.000	5.6	128	72.682	72.158	0.024	Junction	
1.015	15.000	6.9	129	70.489	69.984	0.005	Junction	
1.016	15.010	6.4	130	68.142	67.638	0.004	Junction	
1.017	17.758	5.5	131	65.644	64.409	0.735	Open Manhole	1800
1.018	7.643	318.0	132	64.300	62.876	0.749	Open Manhole	1800
1.019	63.603	400.0	133	65.693	62.717	2.301	Open Manhole	1800
1.020	13.293	58.0	134	65.416	62.488	2.703	Open Manhole	1500
1.021	48.552	15.1	135	60.673	59.273	1.175	Open Manhole	1500

Free Flowing Outfall Details for 7843 - SW 6A.SWS

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.021	135	60.673	59.273	0.000	1500	0

Simulation Criteria for 7843 - SW 6A.SWS

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	16.000	Storm Duration (mins)	30
Ratio R	0.268		

Online Controls for 7843 - SW 6A.SWS

Hydro-Brake® Optimum Manhole: 133, DS/PN: 1.020, Volume (m³): 29.7

Unit Reference	MD-SHE-0207-2370-1500-2370
Design Head (m)	1.500
Design Flow (l/s)	23.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	207
Invert Level (m)	62.717
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)	1.500	23.7	Kick-Flo®	0.994	19.5
Flush-Flo™	0.452	23.7	Mean Flow over Head Range	-	20.4

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	7.1	0.800	22.4	2.000	27.2	4.000	37.9	7.000	49.7
0.200	19.9	1.000	19.5	2.200	28.5	4.500	40.2	7.500	51.4
0.300	23.0	1.200	21.3	2.400	29.7	5.000	42.3	8.000	53.1
0.400	23.6	1.400	22.9	2.600	30.8	5.500	44.3	8.500	54.6
0.500	23.7	1.600	24.4	3.000	33.0	6.000	46.2	9.000	56.2
0.600	23.4	1.800	25.9	3.500	35.6	6.500	48.0	9.500	57.7

Storage Structures for 7843 - SW 6A.SWS

Tank or Pond Manhole: 133, DS/PN: 1.020

Invert Level (m) 62.717

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	1200.0	0.400	1351.9	0.800	1512.8	1.200	1682.8
0.100	1237.1	0.500	1391.3	0.900	1554.5	1.300	1726.7
0.200	1274.8	0.600	1431.2	1.000	1596.7	1.400	1771.2
0.300	1313.1	0.700	1471.7	1.100	1639.4	1.500	1816.2

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 7843 - SW 6A.SWS

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 16.000 Cv (Summer) 0.750
Region England and Wales Ratio R 0.268 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100, 101
Climate Change (%)	0, 0, 50, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	101	15 Winter	1	+0%	30/15 Summer	100/15 Summer			89.210	-0.121
1.001	102	15 Winter	1	+0%	30/15 Summer				88.946	-0.077
2.000	103	15 Winter	1	+0%	100/15 Summer				90.026	-0.149
2.001	104	15 Winter	1	+0%	100/15 Summer				89.634	-0.150
1.002	105	15 Winter	1	+0%	30/15 Summer				88.783	-0.092
1.003	106	15 Winter	1	+0%	30/15 Summer				88.595	-0.166
3.000	107	15 Winter	1	+0%	100/15 Summer				90.218	-0.173
4.000	108	15 Winter	1	+0%	100/15 Summer				90.697	-0.175
3.001	109	15 Winter	1	+0%	30/15 Summer	100/15 Winter			89.962	-0.115
3.002	110	15 Winter	1	+0%	30/15 Summer				89.610	-0.091
3.003	111	15 Winter	1	+0%	30/15 Summer				89.392	-0.154
3.004	112	15 Winter	1	+0%	100/15 Summer				89.211	-0.186
3.005	113	15 Winter	1	+0%	100/15 Winter				88.751	-0.246
1.004	114	15 Winter	1	+0%	30/15 Winter				87.282	-0.285
5.000	115	15 Winter	1	+0%	100/15 Summer	100/15 Winter			87.675	-0.131
5.001	116	15 Winter	1	+0%	30/15 Summer				87.315	-0.136
1.005	117	15 Winter	1	+0%	30/15 Summer				86.797	-0.123
1.006	118	15 Winter	1	+0%	100/15 Summer				86.510	-0.278
1.007	119	15 Winter	1	+0%	100/15 Summer				85.030	-0.280
6.000	120	15 Winter	1	+0%					84.698	-0.178
1.008	121	15 Winter	1	+0%	100/15 Summer				84.282	-0.271
1.009	122	15 Winter	1	+0%	30/15 Summer				82.006	-0.257
1.010	123	15 Winter	1	+0%	30/15 Summer				81.589	-0.113
1.011	124	15 Winter	1	+0%	30/15 Summer				79.897	-0.090
1.012	125	15 Winter	1	+0%					79.537	-0.463
1.013	126	15 Winter	1	+0%					77.626	-0.394
1.014	127	15 Winter	1	+0%					74.950	-0.390
1.015	128	15 Winter	1	+0%					72.277	-0.404
1.016	129	15 Winter	1	+0%					70.101	-0.388
1.017	130	15 Winter	1	+0%					67.752	-0.391

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 7843 - SW 6A.SWS

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	101	0.000	0.43			21.8	OK	5
1.001	102	0.000	0.76			27.9	OK	
2.000	103	0.000	0.24			20.1	OK	
2.001	104	0.000	0.24			21.8	OK	
1.002	105	0.000	0.81			52.5	OK	
1.003	106	0.000	0.59			60.0	OK	
3.000	107	0.000	0.12			6.7	OK	
4.000	108	0.000	0.11			10.6	OK	
3.001	109	0.000	0.47			22.8	OK	2
3.002	110	0.000	0.67			30.2	OK	
3.003	111	0.000	0.47			43.5	OK	
3.004	112	0.000	0.31			48.3	OK	
3.005	113	0.000	0.25			55.4	OK	
1.004	114	0.000	0.29			120.8	OK	
5.000	115	0.000	0.34			13.3	OK	1
5.001	116	0.000	0.33			21.4	OK	
1.005	117	0.000	0.87			143.2	OK	
1.006	118	0.000	0.31			147.1	OK	
1.007	119	0.000	0.31			150.5	OK	
6.000	120	0.000	0.09			5.5	OK	
1.008	121	0.000	0.33			157.5	OK	
1.009	122	0.000	0.38			160.5	OK	
1.010	123	0.000	0.91			164.4	OK	
1.011	124	0.000	0.99			168.2	OK	
1.012	125	0.000	0.03			168.2	OK	
1.013	126	0.000	0.04			167.8	OK	
1.014	127	0.000	0.04			167.3	OK	
1.015	128	0.000	0.04			166.9	OK	
1.016	129	0.000	0.04			167.5	OK	
1.017	130	0.000	0.04			167.8	OK	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 7843 - SW 6A.SWS

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
1.018	131	15 Winter	1	+0%	100/15 Summer				63.278	-0.297	0.000
1.019	132	15 Winter	1	+0%	100/15 Summer				63.174	-0.377	0.000
1.020	133	360 Winter	1	+0%	30/30 Winter				62.898	-0.044	0.000
1.021	134	360 Winter	1	+0%					62.543	-0.170	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.018	131	0.60			167.9	OK	
1.019	132	0.41			167.9	OK	
1.020	133	0.30			17.8	OK	
1.021	134	0.14			17.8	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 7843 - SW 6A.SWS

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	16.000
Region	England and Wales	Ratio R	0.268
Cv (Summer)	0.750		
Cv (Winter)	0.840		

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100, 101
Climate Change (%)	0, 0, 50, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	101	15 Winter	30	+0%	30/15 Summer	100/15 Summer			89.719	0.388
1.001	102	15 Winter	30	+0%	30/15 Summer				89.497	0.474
2.000	103	15 Winter	30	+0%	100/15 Summer				90.075	-0.100
2.001	104	15 Winter	30	+0%	100/15 Summer				89.685	-0.099
1.002	105	15 Winter	30	+0%	30/15 Summer				89.157	0.282
1.003	106	15 Winter	30	+0%	30/15 Summer				88.801	0.039
3.000	107	15 Winter	30	+0%	100/15 Summer				90.341	-0.050
4.000	108	15 Winter	30	+0%	100/15 Summer				90.727	-0.145
3.001	109	15 Winter	30	+0%	30/15 Summer	100/15 Winter			90.312	0.235
3.002	110	15 Winter	30	+0%	30/15 Summer				89.909	0.208
3.003	111	15 Winter	30	+0%	30/15 Summer				89.573	0.027
3.004	112	15 Winter	30	+0%	100/15 Summer				89.293	-0.104
3.005	113	15 Winter	30	+0%	100/15 Winter				88.840	-0.157
1.004	114	15 Winter	30	+0%	30/15 Winter				87.584	0.017
5.000	115	15 Winter	30	+0%	100/15 Summer	100/15 Winter			87.752	-0.054
5.001	116	15 Winter	30	+0%	30/15 Summer				87.550	0.099
1.005	117	15 Winter	30	+0%	30/15 Summer				87.292	0.372
1.006	118	15 Winter	30	+0%	100/15 Summer				86.619	-0.169
1.007	119	15 Winter	30	+0%	100/15 Summer				85.138	-0.172
6.000	120	15 Winter	30	+0%					84.724	-0.152
1.008	121	15 Winter	30	+0%	100/15 Summer				84.398	-0.155
1.009	122	15 Winter	30	+0%	30/15 Summer				82.413	0.150
1.010	123	15 Winter	30	+0%	30/15 Summer				81.999	0.297
1.011	124	15 Winter	30	+0%	30/15 Summer				80.331	0.344
1.012	125	15 Winter	30	+0%					79.597	-0.403
1.013	126	15 Winter	30	+0%					77.683	-0.337
1.014	127	15 Winter	30	+0%					75.006	-0.334
1.015	128	15 Winter	30	+0%					72.336	-0.346
1.016	129	15 Winter	30	+0%					70.159	-0.330
1.017	130	15 Winter	30	+0%					67.807	-0.335

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 7843 - SW 6A.SWS

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	101	0.000	0.86			43.7	SURCHARGED	5
1.001	102	0.000	1.54			56.6	SURCHARGED	
2.000	103	0.000	0.59			48.5	OK	
2.001	104	0.000	0.59			53.7	OK	
1.002	105	0.000	1.76			113.2	SURCHARGED	
1.003	106	0.000	1.30			131.3	SURCHARGED	
3.000	107	0.000	0.26			14.8	OK	
4.000	108	0.000	0.27			25.6	OK	
3.001	109	0.000	1.03			49.9	SURCHARGED	2
3.002	110	0.000	1.49			67.5	SURCHARGED	
3.003	111	0.000	1.11			102.3	SURCHARGED	
3.004	112	0.000	0.74			116.7	OK	
3.005	113	0.000	0.63			137.0	OK	
1.004	114	0.000	0.66			275.0	SURCHARGED	
5.000	115	0.000	0.82			31.8	OK	1
5.001	116	0.000	0.72			46.5	SURCHARGED	
1.005	117	0.000	1.96			323.5	SURCHARGED	
1.006	118	0.000	0.70			332.1	OK	
1.007	119	0.000	0.69			339.1	OK	
6.000	120	0.000	0.23			13.3	OK	
1.008	121	0.000	0.75			354.8	OK	
1.009	122	0.000	0.86			361.3	SURCHARGED	
1.010	123	0.000	2.03			366.4	SURCHARGED	
1.011	124	0.000	2.20			371.8	SURCHARGED	
1.012	125	0.000	0.08			371.6	OK	
1.013	126	0.000	0.09			372.4	OK	
1.014	127	0.000	0.09			372.8	OK	
1.015	128	0.000	0.09			372.8	OK	
1.016	129	0.000	0.10			372.4	OK	
1.017	130	0.000	0.09			371.8	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 7843 - SW 6A.SWS

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
1.018	131	30 Winter	30	+0%	100/15 Summer				63.575	0.000	0.000
1.019	132	15 Winter	30	+0%	100/15 Summer				63.377	-0.174	0.000
1.020	133	360 Winter	30	+0%	30/30 Winter				63.126	0.184	0.000
1.021	134	600 Winter	30	+0%					62.553	-0.160	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.018	131	1.27			356.0	OK	
1.019	132	0.90			370.7	OK	
1.020	133	0.40			23.6	SURCHARGED	
1.021	134	0.18			23.6	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 7843 - SW 6A.SWS

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	16.000
Region	England and Wales	Ratio R	0.268
Cv (Summer)	0.750		
Cv (Winter)	0.840		

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100, 101
Climate Change (%)	0, 0, 50, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	101	15 Winter	100	+50%	30/15 Summer	100/15 Summer			90.541	1.210
1.001	102	15 Winter	100	+50%	30/15 Summer				90.371	1.348
2.000	103	15 Winter	100	+50%	100/15 Summer				90.887	0.712
2.001	104	15 Winter	100	+50%	100/15 Summer				90.580	0.796
1.002	105	15 Winter	100	+50%	30/15 Summer				89.883	1.009
1.003	106	15 Winter	100	+50%	30/15 Summer				89.202	0.440
3.000	107	15 Winter	100	+50%	100/15 Summer				91.632	1.241
4.000	108	15 Winter	100	+50%	100/15 Summer				91.716	0.844
3.001	109	15 Winter	100	+50%	30/15 Summer	100/15 Winter			91.546	1.469
3.002	110	15 Winter	100	+50%	30/15 Summer				90.830	1.129
3.003	111	15 Winter	100	+50%	30/15 Summer				90.076	0.530
3.004	112	15 Winter	100	+50%	100/15 Summer				89.634	0.237
3.005	113	15 Winter	100	+50%	100/15 Winter				89.180	0.183
1.004	114	15 Winter	100	+50%	30/15 Winter				88.935	1.368
5.000	115	15 Winter	100	+50%	100/15 Summer	100/15 Winter			89.232	1.426
5.001	116	15 Winter	100	+50%	30/15 Summer				88.901	1.450
1.005	117	15 Winter	100	+50%	30/15 Summer				88.336	1.416
1.006	118	15 Winter	100	+50%	100/15 Summer				87.208	0.421
1.007	119	15 Winter	100	+50%	100/15 Summer				85.561	0.251
6.000	120	15 Winter	100	+50%					84.783	-0.093
1.008	121	15 Winter	100	+50%	100/15 Summer				84.752	0.199
1.009	122	30 Winter	100	+50%	30/15 Summer				83.482	1.219
1.010	123	30 Winter	100	+50%	30/15 Summer				82.551	0.849
1.011	124	30 Winter	100	+50%	30/15 Summer				80.912	0.925
1.012	125	30 Winter	100	+50%					79.638	-0.362
1.013	126	30 Winter	100	+50%					77.722	-0.298
1.014	127	30 Winter	100	+50%					75.045	-0.295
1.015	128	30 Winter	100	+50%					72.377	-0.305
1.016	129	30 Winter	100	+50%					70.199	-0.290
1.017	130	30 Winter	100	+50%					67.847	-0.296

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 7843 - SW 6A.SWS

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	101	9.682	1.47			74.7	FLOOD	5
1.001	102	0.000	2.21			81.4	FLOOD RISK	
2.000	103	0.000	0.90			74.6	SURCHARGED	
2.001	104	0.000	0.88			80.6	SURCHARGED	
1.002	105	0.000	2.56			164.9	SURCHARGED	
1.003	106	0.000	1.96			198.5	SURCHARGED	
3.000	107	0.000	0.46			26.2	FLOOD RISK	
4.000	108	0.000	0.43			40.7	SURCHARGED	
3.001	109	1.651	1.60			77.5	FLOOD	2
3.002	110	0.000	2.20			99.5	FLOOD RISK	
3.003	111	0.000	1.77			163.1	SURCHARGED	
3.004	112	0.000	1.19			187.7	SURCHARGED	
3.005	113	0.000	1.00			218.7	SURCHARGED	
1.004	114	0.000	1.00			419.8	SURCHARGED	
5.000	115	0.773	1.10			42.4	FLOOD	1
5.001	116	0.000	1.09			70.4	SURCHARGED	
1.005	117	0.000	2.98			492.3	SURCHARGED	
1.006	118	0.000	1.06			498.5	SURCHARGED	
1.007	119	0.000	1.03			506.3	SURCHARGED	
6.000	120	0.000	0.44			25.6	OK	
1.008	121	0.000	1.13			530.6	SURCHARGED	
1.009	122	0.000	1.29			543.2	SURCHARGED	
1.010	123	0.000	3.07			555.5	SURCHARGED	
1.011	124	0.000	3.36			568.3	SURCHARGED	
1.012	125	0.000	0.12			568.4	OK	
1.013	126	0.000	0.14			568.5	FLOOD RISK*	
1.014	127	0.000	0.14			568.4	FLOOD RISK*	
1.015	128	0.000	0.14			568.2	OK	
1.016	129	0.000	0.15			568.0	FLOOD RISK*	
1.017	130	0.000	0.14			568.0	FLOOD RISK*	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 7843 - SW 6A.SWS

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
1.018	131	30 Winter	100	+50%	100/15 Summer				63.860	0.285	0.000
1.019	132	30 Winter	100	+50%	100/15 Summer				63.659	0.108	0.000
1.020	133	480 Winter	100	+50%	30/30 Winter				63.630	0.688	0.000
1.021	134	600 Winter	100	+50%					62.553	-0.160	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.018	131	2.03			568.2	SURCHARGED	
1.019	132	1.37			566.3	SURCHARGED	
1.020	133	0.40			23.6	SURCHARGED	
1.021	134	0.18			23.6	OK	

101 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 7843 - SW 6A.SWS

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	16.000
Region	England and Wales	Ratio R	0.268
Cv (Summer)	0.750		
Cv (Winter)	0.840		

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years)	1, 30, 100, 101
Climate Change (%)	0, 0, 50, 0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	101	15 Winter	101	+0%	30/15 Summer	100/15 Summer			90.204	0.873
1.001	102	15 Winter	101	+0%	30/15 Summer				89.872	0.849
2.000	103	15 Winter	101	+0%	100/15 Summer				90.098	-0.077
2.001	104	15 Winter	101	+0%	100/15 Summer				89.840	0.056
1.002	105	15 Winter	101	+0%	30/15 Summer				89.391	0.517
1.003	106	15 Winter	101	+0%	30/15 Summer				88.865	0.103
3.000	107	15 Winter	101	+0%	100/15 Summer				90.747	0.356
4.000	108	15 Winter	101	+0%	100/15 Summer				90.776	-0.096
3.001	109	15 Winter	101	+0%	30/15 Summer	100/15 Winter			90.710	0.633
3.002	110	15 Winter	101	+0%	30/15 Summer				90.152	0.451
3.003	111	15 Winter	101	+0%	30/15 Summer				89.660	0.114
3.004	112	15 Winter	101	+0%	100/15 Summer				89.321	-0.076
3.005	113	15 Winter	101	+0%	100/15 Winter				88.872	-0.125
1.004	114	15 Winter	101	+0%	30/15 Winter				87.994	0.427
5.000	115	15 Winter	101	+0%	100/15 Summer	100/15 Winter			88.171	0.365
5.001	116	15 Winter	101	+0%	30/15 Summer				87.927	0.476
1.005	117	15 Winter	101	+0%	30/15 Summer				87.559	0.639
1.006	118	15 Winter	101	+0%	100/15 Summer				86.663	-0.125
1.007	119	15 Winter	101	+0%	100/15 Summer				85.181	-0.129
6.000	120	15 Winter	101	+0%					84.734	-0.142
1.008	121	15 Winter	101	+0%	100/15 Summer				84.446	-0.107
1.009	122	15 Winter	101	+0%	30/15 Summer				82.841	0.578
1.010	123	15 Winter	101	+0%	30/15 Summer				82.217	0.515
1.011	124	15 Winter	101	+0%	30/15 Summer				80.562	0.575
1.012	125	15 Winter	101	+0%					79.616	-0.384
1.013	126	15 Winter	101	+0%					77.701	-0.319
1.014	127	15 Winter	101	+0%					75.024	-0.316
1.015	128	15 Winter	101	+0%					72.355	-0.326
1.016	129	15 Winter	101	+0%					70.178	-0.311
1.017	130	15 Winter	101	+0%					67.826	-0.317

101 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 7843 - SW 6A.SWS

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	101	0.000	1.03			52.4	SURCHARGED	5
1.001	102	0.000	1.84			67.8	SURCHARGED	
2.000	103	0.000	0.75			62.0	OK	
2.001	104	0.000	0.72			65.3	SURCHARGED	
1.002	105	0.000	2.15			138.2	SURCHARGED	
1.003	106	0.000	1.57			159.2	SURCHARGED	
3.000	107	0.000	0.33			18.7	SURCHARGED	
4.000	108	0.000	0.35			32.7	OK	
3.001	109	0.000	1.24			60.1	SURCHARGED	2
3.002	110	0.000	1.78			80.6	SURCHARGED	
3.003	111	0.000	1.35			124.2	SURCHARGED	
3.004	112	0.000	0.90			141.9	OK	
3.005	113	0.000	0.77			167.8	OK	
1.004	114	0.000	0.81			338.4	SURCHARGED	
5.000	115	0.000	0.88			33.9	SURCHARGED	1
5.001	116	0.000	0.82			53.4	SURCHARGED	
1.005	117	0.000	2.40			396.6	SURCHARGED	
1.006	118	0.000	0.86			406.1	OK	
1.007	119	0.000	0.85			415.7	OK	
6.000	120	0.000	0.29			17.1	OK	
1.008	121	0.000	0.93			436.3	OK	
1.009	122	0.000	1.05			444.7	SURCHARGED	
1.010	123	0.000	2.49			450.8	SURCHARGED	
1.011	124	0.000	2.70			456.6	SURCHARGED	
1.012	125	0.000	0.09			458.0	OK	
1.013	126	0.000	0.11			459.0	OK	
1.014	127	0.000	0.11			459.3	OK	
1.015	128	0.000	0.12			459.0	OK	
1.016	129	0.000	0.12			458.2	OK	
1.017	130	0.000	0.11			456.7	OK	

101 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for 7843 - SW 6A.SWS

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)
1.018	131	15 Winter	101	+0%	100/15 Summer				63.616	0.041	0.000
1.019	132	15 Winter	101	+0%	100/15 Summer				63.555	0.004	0.000
1.020	133	480 Winter	101	+0%	30/30 Winter				63.269	0.327	0.000
1.021	134	360 Winter	101	+0%					62.553	-0.160	0.000

PN	US/MH Name	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.018	131	1.63			456.5	SURCHARGED	
1.019	132	1.09			449.0	SURCHARGED	
1.020	133	0.40			23.6	SURCHARGED	
1.021	134	0.18			23.6	OK	

Appendix 6

Guidance and Frameworks

NATIONAL PLANNING POLICY

One of the key aims of the National Planning Policy Framework (NPPF) and Flood Risk and Coastal Change Planning Policy Guidance is to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk. Where new development is, exceptionally, necessary in such areas, policy aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall.

A risk-based approach should be adopted at all levels of planning. Applying the source pathway-receptor model to planning for development in areas of flood risk requires:

- a strategic approach which avoids adding to the causes or sources of flood risk, by such means as avoiding inappropriate development in flood risk areas and minimising run-off from new development onto adjacent and other downstream property, and into the river systems;

- managing flood pathways to reduce the likelihood of flooding by ensuring that the design and location of the development maximises the use of SuDS, and takes account of its susceptibility to flooding, the performance and processes of river/coastal systems and appropriate flood defence infrastructure, and of the likely routes and storage of floodwater, and its influence on flood risk downstream; and

- reducing the adverse consequences of flooding on the receptors (Le. people, property, infrastructure, habitats and statutory sites) by avoiding inappropriate development in areas at risk of flooding.

Flood risk assessment should be carried out to the appropriate degree at all levels of the planning process, to assess the risks of all forms of flooding to and from development taking climate change into account. A sequential risk-based approach should be applied to determining the suitability of land for development in flood risk areas.

In areas at risk of river or sea flooding, preference should be given to locating new development in Flood Zone 1. If there is no reasonably available site in Flood Zone 1, the flood vulnerability of the proposed development can be taken into account in locating development in Flood Zone 2 and then Flood Zone 3. Within each Flood Zone new development should be directed to sites at the lowest probability of flooding from all sources.

Flood risk has been categorised as High, Medium and Low based on the probability of inundation. Extracts from Tables 1, 2 and 3 of the Flood Risk and Coastal Change PPG are provided below, which highlights the likely response to planning applications within each Flood Zone.

The PPG classifies *'buildings used for dwelling houses ...'* as more vulnerable and are therefore permitted in this zone.

Table 1 – Flood Zones (Flood Risk and Coastal Change Planning Practice Guidance)

Flood Zone	Definition
Zone 1 **Low Probability**	Zone 1 Land assessed as having a less than 1 in 1000 annual probability of river or Low sea flooding. (Shown as 'clear' on the Flood Map - all land outside Zones 2 and 3)
Zone 2 **Medium Probability**	Land having between a 1 in 100 and 1 in 1000 annual probability of river Medium flooding; or Land having between a 1 in 200 and 1 in 1000 annual probability of sea flooding (Land shown in light blue on the Flood Map)
Zone 3a **High Probability**	Land assessed as having a 1 in 100 or greater annual probability of river High flooding; or Land having a 1 in 200 or greater annual probability of sea flooding (Land shown in dark blue on the Flood Map)
Zone 3b **The Functional Floodplain**	**This zone comprises land where water has to flow or be stored in times** **The of flood.** Local planning authorities should identify in their Strategic Flood Risk Floodplain Assessments areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map)

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

Where required an exception test must be passed in order for developments of that nature to be justified within the Flood Zone. For the Exception Test to be passed the following must be demonstrated:

a) it must be demonstrated that the development provides wider sustainability benefits to the community that outweigh flood risk, informed by a SFRA where one has been prepared.
b) the development should be on developable, previously-developed land or, if it is not there are no reasonable alternative sites on developable previously-developed land; and
c) a FRA must demonstrate that the development will be safe, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

Table 2 - Flood Risk Vulnerability Classification (Flood Risk and Coastal Change Planning Practice Guidance)

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

Highly vulnerable

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

More vulnerable

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

Less vulnerable

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

Water-compatible development

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

Flood risk vulnerability classification (see table 2)		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone (see table 1)	**Zone 1**	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	×	Exception Test required	✓
	Zone 3b	Exception Test required	✓	×	×	×

Extract from the Flood Risk and Coastal Change Planning Practice Guidance

Key: ✓ Development is appropriate.

× Development should not be permitted.

LOCAL PLANNING POLICY

8 Summary and Recommendations

8.1 Summary

This Level 1 SFRA provides a single repository planning tool relating to flood risk and development in Copeland borough. Key flood risk stakeholders namely the EA, LPA / LLFA, UU, local emergency services, emergency planners and local resilience forums were consulted to collate all available and relevant flood risk information on all sources into one comprehensive assessment. Together with this main report, this SFRA also provides a suite of interactive GeoPDF flood risk maps (Appendix B) and a development site assessment spreadsheet (Appendix C) illustrating the level of risk to potential development sites.

The flood risk information, assessment, guidance and recommendations provided in this SFRA will provide the LPA with the evidence base required to apply the Sequential Test, as required under the NPPF, and demonstrate that a risk-based, sequential approach has been applied in the preparation of its new Local Plan.

Whilst the aim of the sequential approach is the avoidance of high flood risk areas, in some locations where the council is looking for continued growth and/or regeneration, this will not always be possible. This SFRA therefore provides the necessary links between spatial development, wider flood risk management policies, local strategies and plans and on the ground works by combining all available flood risk information together into one single repository. As this is a strategic study based on current available information, detailed, site-specific local information on flood risk is not fully accounted for. For a more detailed assessment of specific areas or sites, a Level 2 SFRA may be carried out following on from the completion of a Level 1 assessment, if required.

The data and information used throughout the SFRA process is the most up-to-date data available at the time of writing (October 2021). Once new, updated or further information becomes available, the LPA should look to update this SFRA. The Level 1 SFRA should be considered to be, and maintained as, a 'live' entity which is updated as and when required (when new modelling or flood risk information becomes available). The LPA and LLFA can decide when to update the SFRA, and the EA as a statutory consultee on local plans can also advise the LPA to update the SFRA.

8.1.1 Summary of risk

The risk across the CBC area is varied:

- The main fluvial risk comes from:
  - the River Ehen and Skirting Beck in Egremont,
  - Pow Beck in Whitehaven, and
  - Kirk Beck and Black Beck in Beckermet.
- The main tidal risk comes from the Copeland coastline, particularly along the low-lying coastal flats and estuaries. The town of Millom, in the south of the district, is at high tidal flood risk, particularly east Millom from the Duddon Estuary.
- Surface water risk is spread across the whole of the Copeland borough. The main areas of risk are primarily centred around the Main Rivers; and
- The areas with the highest levels of groundwater vulnerability are spread across the whole of the Copeland authority area with the main areas being located on the estuary in the south of the council area, and to the north areas such as Sellafield, Egremont, Whitehaven, Cleator Moor, and along the A595.

8.2 Planning and flood risk policy recommendations

The following planning flood risk policy recommendations are designed to enable the LPA to use the information provided in this Level 1 SFRA to inform Local Plan policy direction:

Recommendation 1: No development within the functional floodplain…

…as per the National Planning Policy Framework (2019) and Flood Risk and Coastal Change Planning Practice Guidance, unless in exceptional circumstances such as for essential infrastructure, which must still pass the Exception Test, or where development is water compatible.

Development must not impede the flow of water within the functional floodplain nor should it reduce the volume available for the storage of floodwater. Sites within the functional floodplain may still be developable if the site boundary can be removed from the functional floodplain or the site can accommodate the risk on site and keep the area of functional floodplain free from development or obstruction and allowed to flow freely.

Refer to tables 1 to 3 of the FRCC-PPG.

Recommendation 2a: Consider surface water flood risk…

…with equal importance alongside fluvial risk including possible withdrawal, redesign or relocation for sites at significant surface water risk.

Sustainable Drainage Systems on all new development must adhere to industry standards and to the applicable runoff discharge rate and storage volume allowances stated by the Lead Local Flood Authority.

Site specific Flood Risk Assessments should always consider surface water flood risk management and options for on-site flood storage through appropriate Sustainable Drainage Systems. The Local Planning Authority / Lead Local Flood Authority must always be consulted during this process, as should United Utilities and the EA, if required.

A Sustainable Drainage Strategy should always be submitted which clearly takes account of the findings of the site-specific Flood Risk Assessment and specify the proposed design, constructions, adoption and management and maintenance arrangements of the proposed SuDS components. The LPA and LLFA must always be consulted during this process, as should United Utilities and the EA, if required

Recommendation 2b: Use of appropriately sourced SuDS…

…required for all major developments of 10 or more residential units or equivalent commercial development. This is in accordance with Para 163 of the National Planning Policy Framework (2019).

As per the NPPF (2021), in terms of Sustainable Drainage Systems, development in areas at flood risk should only be permitted where SuDS are incorporated into the design, unless clear evidence demonstrates this would be inappropriate.

SuDS scoping and design, as part of a site-specific Flood Risk Assessment, must be included within the early stages of the site design in order to incorporate appropriate SuDS within the development.

The Local Planning Authority / Lead Local Flood Authority, United Utilities (if appropriate) must be consulted during the site design stage and the Flood Risk Assessment must be submitted to and approved by the Local Planning Authority, considering all consultation with key stakeholders.

All SuDS must be designed to meet industry standards, as specified below, including any replacement standards/documents which update or are in addition to those listed:

- Local SuDS Guidance
- Interim national standards published in March 2015
- Technical Standards for Sustainable Drainage Systems (Defra)
- C753 The SuDS Manual
- The Design and Construction Guidance for Sewers (2020)

Recommendation 3: Sequential approach to site allocation and site layout…

…must be followed by the Local Planning Authority to ensure sustainable development when either allocating land in Local Plans or determining planning applications for development.

The overall aim of the Sequential Approach should be to steer new development to low risk Flood Zone 1. Where there are no reasonably available sites in Flood Zone 1, the flood risk vulnerability of land uses and reasonably available sites in Flood Zone 2 should be considered, applying the Exception Test if required.

Only where there are no reasonably available sites in Flood Zones 1 or 2 should the suitability of sites in higher risk Flood Zone 3a, be considered. This should take into account the flood risk vulnerability of land uses, residual surface water and/or groundwater flood risk and the likelihood of meeting the requirements of the Exception Test, if required.

This SFRA, the National Planning Policy Framework and Flood Risk and Coastal Change Planning Policy Guidance must be consulted throughout this process along with the LPA / LLFA, EA, and United Utilities.

Recommendation 4: Requirement for a site-specific Flood Risk Assessment…

…from a developer when a site is:

- Any site located within Flood Zone 2 or 3
- Any site that has an area greater than 1 ha
- Within Flood Zone 1 where any part of the site is identified by the Risk of Flooding from Surface Water maps as being at risk of surface water flooding.
- Identified by the EA as having critical drainage problems (within an Area with Critical Drainage Problems)
- Situated over or within 8 metres of a culverted watercourse or where development will be required to control or influence the flow of any watercourse
- Within 20 metres of a Main River
- Identified as being at increased flood risk in future
- At risk of flooding from other sources of flooding or at residual risk
- Subject to a change of use to a higher vulnerability classification which may be subject to other sources of flooding
- Situated in an area currently benefitting from defences
- Within a council designated Critical Drainage Area

Before deciding on the scope of the Flood Risk Assessment, this SFRA should be consulted along with the LPA / LLFA, and United Utilities. The Flood Risk Assessment should be submitted to and be approved by the LPA including suitable consultation with the LLFA and the EA and any other applicable parties.

Recommendation 5: Natural Flood Management techniques…

…must be considered, where possible, to aid with flood alleviation and implementation of suitable SuDS, depending on the location.

The national Working with Natural Processes mapping (included in this SFRA) should be consulted in the first instance, followed by local investigation into whether such techniques are appropriate and whether the benefits are proportionate to the work required to carry out the identified Working with Natural Processes approaches.

Natural drainage features should be maintained and enhanced and there should be a presumption against culverting of open watercourses. Where possible, culvert removal should be explored.

Recommendation 6: Phasing of development…

…must be carried out by the Local Planning Authority on a site by site basis and also within sites by the developer to avoid any cumulative impacts of flood risk (reinforced by the revised National Planning Policy Framework (2019)).

Using a phased approach to development, should ensure that any sites at risk of causing flooding to other sites are developed first to ensure that flood storage measures are in place and operational before other sites are developed, thus contributing to a sustainable approach to site development during all phases of construction. It may be possible that flood mitigation measures put in place at sites upstream could alleviate flooding at downstream or nearby sites.

Development phasing within large strategic sites of multiple developments should also be considered where parts of such sites are at flood risk.

The EA states that the optimum approach would be to have all development sites that make up a large strategic site to have all developers sign up to a Flood Risk and Drainage Masterplan from the very start of the planning stage. It is often the case that outline planning permission is given for larger strategic sites with individual developers then submitting further separate site-specific FRAs that are not joined up with the rest of the site. These individual FRAs can then fail to include the green SuDS infrastructure indicated within the Outline FRA

Recommendation 7: Planning permission for at risk sites…

…can only be granted by the Local Planning Authority where a site-specific Flood Risk Assessment shows that:

- The National Planning Policy Framework and Flood Risk and Coastal Change Planning Practice Guidance have been referenced together with appropriate consultation with the Lead Local Flood Authority, the EA, and United Utilities, where applicable
- The effects of climate change have been taken into account using the latest allowances developed by the EA
- There is no loss in floodplain storage resulting from the development i.e. where development takes place in a fluvial flood zone or is at risk from surface water flooding, compensatory storage must be found to avoid loss of floodplain and subsequent displacement of water which may cause flooding elsewhere
- The development will not increase flood risk elsewhere
- For previously developed sites, the development should look to meet greenfield runoff rates where practicable (in line with the Non-Statutory Technical Standards for Sustainable Drainage (March 2013)), achieved through providing Sustainable Drainage Systems as appropriate or through the use of appropriate flow and volume control devices.
- There is no adverse effect on the operational functions of any existing flood defence infrastructure
- Proposed resistance / resilience measures designed to deal with current and future risks are appropriate
- Whether the development will be safe for its lifetime and has passed the Exception Test, if applicable
- An appropriate Emergency Plan is included that accounts for the possibility of a flood event and shows the availability of safe access and egress points accessible during times of flood.

8.2.1 Recommendations for further work

The SFRA process has developed into more than just a planning tool. Sitting alongside the SA, LFRMS and FRMP, it can be used to provide a much broader and inclusive vehicle for integrated, strategic and local flood risk management and delivery.

There are a number of plans and assessments listed in Table 8-1 that may be of benefit to the LPA, in developing their flood risk evidence base to support the delivery of the Local Plan, or to the LLFA to help fill critical gaps in flood risk information that have become apparent through the preparation of this Level 1 SFRA.

Type	Study	Reason	Timeframe
Understanding of local flood risk	Level 1 SFRA update	When there are changes to: • the predicted impacts of climate change on flood risk • detailed flood modelling - such as from the EA or LLFA	As required

Type	Study	Reason	Timeframe
		• the local plan, spatial development strategy or relevant local development documents • local flood management schemes • flood risk management plans • shoreline management plans • local flood risk management strategies • national planning policy or guidance Or after a significant flood event.	
	Level 1 SFRA update; Level 2 SFRA; site-specific FRA	Reviewing of EA flood zones in those areas not covered by existing detailed hydraulic models i.e. the Flood Map for Planning does not cover every watercourse such as those <3km^2 in catchment area or Ordinary Watercourses. If a watercourse or drain is present on OS mapping but is not covered by the Flood Map for Planning, this does not mean there is no potential flood risk. A model may therefore be required to ascertain the flood risk, if any, to any nearby sites.	Short term
	Level 2 SFRA	**Further, more detailed assessment of flood risk to high risk sites, large strategic sites, as notified by this Level 1 SFRA. Dependant on the availability EA river model data.**	**Short term**
	Preliminary site-screening FRAs / outline drainage strategy	Further, more detailed assessment of larger strategic sites such as S195.	Short term
	Local Flood Risk Management Strategy review	It is recommended that the LFRMS is updated to ensure it remains consistent with the National Flood and Coastal Erosion Risk Management Strategy that was updated and published July 2020.	
	SWMP / drainage strategy / detailed surface water modelling	CCC developed a SWMP for the borough in 2013 and thus should be updated. At the time of writing, an update is currently underway.	Short to Medium term
	Water Cycle Study	CCC has not developed a WCS for the borough. If the Local Plan highlights large growth and urban expansion, the LLFA should produce a WCS to look at capabilities of water and sewerage providers.	Short to Medium term
	Climate change assessment for Level 1 update or Level 2 SFRA	Modelling of climate change, using the EA's 2016 allowances. February 2016 allowances for updated EA models are currently used. Guidance has been revised in line with UKCP18 where the guidance has changed on how to apply peak river flow allowances so the	Short term

Type	Study	Reason	Timeframe
		approach is the same for both flood zones 2 and 3.	
	Possible CDA delineation	Whether the delineation of CDAs may be appropriate for areas particularly prone to surface water flooding. Detailed analysis and consultation with the LLFA, UU and any relevant Internal Drainage Board would be required. It may then be beneficial to carry out a local SWMP or drainage strategy for targeted locations with any such critical drainage problems.	Medium term
Flood storage and attenuation	Working with Natural Processes	Promote creation of floodplain and riparian woodland, floodplain reconnection and runoff attenuation features where the research indicates that it would be beneficial in Copeland.	Ongoing
Data collection	Flood Incident data	CCC, as LLFA, has a duty to investigate and record details of significant flood events within their area. General data collected for each incident, should include date, location, weather, flood source (if apparent without an investigation), impacts (properties flooded or number of people affected) and response by any Risk Management Authority.	Short term
	FRM Asset Register	CCC has a responsibility to update and maintain a register of structures and features, which are considered to have an effect on flood risk.	Ongoing
Capacity	SuDS review / guidance	The LPA should work with the LLFA to clearly identify its requirements of developers for SuDS in new developments. The LLFA would encourage the creation of a SuDS SPD and robust policy in the DPD to secure maximum weighting is applied to surface water management and sustainable design of new drainage systems to prevent flooding from surface water.	Short Term / Long Term
Partnership	United Utilities	The LLFA should continue to collaborate with UU on sewer and surface water projects. The LPA should be kept informed and carry out an assessment of water company assets to ensure they are operational and resilient at all times across the catchment and that capacity for new development is appropriate.	Ongoing
	EA	CBC and CCC should continue to work with the EA on fluvial flood risk management projects. Potential opportunities for joint schemes to tackle flooding from all sources should be identified.	Ongoing

Type	Study	Reason	Timeframe
	Community	Continued involvement with the community through CCC's existing flood risk partnerships.	Ongoing

Table 8-1: Recommended further work for CBC or developers

8.2.2 Level 2 SFRA

The LPA should review the sites where they expect the main housing numbers and employment sites to be delivered, using Section E.1 of Appendix E, the SFRA maps in Appendix B and the development site assessment spreadsheet in Appendix C. A Level 2 SFRA may be required for sites where any of the following applies:

- The Exception Test is required,
- Further evidencing i.e. climate change modelling is required at the strategic level in order to allocate,
- A large site, or group of sites, are within Flood Zone 3 and have strategic planning objectives, which means they cannot be relocated or avoided,
- A cluster of sites are within Flood Zone 2 or are at significant risk of surface water flooding.

A Level 2 SFRA should build on the source information provided in this Level 1 assessment and should show that a site will not increase risk elsewhere and will be safe for its lifetime, once developed.

As discussed in Section 6.5, a Level 2 assessment can be used to model the February 2016 climate change allowances, where current EA models are available. A Level 2 study may also further assess locations and options, in more detail, for the implementation of open space, or Green Infrastructure, to help manage flood risk in key areas, and also to assess residual risk.

Ultimately, the LPA will need to provide evidence in its Local Plan to show that housing numbers, economic needs and other sites can be delivered. Proposals within the Local Plan may be rejected if a large number of sites require the Exception Test to be passed but with no evidence that this will be possible.

As sites within this Level 1 assessment have been reviewed by the LPA in the consideration of planning applications, then further advice or guidance may be required to establish how best to progress future development proposals, possibly by a further review of the SFRA.

All Strategic Recommendation B sites should have a Level 2 SFRA completed assuming the LPA want to allocate. Those sites with Strategic Recommendation A should be withdrawn based on significant levels of fluvial / tidal and/or surface water flooding; if a site is still going to be taken forward then a Level 2 assessment should be carried out to assess depths and hazards of flooding in order for the site to pass the Exception Test (if applicable). Certain Strategic Recommendation C sites may also benefit from a more in-depth assessment through a Level 2 SFRA.

The EA should always be consulted as to whether a Level 2 SFRA is required.

reducing surface water run off. The Environment Agency have produced guidance on other measures that can be incorporated into developments[33].

Strategic Policy DS8PU: Reducing Flood Risk

The Council will ensure that development in the borough is not prejudiced by flood risk through:

a) Directing development to allocated sites outside areas of flood risk where possible;
b) Only permitting windfall development in areas of flood risk where applicants have carried out the flood risk sequential and exception tests to the satisfaction of the Council and appropriate mitigation is provided;
c) Ensuring that developments on Opportunity Sites within Whitehaven are designed to address the existing levels of flood risk without increasing flood risk elsewhere;
d) Supporting measures to address the constraints of existing drainage infrastructure capacity;
e) Avoiding development in areas where the existing drainage infrastructure is inadequate; unless appropriate mitigation is provided
f) Supporting new flood defence measures to protect against both tidal and fluvial flooding in the borough, including appropriate land management as part of a catchment wide approach;
g) Ensuring that any development that incorporates flood mitigation strategies does not have adverse effects on water quality;
h) Requiring the provision of sustainable drainage systems where appropriate; and
i) Working with partners to manage the risks associated with coastal erosion and flooding and ensure that all new development is located outside areas identified as being at risk either now or in future revisions of the Shoreline Management Plan.

Sustainable Drainage

6.6.9 The need to minimise future developments vulnerability to climate change is a significant factor in the design and construction of new development, particularly in terms of reducing flood risk through its location and active management of surface water. Sustainable Drainage Systems (SuDS), dependent on site specific characteristics, can aid the reduction of the rate and volume of surface water run-

[33] https://www.gov.uk/guidance/use-nature-based-solutions-to-reduce-flooding-in-your-area

off and therefore reduce flood risk. Where possible all new development must incorporate SuDs in accordance with Policy DS9PU below.

6.6.10 It is acknowledged that SuDS may not be appropriate in all cases[34], for example SuDS that incorporate any form of soakaway on contaminated brownfield sites may pose a risk to land and groundwater quality through the movement of soluble contamination.

6.6.11 Applications for new development within the surface water or ground water catchment area of pollution sensitive National Site Networks or Ramsar sites must be supported by a project-level Appropriate Assessment. This must include details of sustainable drainage measures to be employed once operational and water quality control measures within construction plans must be adhered to. In particular, development within the catchment of the River Ehen SAC, its tributaries and the downstream catchment of the SAC must include stringent measures to avoid the risk of pollution.

Policy DS9PU: Sustainable Drainage

Where appropriate new development must incorporate sustainable drainage systems. Drainage systems should be well designed with consideration given to the additional benefits they can provide as spaces for biodiversity and recreation.

Development on Greenfield sites should seek to achieve pre-development or better levels of surface water run-off and on previously developed sites, a reduction in surface water discharge should be sought. In demonstrating a reduction clear evidence of existing connections from the site and associated rates of discharge calculations should be provided. In both cases, measures should be put in place to prevent pollution entering watercourses with surface water managed at source.

Where identified on the local validation list applicants should submit a Drainage Strategy that shows how foul and surface water will be effectively managed and maintained.

Surface water should be discharged in the following order of priority:

1. To a suitable soakaway or some other form of infiltration system
2. An attenuated discharge to a surface water body such as a watercourse giving full consideration to the catchment and sub-catchments

[34] For example, if the site lies on heavy clay

3. An attenuated discharge to a public surface water sewer, highway drain or another discharge system where there is clear evidence, to the satisfaction of the Council, that alternative preferred options are not available.
4. An attenuated discharge to a public combined sewer where there is clear evidence, to the satisfaction of the Council, that alternative preferred options are not available.

6.7 Soils, Contamination and Land Stability

Soils and Contamination

6.7.1 Soil has an important role within ecosystems, providing habitats, storing carbon and filtering water and is vital for agriculture. Soils are however at risk of degradation which involves both the physical loss (erosion) and the reduction in quality of topsoil associated with nutrient decline and contamination[35].

6.7.2 Construction activity can have a negative impact upon soils through contamination, compaction and by covering soils with impermeable materials. It can also have a positive impact through remediation, with the use of brownfield sites for development presenting a positive opportunity for remediation of despoiled, degraded, derelict, contaminated or unstable land.

6.7.3 Copeland contains areas of Best and Most Versatile Land. This is land in grades 1, 2 and 3a of the Agricultural Land Classification and is the most flexible, productive and efficient for farming. Such land should be protected from development and maintained for agriculture.

Land stability

6.7.4 Copeland has a strong mining history and there are a number of recorded mining features present at surface and shallow depth which pose a potential risk to land stability and public safety. Given this it is important that a risk assessment is carried out where necessary.

Policy DS10PU: Soils, Contamination and Land Stability

Soils

[35] https://www.parliament.uk/documents/post/postpn265.pdf