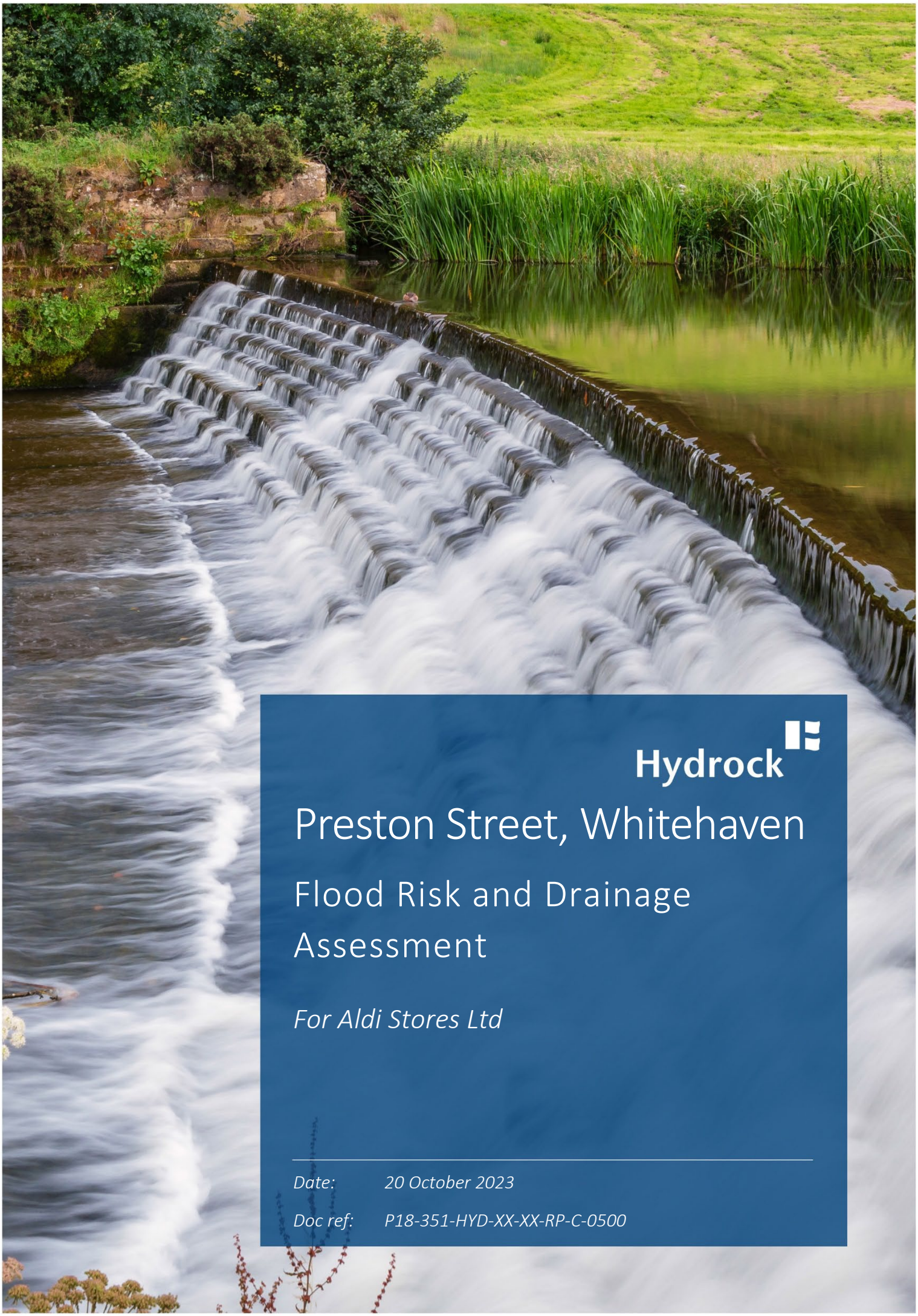

Hydrock

Preston Street, Whitehaven

Flood Risk and Drainage Assessment

For Aldi Stores Ltd

Date: *20 October 2023*

Doc ref: *P18-351-HYD-XX-XX-RP-C-0500*

DOCUMENT CONTROL SHEET

Issued by	Hydrock Consultants Limited 2 Esh Plaza Sir Bobby Robson Way Great Park Newcastle Upon Tyne NE20 0DS	Tel: 0191 2302993 www.hydrock.com
Client	Aldi Stores Ltd	
Project name	Preston Street, Whitehaven	
Title	Flood Risk and Drainage Assessment	
Doc ref	P18-351-HYD-XX-XX-RP-C-0500	
Project no.	P18-351	
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Document Production Record		
Issue Number	P01	Name
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Checked by		Andrew Wallace
Approved by		Martin Pearse

Document Revision Record			
Issue Number	Status	Date	Revision Details
P01	S4	20/10/23	First Issue - For comment

Hydrock Consultants Limited has prepared this report in accordance with the instructions of the above-named client for their sole and specific use. Any third parties who may use the information contained herein do so at their own risk.

CONTENTS

Appendices

1. INTRODUCTION

This report has been prepared by Hydrock Consultants Limited (Hydrock) on behalf of our client Aldi Stores Ltd in support of a Planning Application to be submitted for a development at Preston Street, Whitehaven.

Local Planning Authority are advised by the Government's National Planning policy Framework (NPPF) to consult the Environment Agency (EA) and the Lead Local Flood Authority (LLFA) on development proposals in areas at risk of flooding. For a development of this nature the EA and the LLFA normally require a Flood Risk Assessment and drainage strategy to be submitted in support of such an application. The report has been prepared to consider the requirements of NPPF through:

- Assessing whether the proposed development is likely to be affected by flooding;
- Assessing whether the proposed development is appropriate in the suggested location and
- Detailed measures necessary to mitigate any flood risk identified, to ensure that the proposed development and occupants would be safe and that flood risk would not be increased elsewhere.

The report considered the requirements for undertaking a Flood Risk Assessment as stipulated in NPPF Technical Guidance. Only those requirements that are appropriate to a development of this nature have been considered in the compilation of this report.

This report has been prepared in accordance with current EA policy.

The drainage strategy within this report has been produced in accordance with the Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015), Building Regulations Approved Document H: drainage and waste disposal, Sewers for Adoption requirements and the Cumbria County Councils Local Standards for Sustainable Drainage.

This report is based on the following information;

- Topographical survey
- Ground Investigation Report dated Jan 2022 undertaken by 3E Consulting Engineers Ltd
- United Utilities Sewer Records

This report presents the factual information available during the time of appraisal, interpretation of the data obtained and recommendations relevant to the scope of works. It has been assumed in the production of this report that the site is to be developed for a Food Retail Unit with associated parking.

This report has been prepared for the sole use of Aldi Stores Ltd and their appointed design team. No other third party may rely upon or reproduce the contents of this report without the written approval of Hydrock Consultants Limited. If any unauthorised third party comes into the possession of this report, they rely on it entirely at their own risk and Hydrock do not owe them any Duty of Care or Skill.

2. SITE INFORMATION

2.1 Location and Setting

The site is located to the east of Preston Street, in Whitehaven. The site is currently an area of car parking in the northern part and derelict land to the south with concrete slabs and vegetation. An existing Home Bargains store is situated to the north, with an existing Asda store to the west. To the east is a derelict site.

The site location is shown in Figure 1, with the full address and Ordnance Survey grid reference provided in Table 1.

Table 1: Site Referencing Information

Site Referencing Information	
Site Address	Back Ginns, Kells, Whitehaven, Cumberland, England, CA28 9BT
Grid Reference	NX 97318 17514 297318E , 517514N

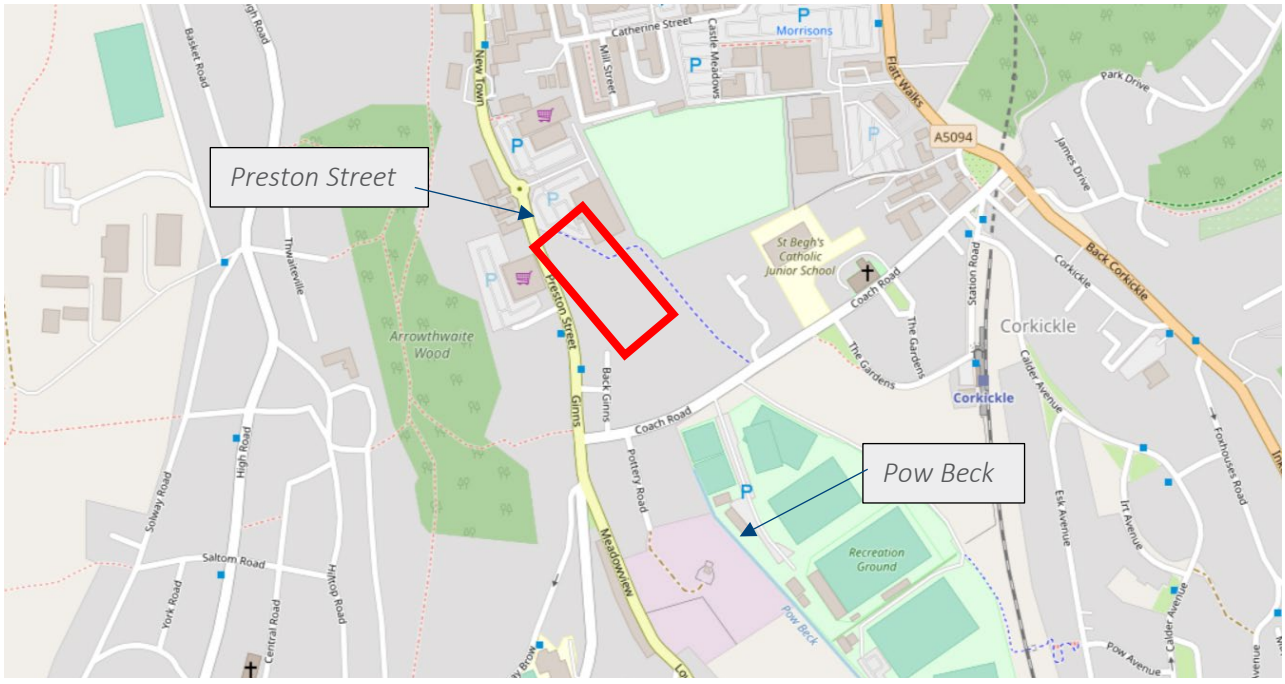


Figure 1: Site Location

2.2 Topography

A site-specific topographical survey has been undertaken for the site. The site is shown to fall from west to east from a highest level of 12.40mAOD in the south west to a lowest level of 8.07mAOD in the east.

A copy of the topographical survey is provided in Appendix A

2.3 Current Site

The northern area of the site is currently a car park with an impermeable tarmac surface.

The area to the south is a derelict area formerly housing industrial units with remains of concrete floor slabs and vegetation.

A large brick boundary wall borders the parking area to all boundaries.

2.4 Proposed Development

The proposed development comprises of a new Aldi store with dedicated parking area to the north of the store and a loading bay area to the south east of the site.

A copy of the proposed development plan is provided in Appendix B.

3. SOURCES OF FLOOD RISK

3.1 Fluvial Flooding

The Pow Beck is culverted directly below the site, situated near the eastern boundary it runs from south to north at a depth of around 5m.

The EA flood maps have been assessed to determine the extent of fluvial flood risk from the Pow Beck, as per the extract below, the site is shown to sit wholly within Flood Zone 1.

Product 4 Data has been obtained from the EA due to the Pow Beck being located within the site boundary. This shows that the highest modelled flood level directly adjacent to the site is located to the east of the proposed store just outside of the site boundary. The modelled level is shown to be 7.37mAOD for the 0.1% AEP Undefended Scenario.

For reference to the proposed site, the FFL of the proposed building is 9.42mAOD which means there is over 2m freeboard from the worst-case scenario modelled flood event.

Modelled data for the 1% AEP +20%CC shows that no flooding occurs within the vicinity of the site. The nearest modelled Node location is to the south at the point the Pow Beck intersects Coach Road, with an estimated flood level of 7.79mAOD. This location is around 100m south of the site boundary and the FFL of 9.42mAOD has a freeboard of 1.62m.

Therefore, it is considered the site is at low risk of fluvial flooding.

A copy of the EA Product 4 Data is contained within Appendix C.

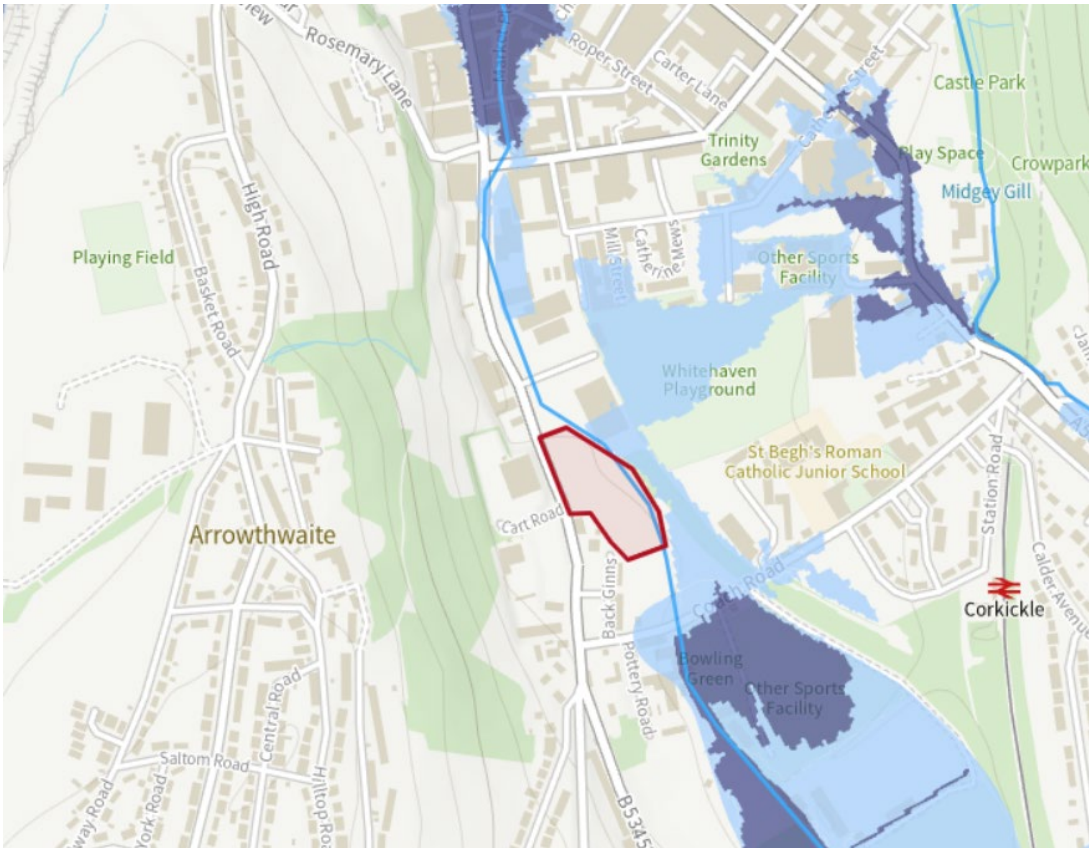


Figure 2: Extract of EA Flood Zone Map

For Reference the Environment Agency Flood Zones are defined as follows:

- Flood Zone 1 (Low Risk) comprises land assessed as having a <0.1% Annual Exceedance Probability (AEP) of fluvial or tidal flooding in any given year, equivalent to the >1000 year return period flood event.
- Flood Zone 2 (Medium Risk) comprises land assessed as having a 0.1%-1% AEP of fluvial flooding or 0.1-0.5% AEP of tidal flooding in any given year, equivalent to the 1000-100 year or 1,000-200 year return period flood event.
- Flood Zone 3a (High Risk) comprises land assessed as having a > 1% AEP of fluvial or tidal flooding in any given year or a .0.5% AEP of tidal flooding in any given year, equivalent to the <100 year or <200 year return period flood event.
- Flood Zone 3b(Functional Flood Plain) comprises land where water from rivers or the sea has to flow or be stored in times of flood. The identification of functional flood plain should take account of local circumstances and be defined solely on rigid probability parameters. Functional flood plain will normally comprise:
  - » Land having a 3.3% (1 in 30 year) or greater annual probability of flooding, with any existing flood risk management infrastructure operating effectively; or
  - » Land that is designed to flood (such as a flood attenuation scheme), even if it would only flood in more extreme events (such as 0.1% annual probability of flooding).

3.2 Historic Fluvial Flooding

As part of the Product 4 data provided the EA have confirmed that there are no recorded flood events affecting the site.

This does not mean that flooding has never occurred, only that the EA hold no records of any such event occurring.

3.3 Tidal Flooding

It should be noted that the EA Flood Zone Mapping does not distinguish between fluvial and tidal flood risk, however , given the inland geographical location and the distance from any tidally influenced waterbodies, the risk of tidal flooding at the site is concluded to be 'low'.

3.4 Surface Water Flooding

Surface water flooding occurs as the result of inability of intense rainfall to infiltrate the ground. This often happens when the maximum soil infiltration rate or storage capacity is reached. Flows generated by such events either enter existing land drainage features or follow the general topography which can concentrate flows and lead to localised ponding/flooding.

The EA Surface Water Flood Risk Maps (Figure 3) shows the majority of the site to be classified as 'Very Low' Risk.

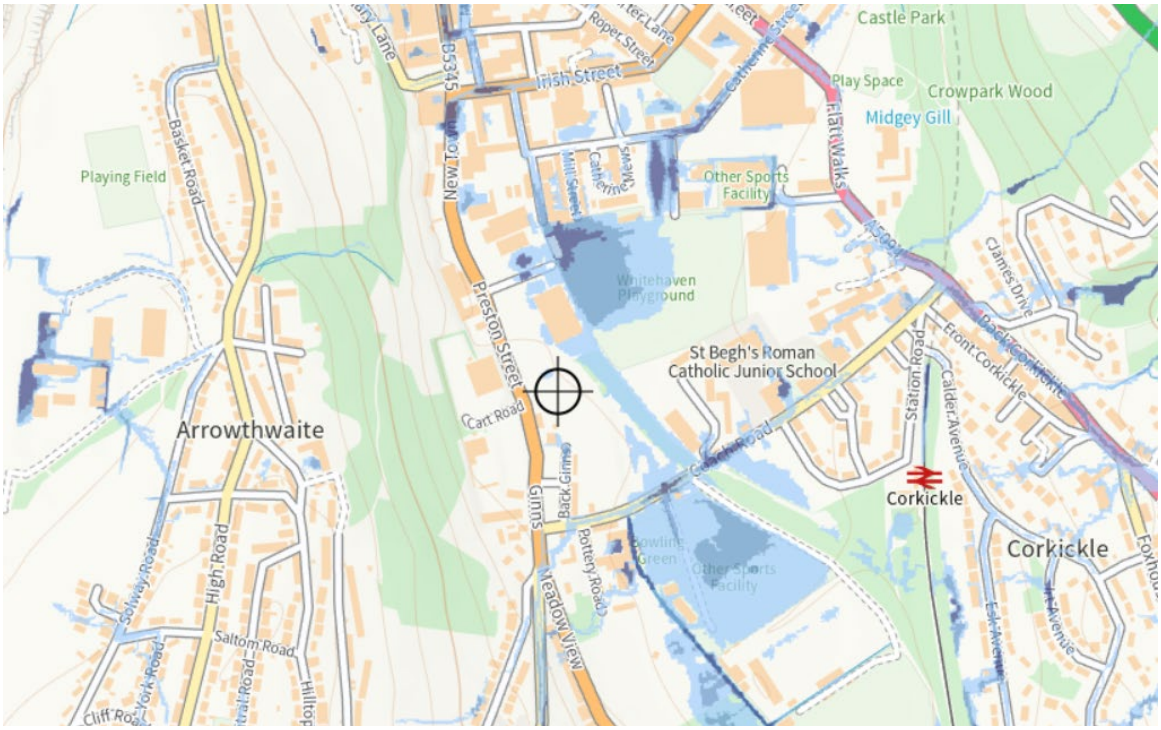


Figure 3: Extract of EA Surface Water Flood Risk Map

3.5 Ground Water Flooding

A site investigation was undertaken by 3E Consulting Engineers dated Jan 2022. This shows that groundwater was encountered within the mini percussive boreholes at depths of between 1.30m and 3.00m which is considered to be attributable to water contained within the upper superficial deposits below the site. It should be noted that groundwater levels vary seasonally and that a higher water table than recorded could occur.

No recorded flood events have been recorded at the site as a result of ground water flooding. It should be noted that whilst groundwater flooding is considered to be low on the site, due to the boreholes identifying groundwater to be near surface there is a potential for there to be interaction with ground water at construction phase but it is not expected to cause a risk of flooding during the operation of the development.

3.6 Sewers and Artificial Infrastructure Flooding

A 600mm X 800mm brick egg public combined water sewer is shown to flow from south to north beyond the site boundary to the north. The sewer is shown to be around 5m deep with no flood risk highlighted by United Utilities as part of the pre planning response.

The sewer will be subject to UU maintenance with a 10m sewer easement provided for access.

If flooding was to occur, flows would exit the 2No public manholes located within the service road to the east of the store. The levels of the road fall to the eastern boundary away from the building and would not pose a risk to the store.

The online EA Reservoir Failure Extents mapping has been reviewed and shows that the site is not at risk of flooding of this kind.

4. NATIONAL PLANNING POLICY FRAMEWORK

4.1 Sequential Test

The NPPF Sequential Test requires that a sequential approach is followed to steer new development to areas with the lowest probability of flooding (i.e., Flood Zone 1, then zone 2,then zone 3).

This assessment has demonstrated that the site is on land designated as Flood Zone 1.

4.2 Exception Test

The proposed development is for a supermarket which falls under the category of 'less vulnerable' development in accordance with Table 2 of the Flood Risk and Coastal Change National Planning Practice Guidance (NPPG).

Table 2 (taken from Table 2, Paragraph 079 of NPPG) shows that less vulnerable developments in flood zone 1 do not require an Exception test to be undertaken and no mitigation measures will be required.

Table 2:Flood Risk Vulnerability and Flood Zone 'incompatibility'

Flood Risk Vulnerability Classification	Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone 1	✓	✓	✓	✓	✓
Flood Zone 2	✓	✓	Exception Test Required	✓	✓
Flood Zone 3a	Exception Test Required	✓	X	Exception Test Required	✓
Flood Zone 3b	Exception Test Required	✓	X	X	X

Where ✓ means development is appropriate and X means development should not be permitted.

5. SURFACE WATER DRAINAGE

5.1 Existing Surface Water Drainage

There are no existing surface water details for the derelict land in the southern part of the site.

Existing surface water from the car park area in the north is expected to discharge flows at an unrestricted rate into the adjacent brick egg combined sewer.

A copy of the United utilities Sewer Records are included in Appendix F.

5.2 Proposed Surface Water Drainage

In line with the National Planning Policy Framework (NPPF) and Cumbria County Council's current Policy, the aim should be to discharge surface water run-off from the site in line with the order of priority within the surface water drainage hierarchy;

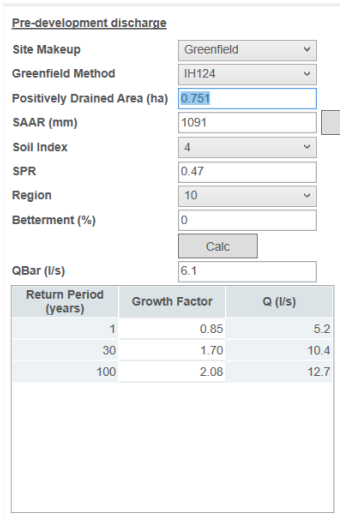
1. Into the ground (infiltration)
2. To a surface water body
3. To a surface water sewer, highway drain or another drainage system
4. A combined water sewer.

A site investigation has been undertaken which confirms the site is underlain by stiff clay deposits which were identified from depths of between 2.90m and 3.60m up to a maximum recorded depth of 4.45m, with grey clay deposits also noted within rotary boreholes from depths of between 3.70m and 6.30m. Varying ground water levels have also been recorded which would preclude the use of infiltration at the site.

The Pow Beck is culverted directly below the site and a 1700mm culvert runs to the north, along the eastern boundary. It is therefore proposed that surface water will be discharged into the Pow Beck, subject to the approval of EA & LLFA.

5.3 Proposed Surface Water Discharge Rates

The proposed development will have an impermeable area of approximately 0.751ha. The pre-development discharge calculation tool within Causeway Flow has been utilised to obtain the Qbar greenfield flow rate. The extract below shows the results.



Pre-development discharge

Site Makeup	Greenfield
Greenfield Method	IH124
Positively Drained Area (ha)	0.751
SAAR (mm)	1091
Soil Index	4
SPR	0.47
Region	10
Betterment (%)	0
	Calc
QBar (l/s)	6.1

Return Period (years)	Growth Factor	Q (l/s)
1	0.85	5.2
30	1.70	10.4
100	2.08	12.7

It is therefore proposed to restrict flows to a maximum discharge rate of 6.1l/s, through the use of a Hydrobrake chamber, as detailed on the Proposed Drainage Layout provided in Appendix D.

5.4 Proposed Surface Water Treatment

Sustainable Drainage Systems (SuDS) should also be used wherever possible to mimic as far as practicable the natural run off regime, improve water quality, reduce run-off volume and attenuate peak flows. These should be designed in accordance with the current guidance, The SuDS Manual (CIRIA C753) and should meet the required treatment indices levels in line with this guidance.

The following SuDS options have been reviewed for the proposed development.

Table 3: Suitability of SuDS Features

SuDS Feature	Incorporated within design	Reasoning
Green Roofs / Blue Roofs	No	Not suitable for use on this scheme
Pond/Basin	No	No space to facilitate a basin/pond
Rainwater Harvesting	No	Rainwater harvesting has not been considered within the development due to future maintenance and lack of demand
Infiltration Methods	No	Due to the underlying strata infiltration methods have not been considered
Raingardens/Bio-retention areas	No	Ground levels and open spaces are not suitable for raingardens
Filter strips and swales	Yes	Filter drains provide to the rear of kerbs wherever possible.
Permeable Paving	No	Permeable paving is considered unsuitable by the client due to the many issues experienced in stores including H&S risks to customer.
Below ground attenuation systems / Oversized Pipework	Yes	Below ground attenuation will be provided to provide attenuation to reduce the peak flows from the development. This will be in the form of cellular storage. A SPEL ESR unit will also be used prior to discharge from the site to meet the SuDS manual treatment indices requirements.

Parking Bays

The parking bays within the car park have been classified as a medium pollution hazard in line with Table 26.2 of the SuDS Manual (C753) 'non residential car parking with frequent change'. This states the pollution hazard indices as follows:

Table 4 Extract of Table 26.2 C753

Pollution Hazard	Total Suspended Solids(TSS)	Metals	Hydrocarbons
Medium	0.7	0.6	0.7

It is proposed for the parking bays to be treated by Filter Drains followed by a SPEL ESR proprietary unit prior to discharge to the culvert, which provide the following mitigation indices.

Table 5 Extract of Table 26.3 C753

SuDS Component	Total Suspended Solids(TSS)	Metals	Hydrocarbons
Filter Drain	0.4	0.4	0.4
SPEL ESR UNIT	0.8/2	0.6/2	0.9/2
Total	0.8	0.7	0.85

These indices provide greater indices than that required within the SuDS Manual therefore providing sufficient treatment of surface water flows from these areas.

Roof Areas

The roof areas have been classified as a Low pollution hazard in line with Table 26.2 of the SuDS Manual (C753) 'commercial roof'. This states the pollution hazard indices as follows:

Table 6 Extract of Table 26.2 C753

Pollution Hazard	Total Suspended Solids(TSS)	Metals	Hydrocarbons
Low	0.3	0.2	0..05

It is proposed for the roof are to utilised filter drains for treatment prior to discharge from the site.

Table 7 Green Roof

SuDS Component	Total Suspended Solids(TSS)	Metals	Hydrocarbons
Filter Drain	0.4	0.4	0.4

These unit indices are greater than that required within the SuDS Manual therefore providing sufficient treatment of surface water flows required from these areas.

5.5 Surface Water Attenuation

All proposed surface water systems should be designed to accommodate the worst case 1 in 30 year storm event without flooding. Furthermore, the worst case 1 in 100 year plus climate change storm event should also be retained on site in an area that will not cause flooding to any existing or proposed buildings. In accordance with the updated NPPF Technical Guidance a climate change uplift of 45% and an urban creep uplift of 10% should be considered in the design. Due to the nature of the development and the limited space to accommodate an increase due to urban creep the additional 10% increase has not been considered within the design.

Drainage calculations have been undertaken utilising Flow Drainage Design Software based on a proposed impermeable area of 0.715ha (excludes a 10% increase due to potential urban creep). Surface water is proposed to be attenuated utilising cellular storage which is to be located within the open area of car parking and will accommodate the worst case 1 in 100-year + 45%cc storm event.

The proposed drainage has been designed to ensure the maximum water level in the drainage system is 9.020mAOD which is greater than 300mm below the proposed finished floor level of the building.

Calculations are provided in Appendix E.

The Proposed drainage layout is provided in Appendix D.

5.6 Surface Water Maintenance

Failures or blockages within the drainage network can cause flooding if not adequately maintained. To enable the water treatment process to continue as intended and to reduce the risk of flooding the drainage network will require regular maintenance.

Maintenance and inspection of SuDS features will comply with the requirements of the SuDS Manual (CIRIA C753).

A copy of the proposed surface water drainage management plan is provided in Appendix G detailing the required frequency of works for each particular drainage element and who is responsible to undertake these works

6. FOUL WATER DRAINAGE

6.1 Existing Foul Water Drainage

United Utilities sewer records have been obtained and these indicate there are existing combined sewers within the site.

As the site is currently a car park there is no existing private foul water discharge from the site.

6.2 Proposed Foul Water Drainage

New foul drainage will be provided within the site which will discharge into the existing combined 800x600 brick egg sewer, located to the east of the proposed building.

7. CONCLUSIONS

This Flood Risk and Drainage Assessment Report has been prepared by Hydrock on behalf of Aldi Stores Ltd in support of a planning application for a proposed food retail store on Preston Street, Whitehaven.

A detailed assessment has identified that the site is located in Flood Zone 1 (Low Risk) in accordance with the EA Flood Zone Mapping. Hydraulic flood model data provided by the EA and recorded River levels on the Pow Beck have been used as the best available data to inform flood risk at the site.

The proposed surface water drainage system will be restricted to a maximum discharge of 6.1 l/s into the culvert watercourse (Pow Beck), to the eastern boundary of the site.

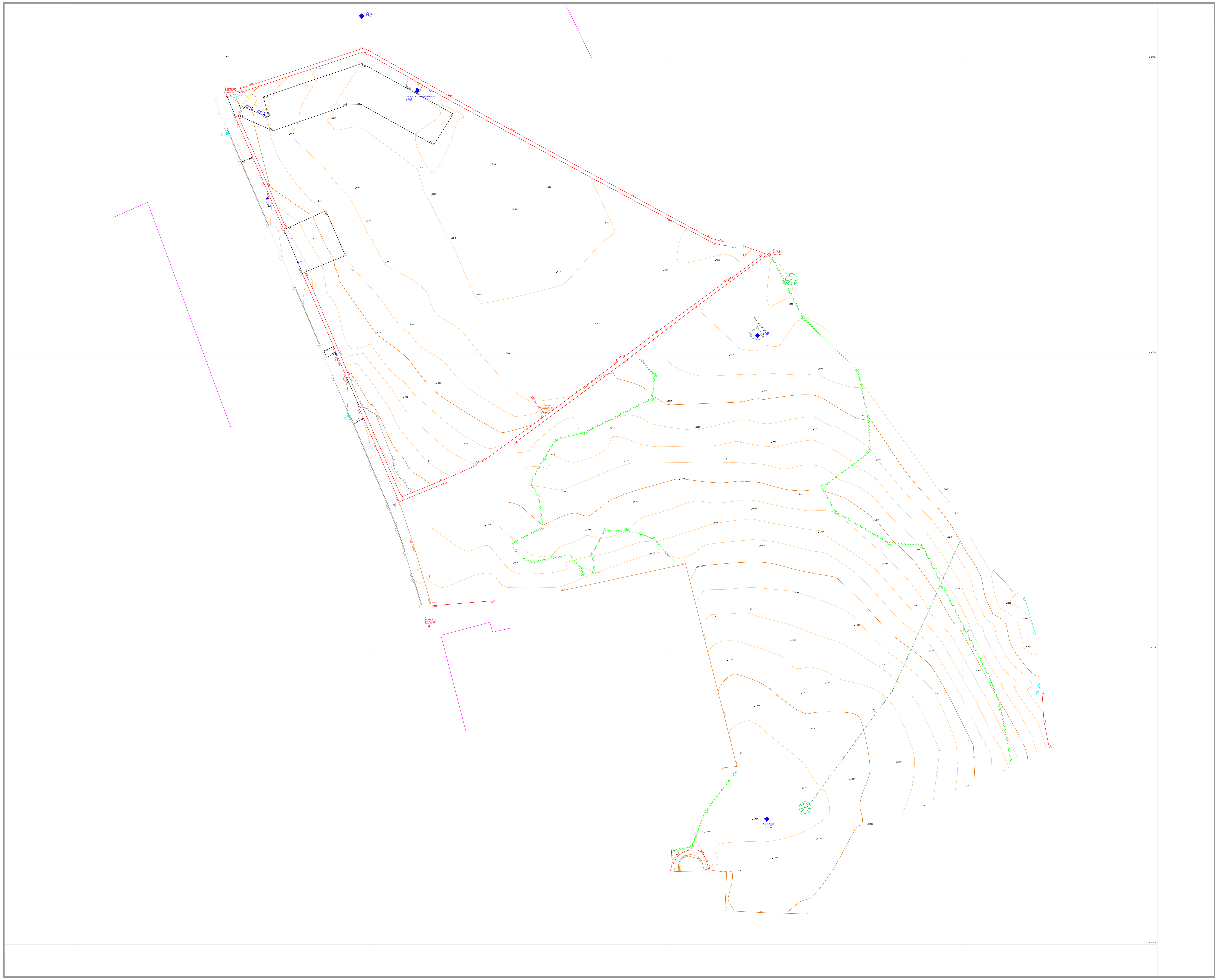
SuDs options have been considered for the site will be in the form of Filter Drains and an underground proprietary SPEL ESR unit will be utilised in the drainage system to provide treatment of surface water flows prior to discharge to the Pow Beck.

Foul water flows will discharge into the existing combined 800x600 brick egg sewer, located to the east of the proposed building.

The proposed drainage system has been designed to accommodate a 1 in 100 year+45% climate change storm event. Attenuation will be provided within the site in the form of underground cellular storage tank.

Appendix A - Topographical Survey

Reference	Title
PRO/W'HAVEN/001	Topographical Survey



Legend

Topographical Linetypes:

- Road
- Drop Kerb
- Steps
- Building Line
- Barrier
- Channel
- Concrete
- Chain Fence
- Metal Fence
- Post & Wire Fence
- Wooden Fence
- Top of Bank
- Bottom of Bank
- Tree Canopy Line
- Verge Line
- Wall
- Footpath

Underground Utility Linetypes

E	Electric
GAS	Gas
W	Water
CATV	Cable TV
CATVTFR	Cable TV TFR
CCTV	Closed Circuit TV
BT	British Telecom
BTTFR	British Telecom TFR
EMPTY	Empty Ducting
UNK	Unknown Metallic Utility
GPR	GPR Anomaly Possible Utility
COM	Communications
	Foul Water Drainage Route
	Surface Water Drainage Route
	Combined Service Drainage Route
	Unknown Drainage Route
Field Drain	Field Drain
Aco Drain	Aco Drain
E-TFR	Electric - Taken from Records
E AR	Assumed Electric
O/H E	Electric Overhead
O/H BT	BT Overhead
MSR	Multi Service Route
MULTI SERVICE TRENCH	Multi Service Trench
W-TFR	Water - Taken from Records
W AR	Assumed Water
GAS AR	Assumed Gas
GAS-TFR	Gas - Taken from Records
	Survey Extents
EOS	End of Signal
UTR	Unable to Raise
UTT	Unable to Trace

PAS 128:2014
Specification for underground utility detection, verification and location

© The British Standards Institution 2014

PAS 128 QUALITY LEVELS

B1 ±15% of depth or 0.15 m (whichever is greatest)
B2 ±25% of depth or 0.25 m (whichever is greatest)
B3 Detection successful but no depth,horizontal ±0.50m
B4 Detection unsuccessful information taken from records
Note: (P) Post fix indicates GPR post processing

Symbols

TP	Telegraph Pole		Gate
LP	Lamp Post	MH1 CL 100.000 IL 98.000	Manhole
EP	Electric Post		
TL	Traffic Light	IC CL 100.000	Inspection Chamber
FL	Floodlight	CATV CL 100.000	Cable TV Chamber
CTV	Cable TV IC		
SC	Stop Cock	BT CL 100.000	BT Chamber
GV	Gas Valve	RG 100.000	Road Gully
BOL	Bollard	SV CL 100.000	Stop Valve
2.345	Spot Level	WM CL 100.000	Water Meter
Post	Post	AV CL 100.000	Air Valve
GUL	Gully	WO CL 100.000	Wash Out
		FH CL 100.000	Fire Hydrant
ER	Earth Rod	GV CL 100.000	Gas Valve
GR	Gas Riser	Cabinet 100.000	Cabinet
RWP	Rain Water Pipe	LB CL 100.000	Electric Link Box
RS	Road Sign		
SVP	Soil Vent Pipe	MH2 CL 100.000 IL 97.500	Circular Manhole
S1 E=436676.617 N=546728.511 Level=25.558	Station Control Details	MH3 CL 100.000 IL 97.500	Triangular Manhole
RE	Rodding Eye		Tree
BLOCKED	Blockage Encountered with Sonde	EOS	End of Signal

Approximate National Grid North
and datum based upon the Trimble OSTN15 system

N

THREE SIXTY GROUP
THE TOWN HALL HIGH STREET EAST, WALLSEND, TYNE AND WEAR NE28 7AT
0191 594 7672
ADMIN@360HQ.CO.UK
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projekt

Proposed Aldi Site
Whitehaven, Cumbria

Topographical Survey

1:200 @ A0	08.02.19	OSTN15
AW/DL	AW/PH	PH
PRO/W'HAVEN/001	Overview	

Appendix B - Proposed Site Layout

Reference	Title
0470-PA-XX-00-DR-A-PM_00_10_00-0002_P03	Proposed Site Plan

REV	DATE	DESCRIPTION	DRW	CHK
P01	2023-10-18	First issue	AdeL	MJ

existing wall (repaired)
shrub planting
600mm high reclaimed stone wall
knee rail
shrub planting
9.5m
7190
M/C
shrub planting
existing wall (repaired)
shrub planting
10000
shrub planting
shrub planting
6000
POST SIGN
shrub planting
HGV ONLY
2m weldmesh fence
meadow grass to grade
600mm high reclaimed stone wall
6000
600mm high stone wall
shrub planting
2.5m acoustic fence
6500
2.5m acoustic fence
2m weldmesh fence
existing brick wall (repaired)
SM
1
3
4
2.5m acoustic fence
8000
meadow grass
2.5m acoustic fence & access gate
meadow grass
11.3m
TCB
existing walls (repaired)
2m weldmesh fence
2m weldmesh fence
10
PH
meadow grass
2.5m acoustic fence around plant
2m weldmesh fence
2m weldmesh fence
2m weldmesh fence
N
0 1 2 3 4 5 10 20m

REFER TO LANDSCAPE ARCHITECT'S DRAWING FOR DETAILS OF SOFT LANDSCAPING

SITE AREA (Store Plot)	10080 sq m	2.49 ac
STANDARD PARKING BAYS	2.5 x 5.0m	86
ACCESSIBLE PARKING BAYS	3.7 x 6.2m	5
PARENT & CHILD PARKING BAYS	3.0 x 5.0m	9
TOTAL PARKING BAYS		100

ALDI Building	
GROSS EXTERNAL FLOOR AREA (incl. loading bay, lobby, canopy)	2127 sq m
GROSS INTERNAL AREA (incl. loading bay & lobby)	1916 sq m
NET SALES AREA (incl. lobby)	1356 sq m

Client
Aldi Stores Ltd.

Project Title
Aldi - Whitehaven

Project Address
Preston Street
Whitehaven

Drawing Title
Proposed Site Plan

Job No.	Originator	Zone	Level	Type	Role
0470	PA	XX	00	DR	A

System Classification	Drawing No.	Suitability	Revision
PM_40_50-21-0002		S4	P01

Drawn	Checked	Date	Scale	Size
AdeL	MJ	2023-10-09	1:250	A1

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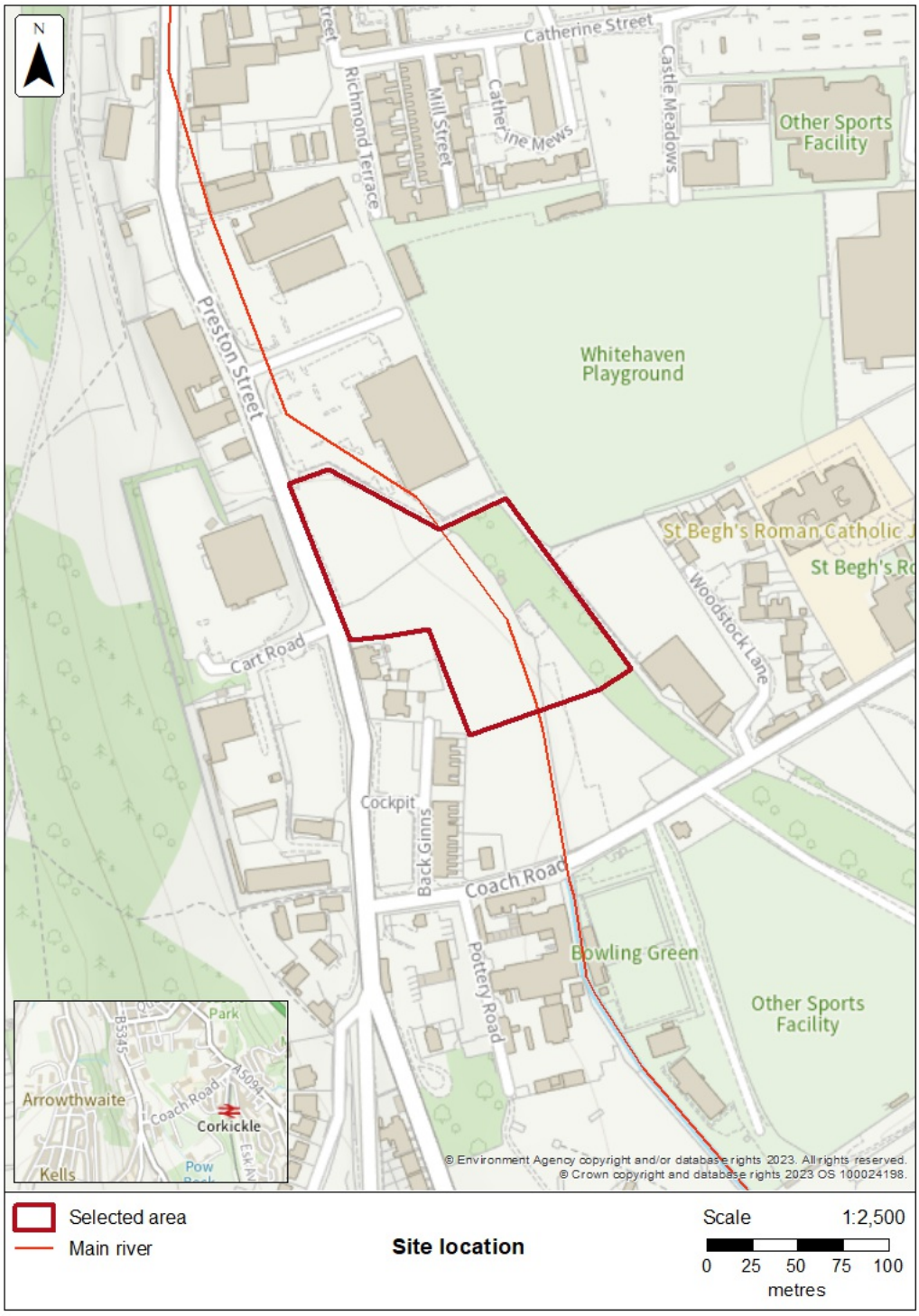
Appendix C - Environment Agency Data

Reference	Title
9E2TFJWN4T26	Product 4 Flood Risk Asessment Data

Flood risk assessment data

Location of site: 297319 / 517529 (shown as easting and northing coordinates)
Document created on: 31 January 2023
This information was previously known as a product 4.
Customer reference number: 9E2TFJWN4T26

Map showing the location that flood risk assessment data has been requested for.



How to use this information

You can use this information as part of a flood risk assessment for a planning application. To do this, you should include it in the appendix of your flood risk assessment.

> **We recommend that you work with a flood risk consultant to get your flood risk assessment.**

Included in this document

In this document you'll find:

- how to find information about surface water and other sources of flooding
- information on the models used
- definitions for the terminology used throughout
- flood map for planning (rivers and the sea)
- historic flooding
- flood defences and attributes
- information to help you assess if there is a reduced flood risk from rivers and the sea because of defences
- modelled data
- climate change modelled data
- information about strategic flood risk assessments
- information about this data
- information about flood risk activity permits
- help and advice

Not included in this document

This document does not include a Flood Defence Breach Hazard Map.

If your location has a reduced flood risk from rivers and sea because of defences, you need to request a Flood Defence Breach Hazard Map and information about the level of flood protection offered at your location from the Cumbria and Lancashire Environment Agency team at inforequests.cmblnc@environment-agency.gov.uk. This information will only be available if modelling has been carried out for breach scenarios.

Include a site location map in your request.

Surface water and other sources of flooding

Use the long term flood risk service to find out about the risk of flooding from:

- surface water
- ordinary watercourses
- reservoirs

For information about sewer flooding, contact the relevant water company for the area.

About the models used

Model name: Pow Beck 2012
Scenario(s): Defended fluvial, defences removed fluvial, defended climate change fluvial, defences removed climate change fluvial
Date: 5 March 2013

Model name: Whitehaven_Tidal 2012
Scenario(s): Defended tidal, defences removed tidal, defended climate change tidal, defences removed climate change tidal
Date: 1 July 2013

These models contain the most relevant data for your area of interest.

Terminology used

Annual exceedance probability (AEP)

This refers to the probability of a flood event occurring in any year. The probability is expressed as a percentage. For example, a large flood which is calculated to have a 1% chance of occuring in any one year, is described as 1% AEP.

Metres above ordnance datum (mAOD)

All flood levels are given in metres above ordnance datum which is defined as the mean sea level at Newlyn, Cornwall.

Flood map for planning (rivers and the sea)

Your selected location is in flood zone 2.

Flood zone 3 shows the area at risk of flooding for an undefended flood event with a:

- 0.5% or greater probability of occurring in any year for flooding from the sea
- 1% or greater probability of occurring in any year for fluvial (river) flooding

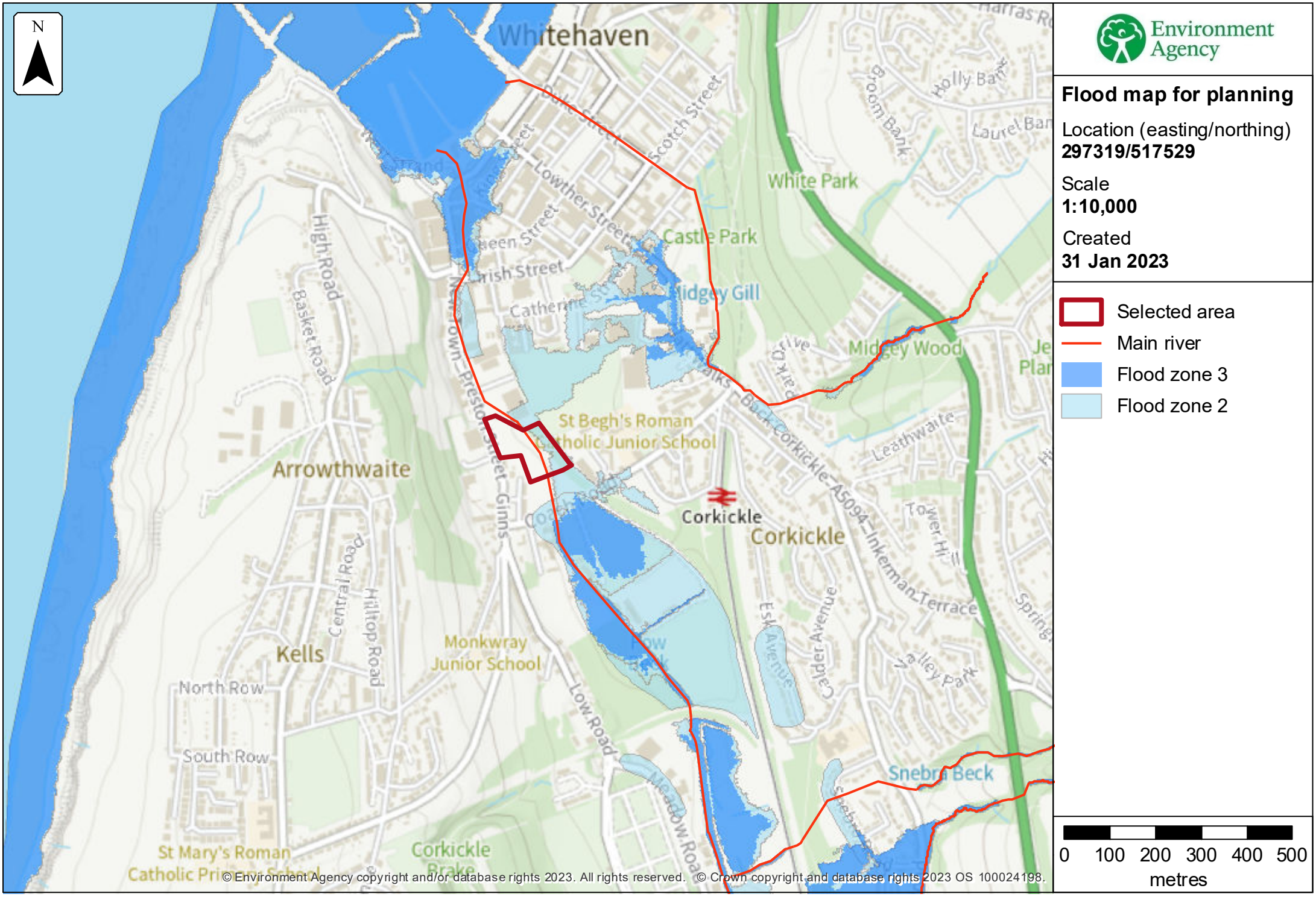
Flood zone 2 shows the area at risk of flooding for an undefended flood event with:

- between a 0.1% and 0.5% probability of occurring in any year for flooding from the sea
- between a 0.1% and 1% probability of occurring in any year for fluvial (river) flooding

It's important to remember that the flood zones on this map:

- refer to the land at risk of flooding and do not refer to individual properties
- refer to the probability of river and sea flooding, ignoring the presence of defences
- do not take into account potential impacts of climate change

This data is updated on a quarterly basis as better data becomes available.


N
Whitehaven
White Park
Castle Park
Midgey Gill
Midgey Wood
Arrowthwaite
St Begh's Roman Catholic Junior School
Corkickle
Corkickle
Kells
Monkwray Junior School
North Row
South Row
St Mary's Roman Catholic Primary School
Corkickle Brake
Snebrn Beck
High Road
Basket Road
Lowther Street
Scotch Street
Preston Street
Ginns
Low Road
Meadow Road
Hillcrest Road
Hilltop Road
Cleator Avenue
Esk Avenue
Inkerman Terrace
Tower Hill
Leathwaite
Broom Bank
Holly Bank
Laurel Bank
Environment Agency
Flood map for planning
Location (easting/northing)
297319/517529
Scale
1:10,000
Created
31 Jan 2023
Selected area
Main river
Flood zone 3
Flood zone 2
0 100 200 300 400 500
metres
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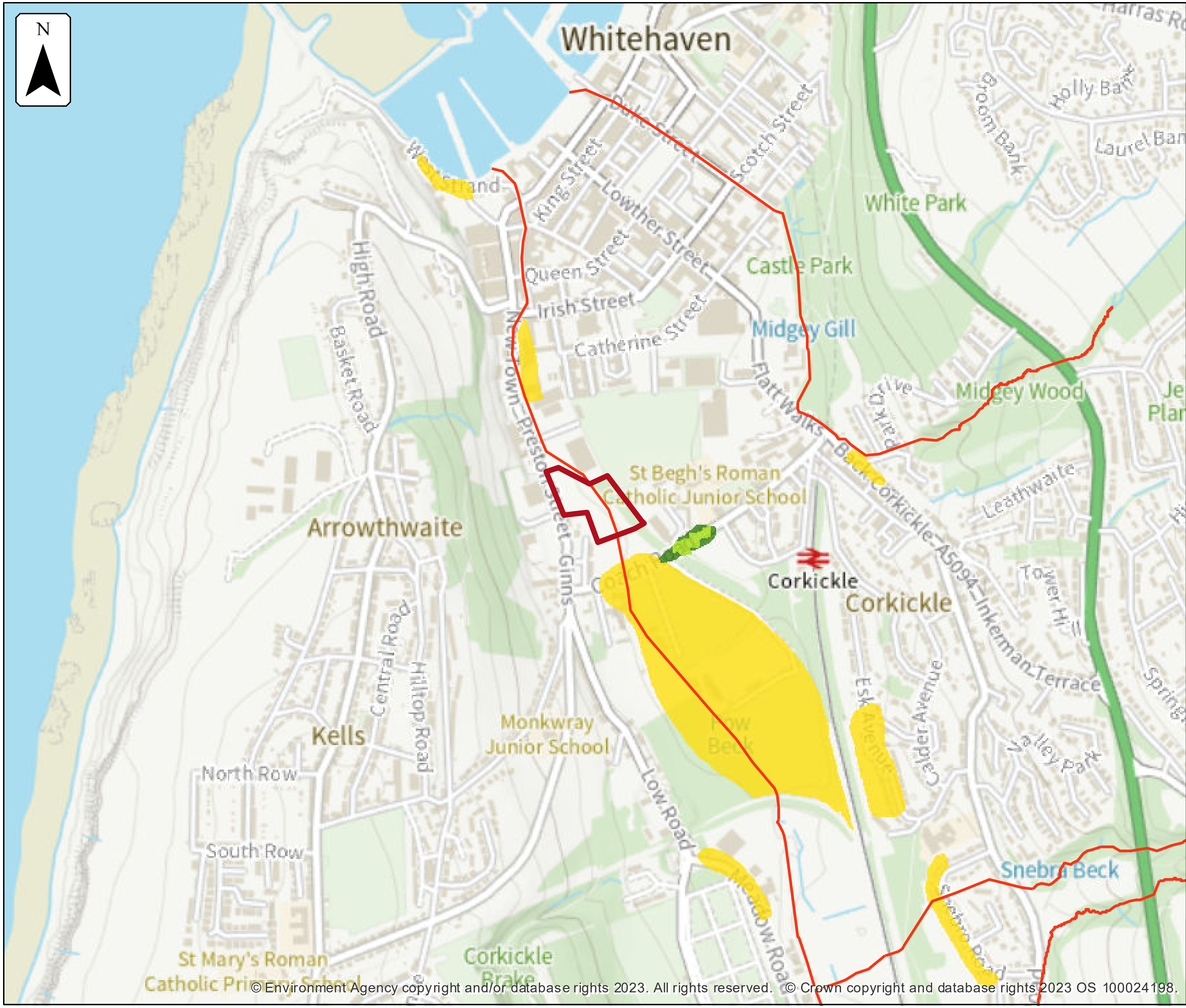
Historic flooding

This map is an indicative outline of areas that have previously flooded. Remember that:

- our records are incomplete, so the information here is based on the best available data
- it is possible not all properties within this area will have flooded
- other flooding may have occurred that we do not have records for
- flooding can come from a range of different sources - we can only supply flood risk data relating to flooding from rivers or the sea

You can also contact your Lead Local Flood Authority or Internal Drainage Board to see if they have other relevant local flood information. Please note that some areas do not have an Internal Drainage Board.

Download recorded flood outlines in GIS format



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Environment Agency

Historic flood map

Location (easting/northing)
297319/517529

Scale
1:10,000

Created
31 Jan 2023

Selected area

Main river

Date of flood event

June, 2007

August, 2006

November, 1999

0 100 200 300 400 500
metres

Historic flood event data

Start date	End date	Source of flood	Cause of flood	Affects location
12 June 2007	12 June 2007	drainage	local drainage/surface water	No
11 August 2006	11 August 2006	main river	unknown	No
5 November 1999	5 November 1999	main river	channel capacity exceeded (no raised defences)	No

Flood defences and attributes

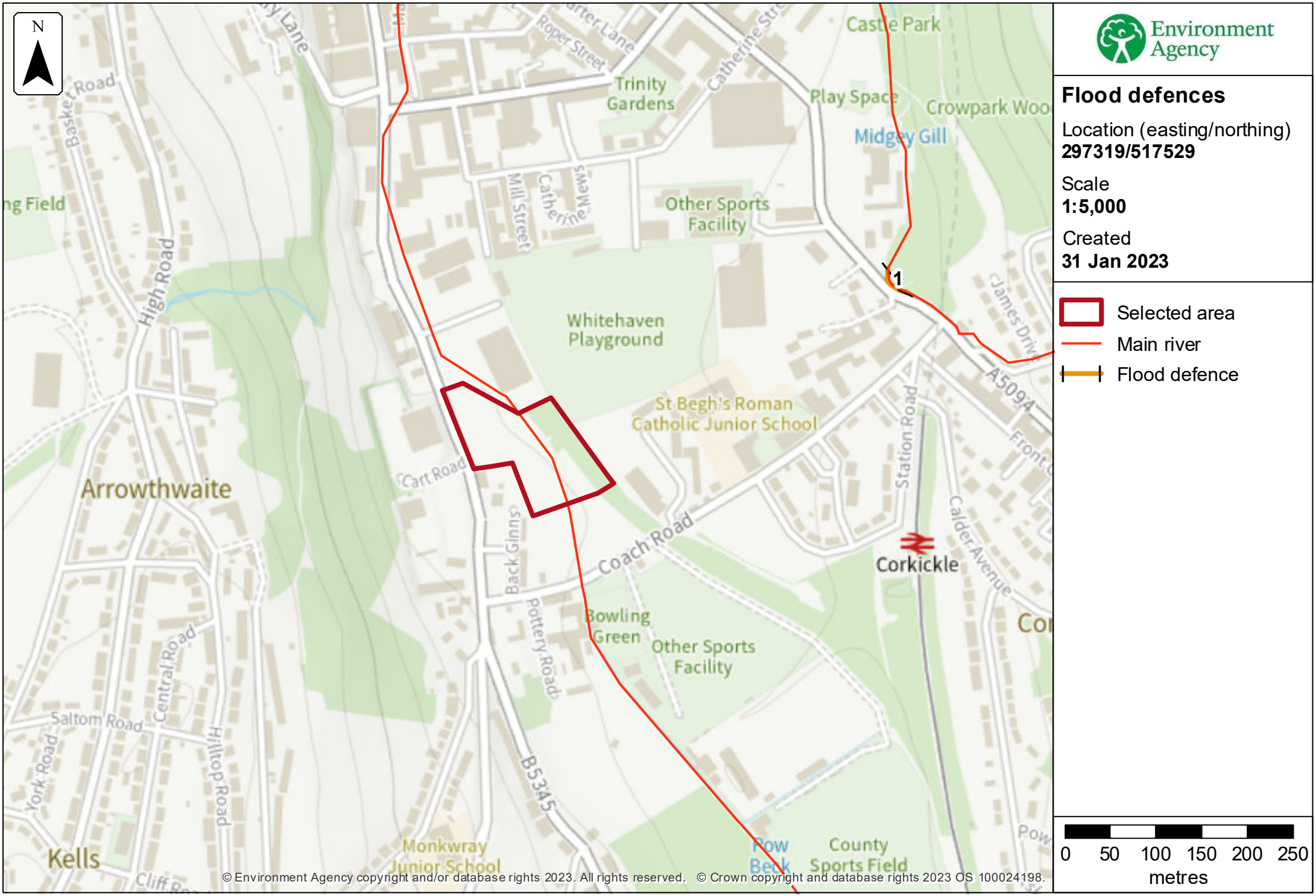
The flood defences map shows the location of the flood defences present.

The flood defences data table shows the type of defences, their condition and the standard of protection. It shows the height above sea level of the top of the flood defence (crest level). The height is In mAOD which is the metres above the mean sea level at Newlyn, Cornwall.

It's important to remember that flood defence data may not be updated on a regular basis. The information here is based on the best available data.

Use this information:

- to help you assess if there is a reduced flood risk for this location because of defences
- with any information in the modelled data section to find out the impact of defences on flood risk



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Flood defences data

Label	Asset ID	Asset Type	Standard of protection (years)	Current condition	Downstream actual crest level (mAOD)	Upstream actual crest level (mAOD)	Effective crest level (mAOD)
1	94578	Wall	20	Fair	17.58	18.54	17.58

Any blank cells show where a particular value has not been recorded for an asset.

Modelled data

This section provides details of different scenarios we have modelled and includes the following (where available):

- outline maps showing the area at risk from flooding in different modelled scenarios
- modelled node point map(s) showing the points used to get the data to model the scenarios and table(s) providing details of the flood risk for different return periods
- map(s) showing the approximate water levels for the return period with the largest flood extent for a scenario and table(s) of sample points providing details of the flood risk for different return periods

Climate change

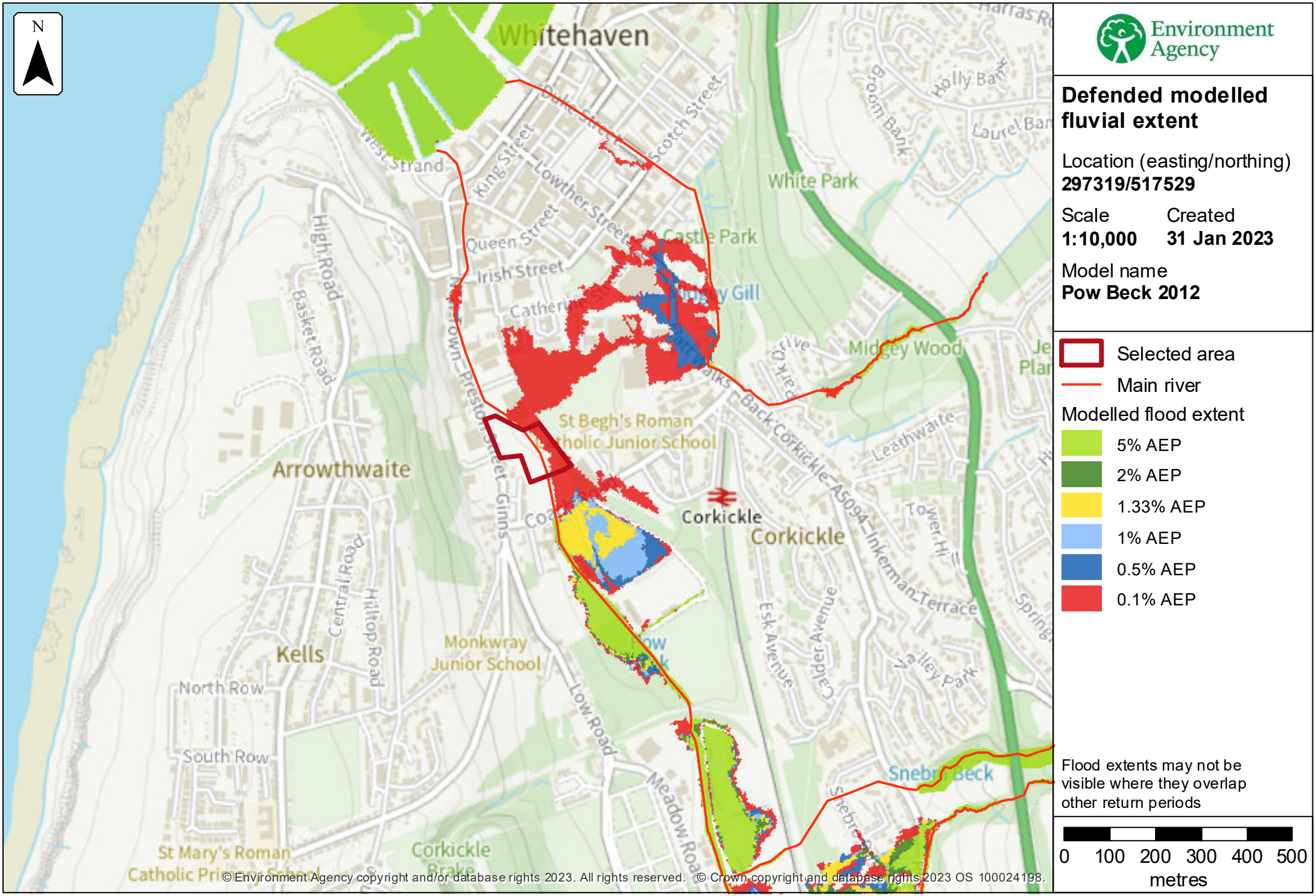
The climate change data included in the models may not include the latest flood risk assessment climate change allowances. Where the new allowances are not available you will need to consider this data and factor in the new allowances to demonstrate the development will be safe from flooding.

The Environment Agency will incorporate the new allowances into future modelling studies. For now, it's your responsibility to demonstrate that new developments will be safe in flood risk terms for their lifetime.

Modelled scenarios

The following scenarios are included:

- Defended modelled fluvial: risk of flooding from rivers where there are flood defences
- Defences removed modelled fluvial: risk of flooding from rivers where flood defences have been removed
- Defended modelled tidal: risk of flooding from the sea where there are flood defences
- Defences removed modelled tidal: risk of flooding from the sea where flood defences have been removed
- Defended climate change modelled fluvial: risk of flooding from rivers where there are flood defences, including estimated impact of climate change
- Defences removed climate change modelled fluvial: risk of flooding from rivers where flood defences have been removed, including estimated impact of climate change
- Defended climate change modelled tidal: risk of flooding from the sea where there are flood defences, including estimated impact of climate change
- Defences removed climate change modelled tidal: risk of flooding from the sea where flood defences have been removed, including estimated impact of climate change



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Environment Agency

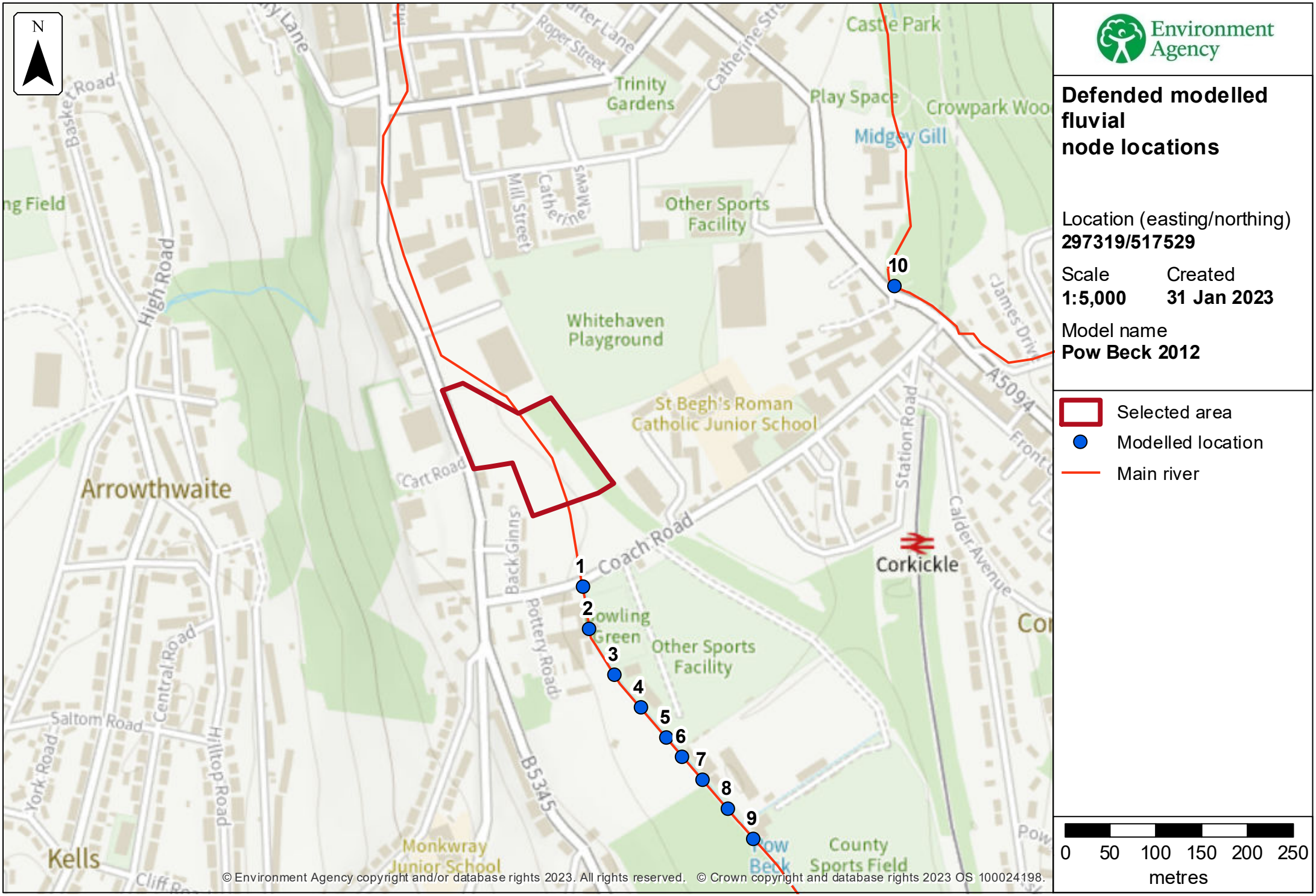
Defended modelled fluvial extent

Location (easting/northing)
297319/517529

Scale
1:10,000

Created
31 Jan 2023

Model name
Pow Beck 2012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Environment Agency
Defended modelled fluvial node locations
Location (easting/northing)
297319/517529
Scale
1:5,000
Created
31 Jan 2023
Model name
Pow Beck 2012
Selected area
Modelled location
Main river
0 50 100 150 200 250
metres
1
2
3
4
5
6
7
8
9
10
Arrowthwaite
Whitehaven Playground
St Begh's Roman Catholic Junior School
Other Sports Facility
Trinity Gardens
Castle Park
Play Space
Crowpark Wood
Midgey Gill
Corkickle
Coach Road
Cart Road
Back Ginns
Pottery Road
Mill Street
Catherine Street
Roper Street
Basket Road
High Road
Station Road
Calder Avenue
A5094
B5345
Central Road
Saltom Road
York Road
Hilltop Road
Kells
Monkwray Junior School
Pow Beck
County Sports Field
Bowling Green
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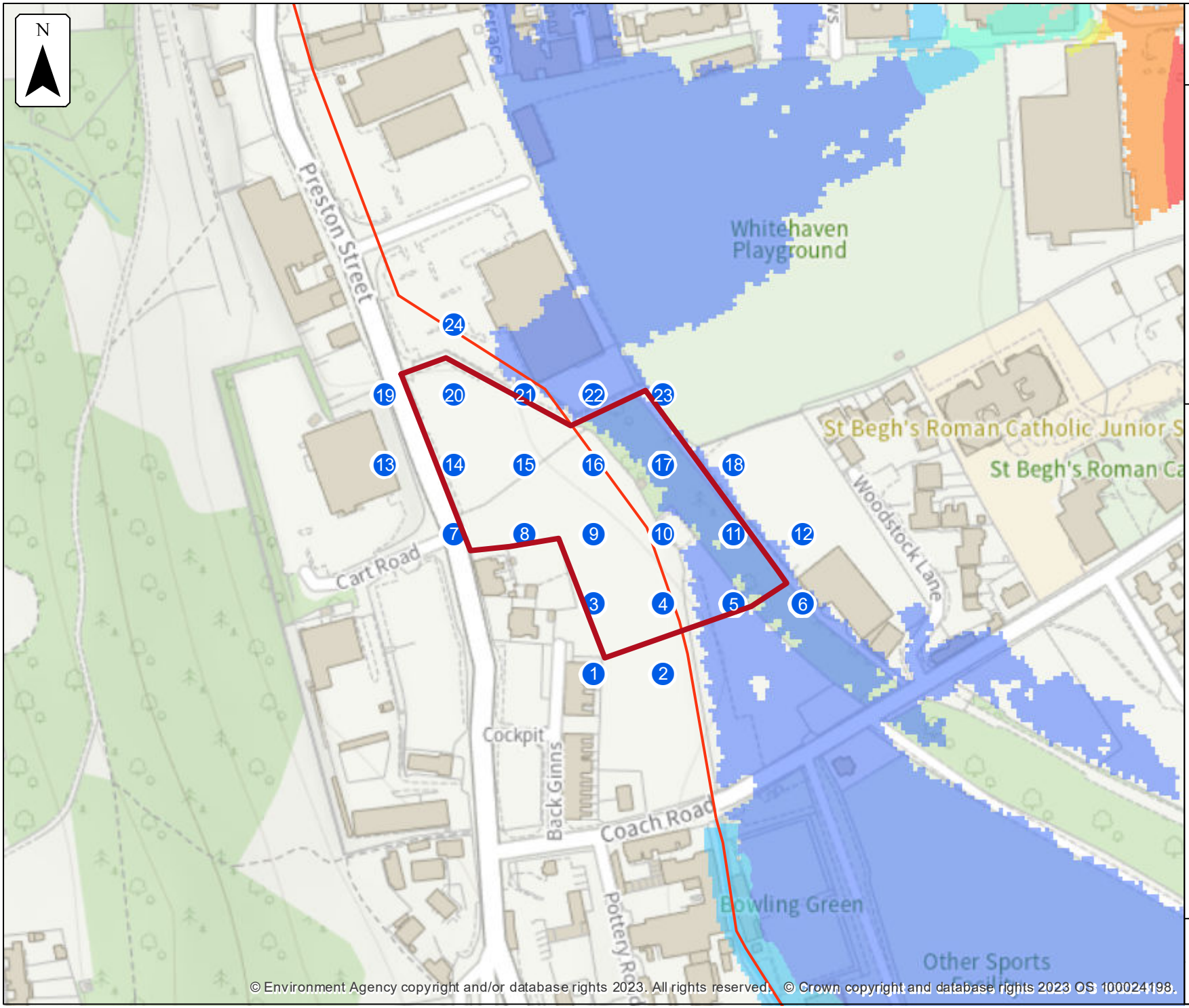
Modelled node locations data

Defended

Label	Modelled location ID	Easting	Northing	5% AEP		2% AEP		1.33% AEP		1% AEP		0.5% AEP		0.1% AEP	
				Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow
1	83652	297380	517376	7.21	4.89	7.39	5.48	7.63	5.83	7.69	5.89	7.76	6.02	7.92	6.18
2	79441	297387	517331	7.41	4.89	7.56	5.47	7.74	5.81	7.78	5.87	7.83	6.0	7.92	6.18
3	150387	297414	517280	7.66	4.89	7.79	5.46	7.89	5.95	7.90	6.27	7.92	7.01	7.93	8.68
4	45652	297443	517244	7.80	4.88	7.93	5.27	8.03	5.48	8.05	5.71	8.09	6.14	8.21	6.96
5	163974	297471	517211	7.86	4.30	7.99	4.34	8.08	4.45	8.11	4.50	8.16	4.47	8.28	4.71
6	297896	297489	517190	7.88	4.32	8.0	4.37	8.09	4.52	8.11	4.53	8.17	4.59	8.29	4.92
7	157061	297511	517165	7.97	3.90	8.05	4.04	8.12	4.15	8.15	4.09	8.19	4.78	8.31	5.10
8	267850	297539	517133	7.97	4.69	8.05	5.0	8.12	5.37	8.15	5.48	8.19	5.75	8.31	7.17
9	335533	297567	517100	7.99	4.08	8.06	4.17	8.13	4.33	8.15	4.33	8.20	4.53	8.31	4.95
10	130766	297722	517706	17.21	0.88	17.32	1.08	17.37	1.19	17.41	1.27	17.51	1.50	17.55	1.92

Data in this table comes from the Pow Beck 2012 model.
Level values are shown in mAOD, and flow values are shown in cubic metres per second.
Any blank cells show where a particular scenario has not been modelled for this location.



Environment Agency

Defended modelled fluvial extent and height

Location (easting/northing)
297319/517529

Scale
1:2,500

Created
31 Jan 2023

Model name
Pow Beck 2012

Selected area

Main river

Modelled 2D grid
Water level in mAOD

- 0 - 7.0
- 7.0 - 7.625
- 7.625 - 8.25
- 8.25 - 8.875
- 8.875 - 9.5
- 9.5 - 10.125
- 10.125 - 10.75
- 10.75 - 11.375
- 11.375 - 12.0

This map shows the 0.1% AEP height data

0 25 50 75 100
metres

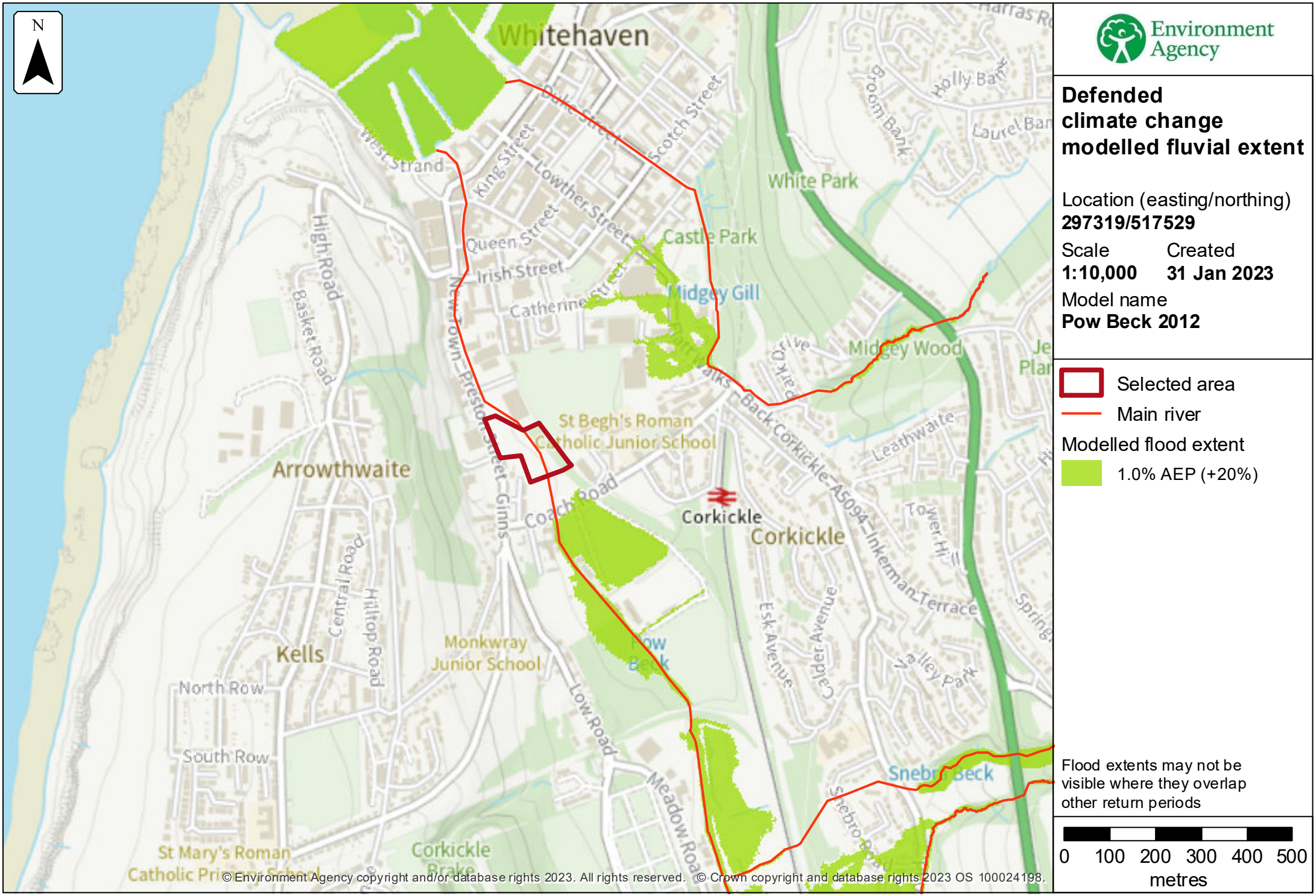
Sample point data

Defended

Label	Easting	Northing	5% AEP		2% AEP		1.33% AEP		1% AEP		0.5% AEP		0.1% AEP	
			Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height
1	297320	517447	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
2	297354	517447	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
3	297320	517481	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
4	297354	517481	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
5	297388	517481	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.08	7.60
6	297422	517481	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.19	7.40
7	297252	517515	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
8	297286	517515	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
9	297320	517515	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
10	297354	517515	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
11	297388	517515	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.37	7.40
12	297422	517515	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
13	297218	517549	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
14	297252	517549	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
15	297286	517549	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
16	297320	517549	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData

Label	Easting	Northing	5% AEP		2% AEP		1.33% AEP		1% AEP		0.5% AEP		0.1% AEP	
			Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height
17	297354	517549	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.21	7.39
18	297388	517549	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
19	297218	517583	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
20	297252	517583	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
21	297286	517583	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
22	297320	517583	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.27	7.37
23	297354	517583	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
24	297252	517617	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData

Data in this table comes from the Pow Beck 2012 model.
Height values are shown in mAOD, and depth values are shown in metres.
Any blank cells show where a particular scenario has not been modelled for this location.
Cells which contain text 'NoData' for a scenario show that return period has been modelled but there is no flood risk for that return period for that location.



Environment Agency

Defended climate change modelled fluvial extent

Location (easting/northing)
297319/517529

Scale
1:10,000

Created
31 Jan 2023

Model name
Pow Beck 2012

Selected area

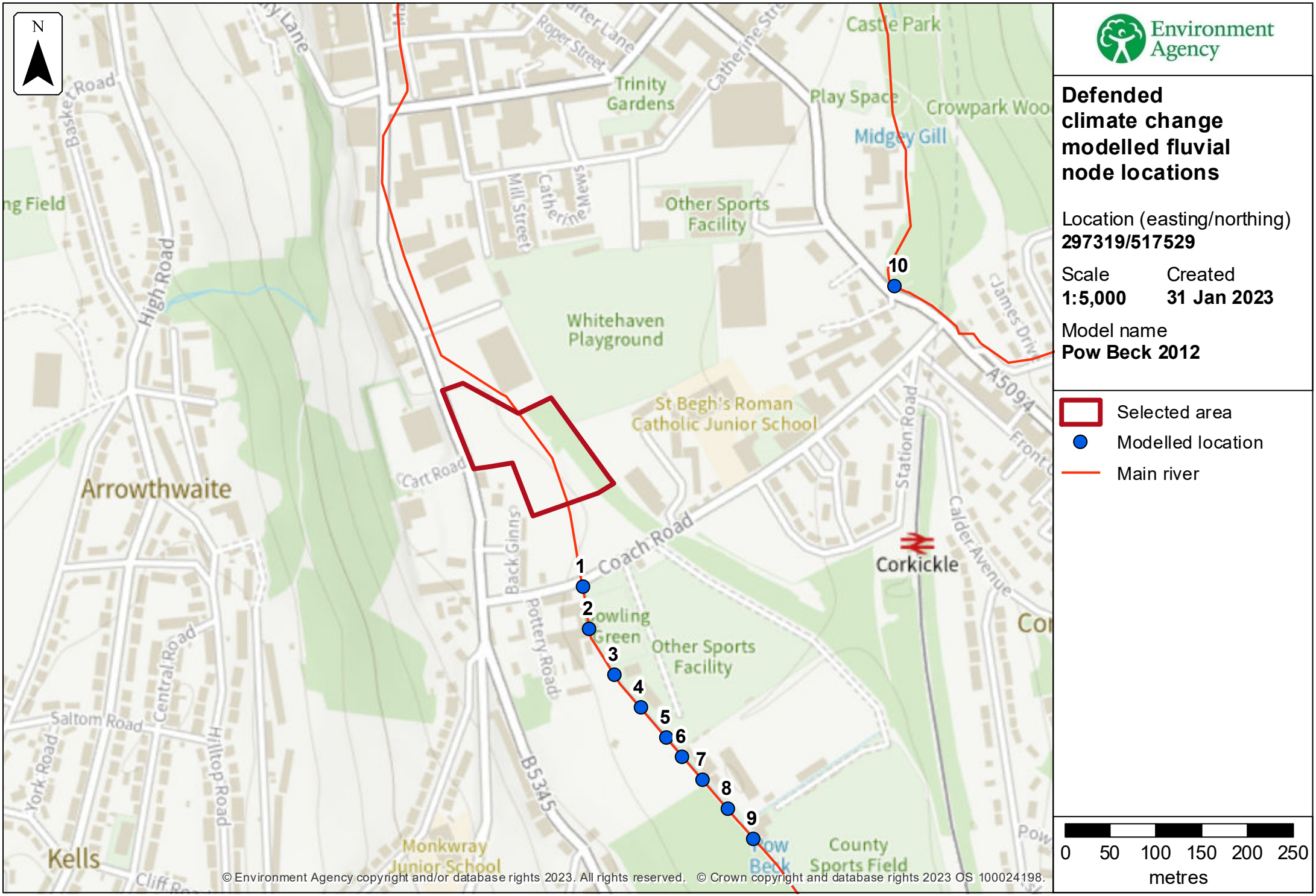
Main river

Modelled flood extent

1.0% AEP (+20%)

Flood extents may not be visible where they overlap other return periods

0 100 200 300 400 500
metres


N
Environment Agency
Defended climate change modelled fluvial node locations
Location (easting/northing)
297319/517529
Scale
1:5,000
Created
31 Jan 2023
Model name
Pow Beck 2012
Selected area
Modelled location
Main river
0 50 100 150 200 250
metres
Arrowthwaite
Whitehaven Playground
St Begh's Roman Catholic Junior School
Other Sports Facility
Trinity Gardens
Castle Park
Play Space
Crowpark Wood
Midgey Gill
Corkickle
Coach Road
Cart Road
Back Ginns
Pottery Road
Mill Street
Catherine Street
Roper Street
Station Road
Calder Avenue
James Drive
A5094
High Road
Basket Road
Central Road
Saltom Road
Hilltop Road
York Road
B5345
Kells
Monkwray Junior School
Pow Beck
County Sports Field
Bowling Green
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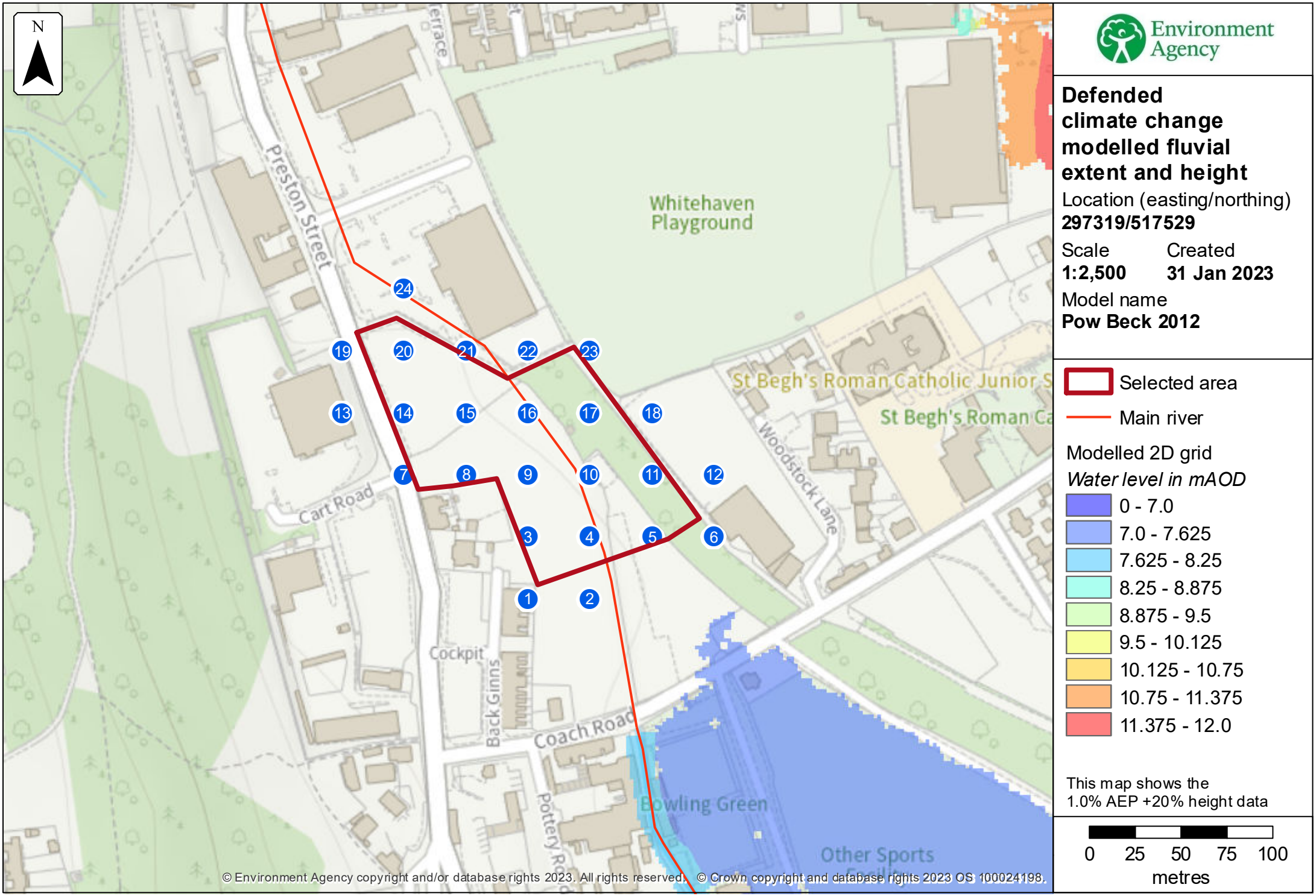
Modelled node locations data

Defended climate change

Label	Modelled location ID	Easting	Northing	1.0% AEP (+20%)	
				Level	Flow
1	83652	297380	517376	7.79	6.07
2	79441	297387	517331	7.85	6.06
3	150387	297414	517280	7.92	7.38
4	45652	297443	517244	8.12	6.31
5	163974	297471	517211	8.19	4.70
6	297896	297489	517190	8.19	4.75
7	157061	297511	517165	8.22	4.42
8	267850	297539	517133	8.22	6.02
9	335533	297567	517100	8.22	4.69
10	130766	297722	517706	17.52	1.64

Data in this table comes from the Pow Beck 2012 model.
Level values are shown in mAOD, and flow values are shown in cubic metres per second.
Any blank cells show where a particular scenario has not been modelled for this location.



Environment Agency

Defended climate change modelled fluvial extent and height

Location (easting/northing)
297319/517529

Scale
1:2,500

Created
31 Jan 2023

Model name
Pow Beck 2012

Selected area

Main river

Modelled 2D grid
Water level in mAOD

- 0 - 7.0
- 7.0 - 7.625
- 7.625 - 8.25
- 8.25 - 8.875
- 8.875 - 9.5
- 9.5 - 10.125
- 10.125 - 10.75
- 10.75 - 11.375
- 11.375 - 12.0

This map shows the 1.0% AEP +20% height data

0 25 50 75 100
metres

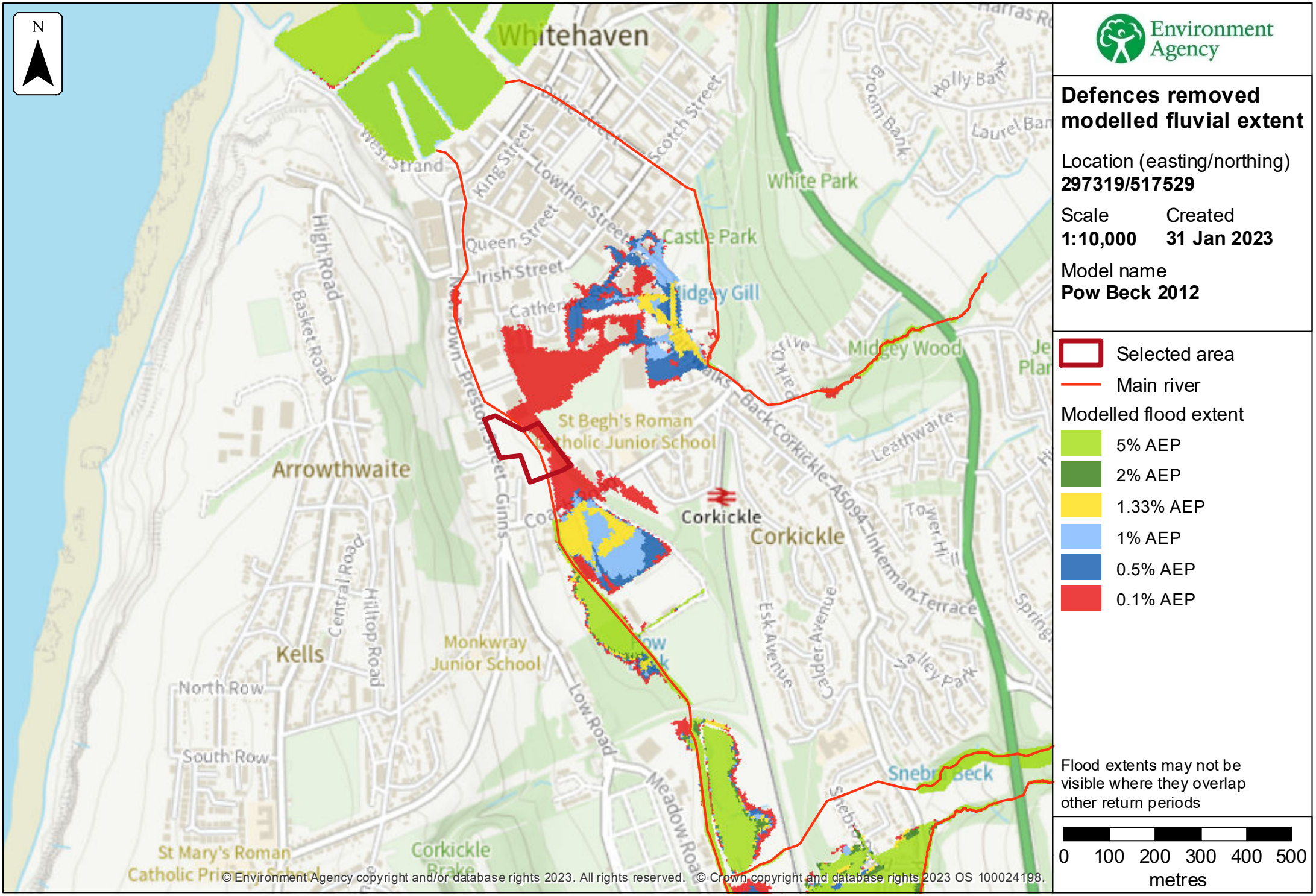
Sample point data

Defended climate change

Label	Easting	Northing	1% AEP (+20%)	
			Depth	Height
1	297320	517447	NoData	NoData
2	297354	517447	NoData	NoData
3	297320	517481	NoData	NoData
4	297354	517481	NoData	NoData
5	297388	517481	NoData	NoData
6	297422	517481	NoData	NoData
7	297252	517515	NoData	NoData
8	297286	517515	NoData	NoData
9	297320	517515	NoData	NoData
10	297354	517515	NoData	NoData
11	297388	517515	NoData	NoData
12	297422	517515	NoData	NoData
13	297218	517549	NoData	NoData
14	297252	517549	NoData	NoData
15	297286	517549	NoData	NoData
16	297320	517549	NoData	NoData

Label	Easting	Northing	1% AEP (+20%)	
			Depth	Height
17	297354	517549	NoData	NoData
18	297388	517549	NoData	NoData
19	297218	517583	NoData	NoData
20	297252	517583	NoData	NoData
21	297286	517583	NoData	NoData
22	297320	517583	NoData	NoData
23	297354	517583	NoData	NoData
24	297252	517617	NoData	NoData

Data in this table comes from the Pow Beck 2012 model.
Height values are shown in mAOD, and depth values are shown in metres.
Any blank cells show where a particular scenario has not been modelled for this location.
Cells which contain text 'NoData' for a scenario show that return period has been modelled but there is no flood risk for that return period for that location.



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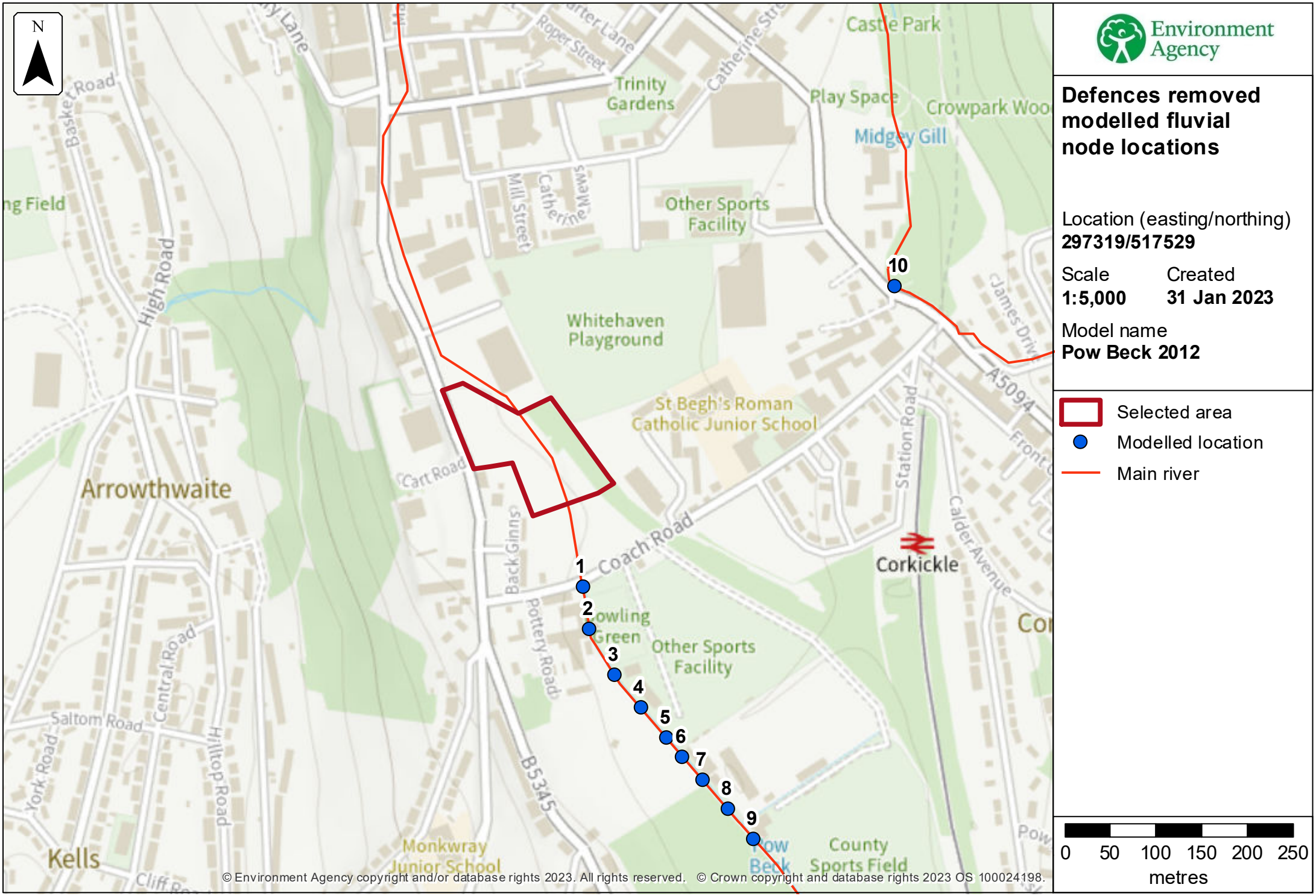
N
Environment Agency
Defences removed modelled fluvial node locations
Location (easting/northing)
297319/517529
Scale
1:5,000
Created
31 Jan 2023
Model name
Pow Beck 2012
Selected area
Modelled location
Main river
0 50 100 150 200 250
metres
Trinity Gardens
Play Space
Crowpark Wood
Midgey Gill
Other Sports Facility
Whitehaven Playground
St Begh's Roman Catholic Junior School
Arrowthwaite
Corkickle
Coach Road
Bowling Green
Other Sports Facility
Monkwray Junior School
County Sports Field
Pow Beck
Kells
Castle Park
Roper Street
Basket Road
High Road
Mill Street
Catherine
Cart Road
Back Ginns
Pottery Road
Station Road
Calder Avenue
A5094
B5345
Saltom Road
Central Road
Hilltop Road
York Road
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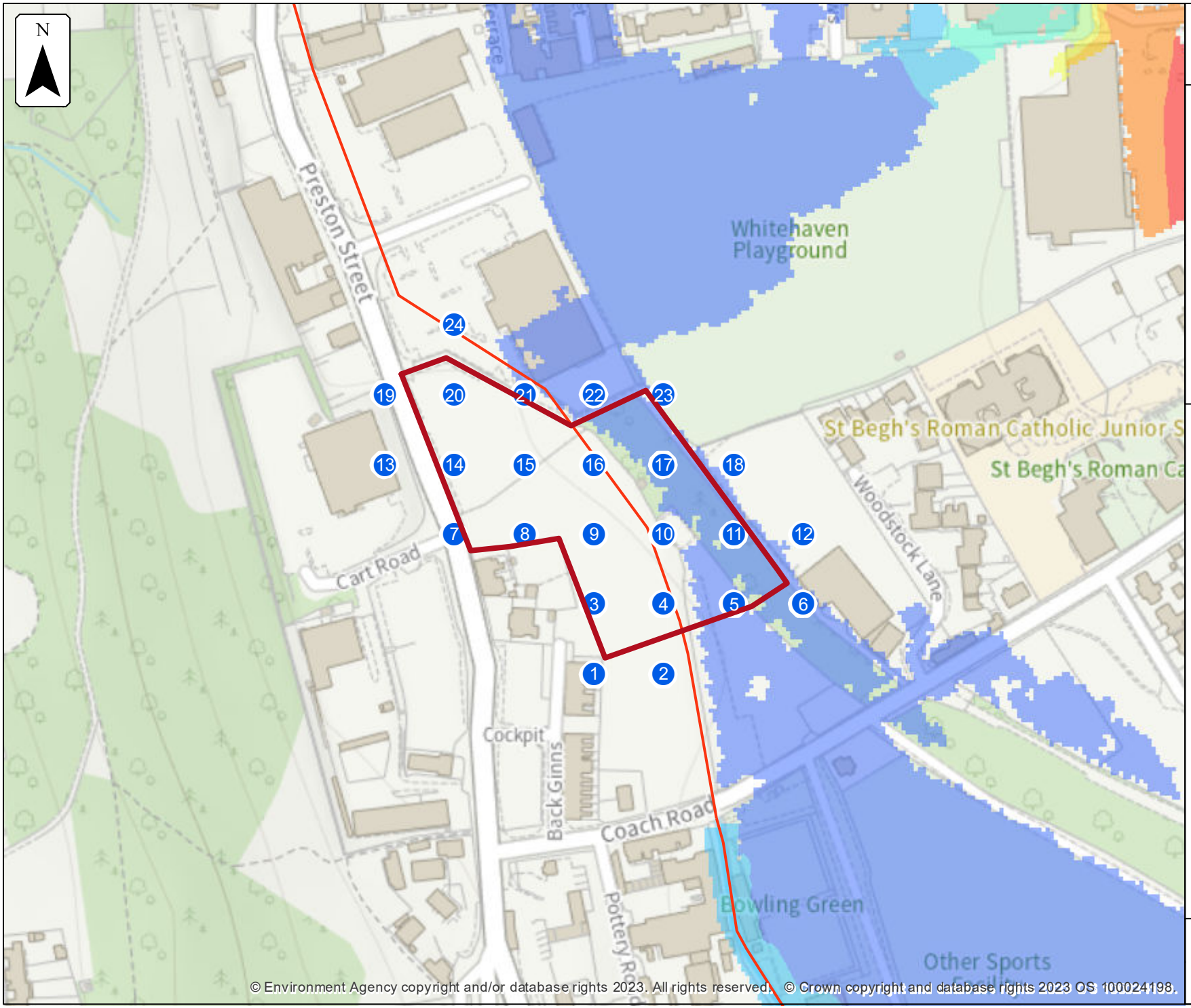
Modelled node locations data

Defences removed

Label	Modelled location ID	Easting	Northing	5% AEP		2% AEP		1.33% AEP		1% AEP		0.5% AEP		0.1% AEP	
				Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow
1	83652	297380	517376	7.20	4.85	7.37	5.41	7.63	5.81	7.69	5.87	7.76	5.99	7.91	6.18
2	79441	297387	517331	7.40	4.85	7.54	5.41	7.74	5.78	7.78	5.84	7.83	5.98	7.93	6.18
3	150387	297414	517280	7.65	4.84	7.78	5.41	7.89	5.89	7.90	6.23	7.91	6.96	7.93	8.67
4	45652	297443	517244	7.79	4.84	7.91	5.23	8.02	5.44	8.04	5.66	8.09	6.12	8.21	6.88
5	163974	297471	517211	7.86	4.29	7.98	4.34	8.08	4.45	8.11	4.49	8.16	4.49	8.28	4.95
6	297896	297489	517190	7.87	4.32	7.99	4.37	8.09	4.52	8.11	4.53	8.16	4.59	8.28	5.0
7	157061	297511	517165	7.96	3.90	8.04	4.04	8.12	4.15	8.14	4.09	8.19	4.78	8.30	5.11
8	267850	297539	517133	7.96	4.68	8.04	5.0	8.12	5.37	8.14	5.48	8.19	5.78	8.31	7.16
9	335533	297567	517100	7.98	4.03	8.05	4.13	8.13	4.30	8.15	4.30	8.20	4.44	8.31	4.94
10	130766	297722	517706	17.21	0.88	17.32	1.08	17.37	1.19	17.38	1.27	17.40	1.50	17.48	1.91

Data in this table comes from the Pow Beck 2012 model.
Level values are shown in mAOD, and flow values are shown in cubic metres per second.
Any blank cells show where a particular scenario has not been modelled for this location.



Environment Agency

Defences removed modelled fluvial extent and height

Location (easting/northing)
297319/517529

Scale
1:2,500

Created
31 Jan 2023

Model name
Pow Beck 2012

Selected area

Main river

Modelled 2D grid
Water level in mAOD

- 0 - 7.0
- 7.0 - 7.625
- 7.625 - 8.25
- 8.25 - 8.875
- 8.875 - 9.5
- 9.5 - 10.125
- 10.125 - 10.75
- 10.75 - 11.375
- 11.375 - 12.0

This map shows the 0.1% AEP height data

0 25 50 75 100
metres

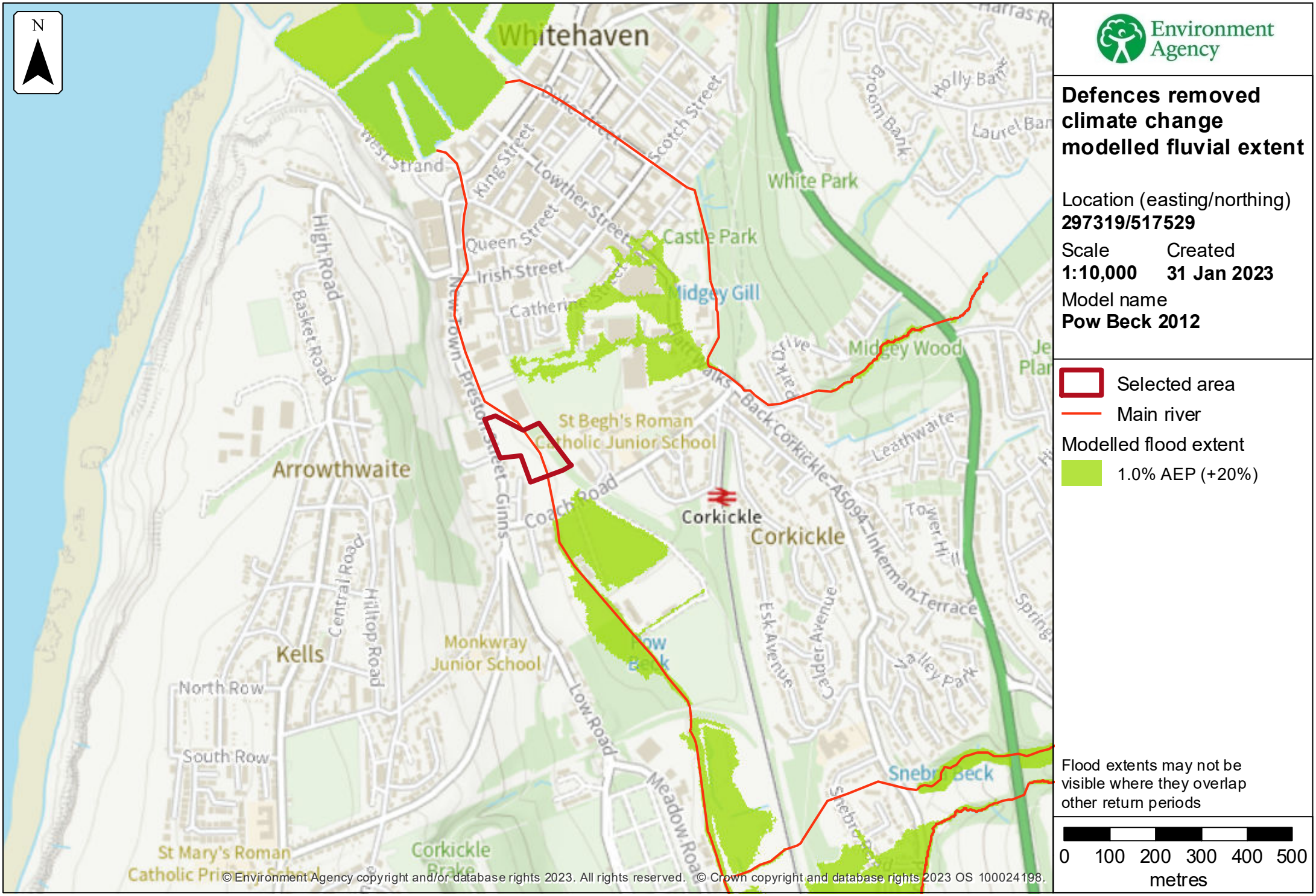
Sample point data

Defences removed

Label	Easting	Northing	5% AEP		2% AEP		1.33% AEP		1% AEP		0.5% AEP		0.1% AEP	
			Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height
1	297320	517447	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
2	297354	517447	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
3	297320	517481	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
4	297354	517481	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
5	297388	517481	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.08	7.60
6	297422	517481	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.18	7.39
7	297252	517515	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
8	297286	517515	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
9	297320	517515	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
10	297354	517515	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
11	297388	517515	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.35	7.38
12	297422	517515	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
13	297218	517549	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
14	297252	517549	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
15	297286	517549	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
16	297320	517549	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData

Label	Easting	Northing	5% AEP		2% AEP		1.33% AEP		1% AEP		0.5% AEP		0.1% AEP	
			Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height
17	297354	517549	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.20	7.37
18	297388	517549	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
19	297218	517583	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
20	297252	517583	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
21	297286	517583	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
22	297320	517583	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.26	7.36
23	297354	517583	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
24	297252	517617	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData

Data in this table comes from the Pow Beck 2012 model.
Height values are shown in mAOD, and depth values are shown in metres.
Any blank cells show where a particular scenario has not been modelled for this location.
Cells which contain text 'NoData' for a scenario show that return period has been modelled but there is no flood risk for that return period for that location.



Environment Agency

Defences removed climate change modelled fluvial extent

Location (easting/northing)
297319/517529

Scale
1:10,000

Created
31 Jan 2023

Model name
Pow Beck 2012

Selected area

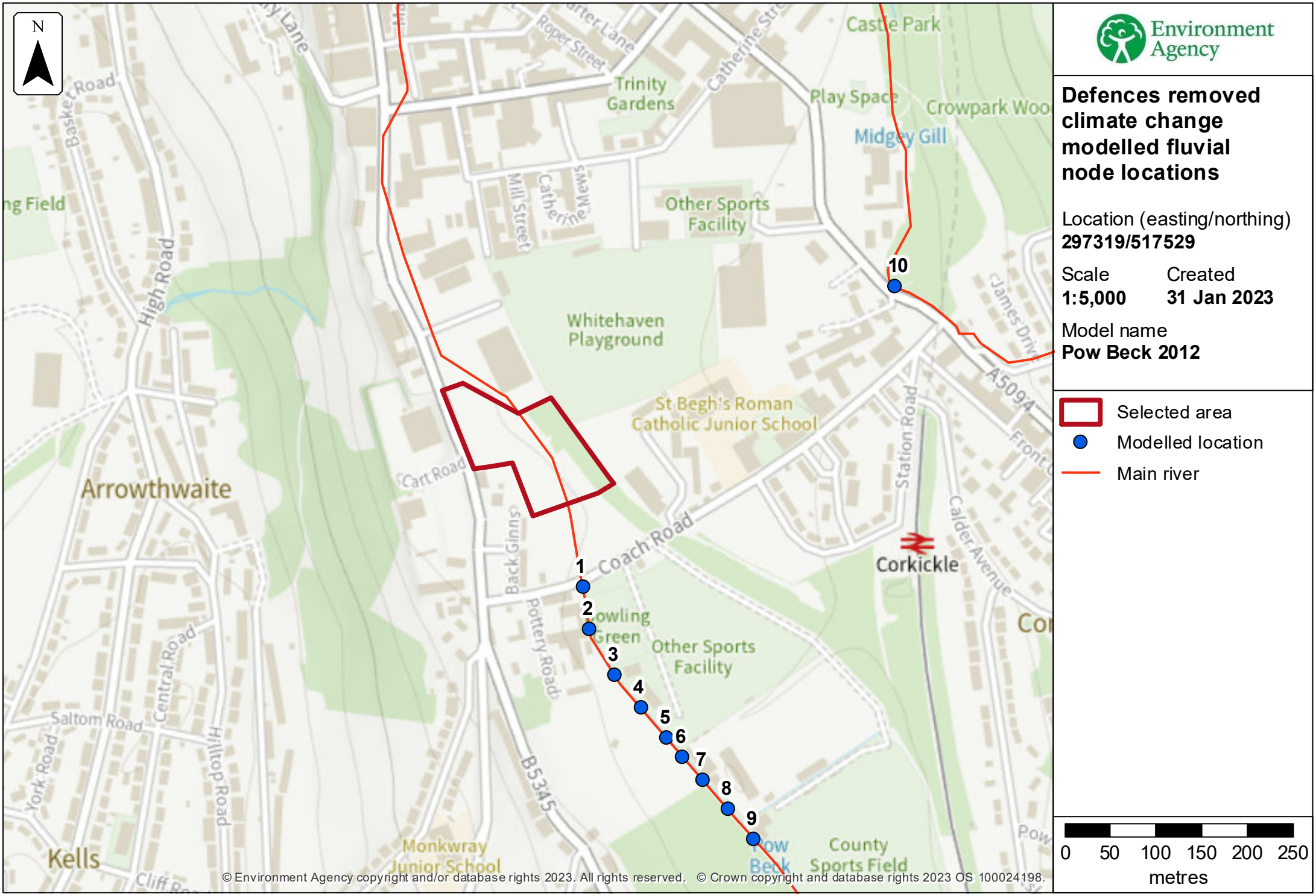
Main river

Modelled flood extent

1.0% AEP (+20%)

Flood extents may not be visible where they overlap other return periods

0 100 200 300 400 500
metres


N
Environment Agency
Defences removed climate change modelled fluvial node locations
Location (easting/northing)
297319/517529
Scale
1:5,000
Created
31 Jan 2023
Model name
Pow Beck 2012
Selected area
Modelled location
Main river
0 50 100 150 200 250
metres
Trinity Gardens
Castle Park
Play Space
Crowpark Wood
Midgey Gill
Other Sports Facility
Whitehaven Playground
St Begh's Roman Catholic Junior School
Arrowthwaite
Corkickle
Coach Road
Bowling Green
Other Sports Facility
Monkwray Junior School
County Sports Field
Pow Beck
Kells
Basket Road
High Road
Mill Street
Catherine
Roper Street
Cart Road
Back Ginns
Pottery Road
Station Road
Calder Avenue
A5094
B5345
Saltom Road
Central Road
Hilltop Road
York Road
1
2
3
4
5
6
7
8
9
10
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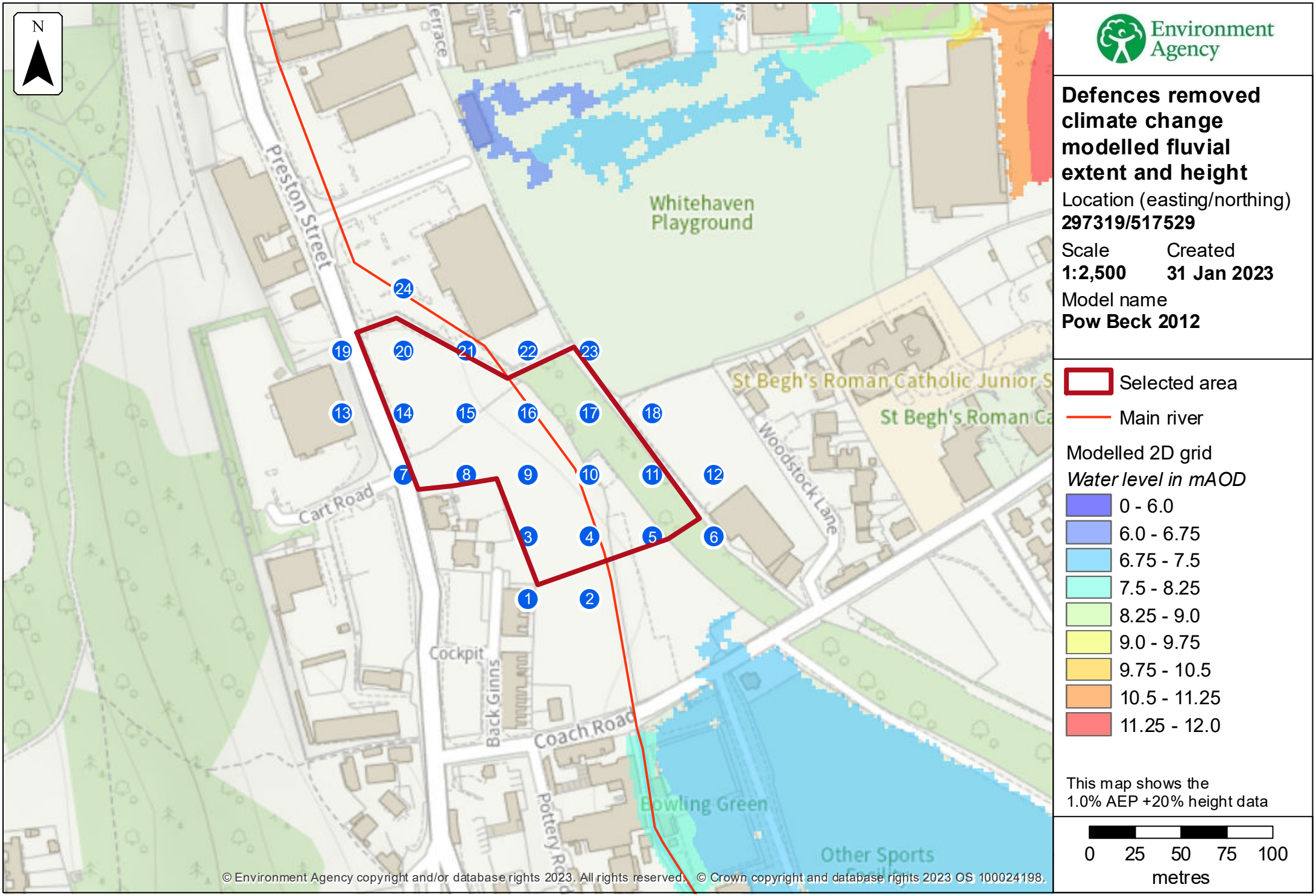
Modelled node locations data

Defences removed climate change

Label	Modelled location ID	Easting	Northing	1.0% AEP (+20%)	
				Level	Flow
1	83652	297380	517376	7.79	6.05
2	79441	297387	517331	7.85	6.04
3	150387	297414	517280	7.92	7.37
4	45652	297443	517244	8.12	6.30
5	163974	297471	517211	8.19	4.70
6	297896	297489	517190	8.19	4.74
7	157061	297511	517165	8.22	4.42
8	267850	297539	517133	8.22	6.02
9	335533	297567	517100	8.22	4.60
10	130766	297722	517706	17.42	1.64

Data in this table comes from the Pow Beck 2012 model.
Level values are shown in mAOD, and flow values are shown in cubic metres per second.
Any blank cells show where a particular scenario has not been modelled for this location.



Environment Agency

Defences removed climate change modelled fluvial extent and height

Location (easting/northing)
297319/517529

Scale
1:2,500

Created
31 Jan 2023

Model name
Pow Beck 2012

Selected area

Main river

Modelled 2D grid
Water level in mAOD

- 0 - 6.0
- 6.0 - 6.75
- 6.75 - 7.5
- 7.5 - 8.25
- 8.25 - 9.0
- 9.0 - 9.75
- 9.75 - 10.5
- 10.5 - 11.25
- 11.25 - 12.0

This map shows the 1.0% AEP +20% height data

0 25 50 75 100
metres

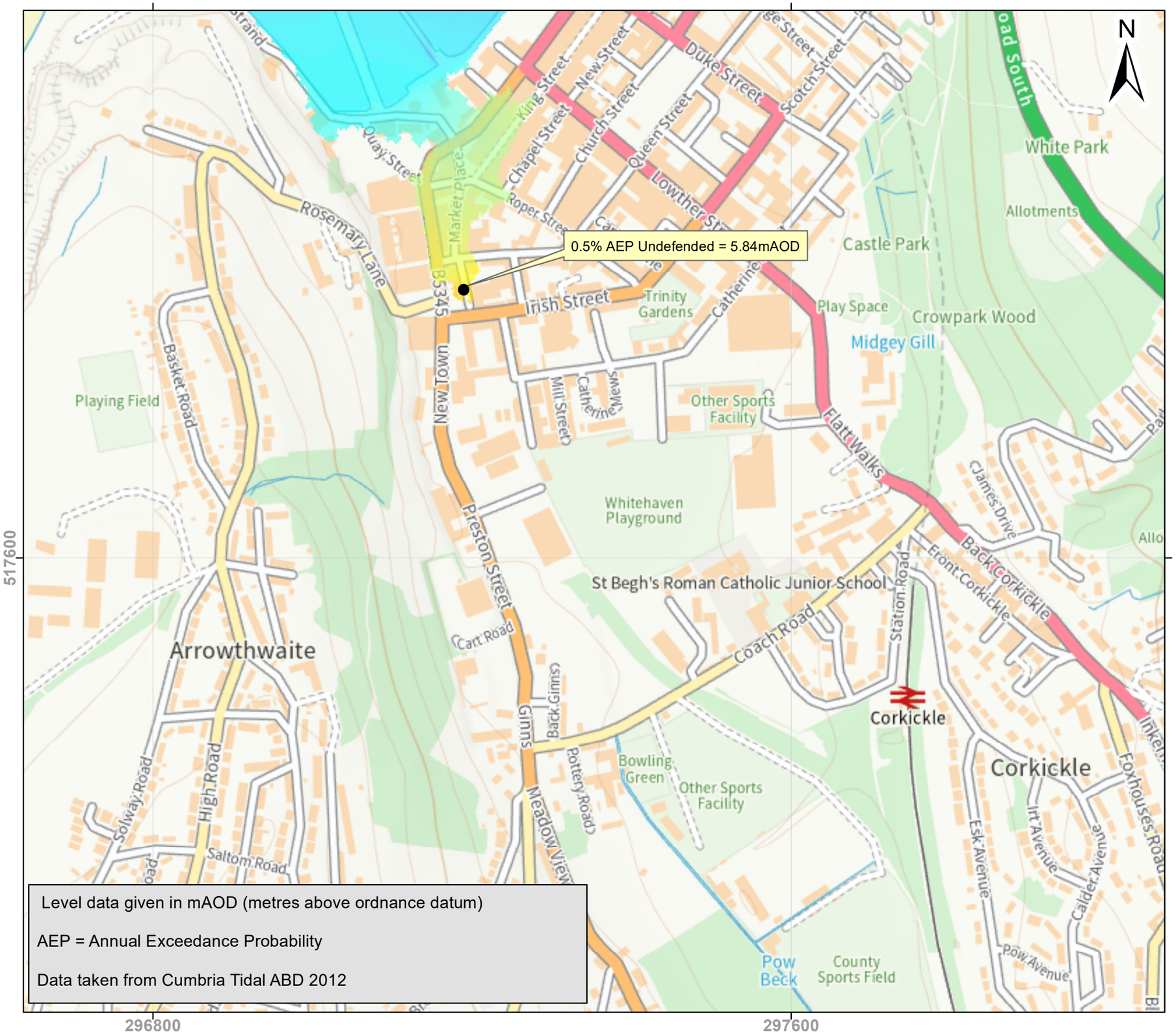
Sample point data

Defences removed climate change

Label	Easting	Northing	1% AEP (+20%)	
			Depth	Height
1	297320	517447	NoData	NoData
2	297354	517447	NoData	NoData
3	297320	517481	NoData	NoData
4	297354	517481	NoData	NoData
5	297388	517481	NoData	NoData
6	297422	517481	NoData	NoData
7	297252	517515	NoData	NoData
8	297286	517515	NoData	NoData
9	297320	517515	NoData	NoData
10	297354	517515	NoData	NoData
11	297388	517515	NoData	NoData
12	297422	517515	NoData	NoData
13	297218	517549	NoData	NoData
14	297252	517549	NoData	NoData
15	297286	517549	NoData	NoData
16	297320	517549	NoData	NoData

Label	Easting	Northing	1% AEP (+20%)	
			Depth	Height
17	297354	517549	NoData	NoData
18	297388	517549	NoData	NoData
19	297218	517583	NoData	NoData
20	297252	517583	NoData	NoData
21	297286	517583	NoData	NoData
22	297320	517583	NoData	NoData
23	297354	517583	NoData	NoData
24	297252	517617	NoData	NoData

Data in this table comes from the Pow Beck 2012 model.
Height values are shown in mAOD, and depth values are shown in metres.
Any blank cells show where a particular scenario has not been modelled for this location.
Cells which contain text 'NoData' for a scenario show that return period has been modelled but there is no flood risk for that return period for that location.



Level data given in mAOD (metres above ordnance datum)

AEP = Annual Exceedance Probability

Data taken from Cumbria Tidal ABD 2012

Environment Agency

Modelled 2d Data Map:
Preston Street, Whitehaven

Produced: 2/2/2023
Our Ref: CL291634
NGR: NX 97294 17548
Whitehaven Tidal 2012

Key

0.5% AEP Undefended

mAOD

High : 10.00

Low : 0

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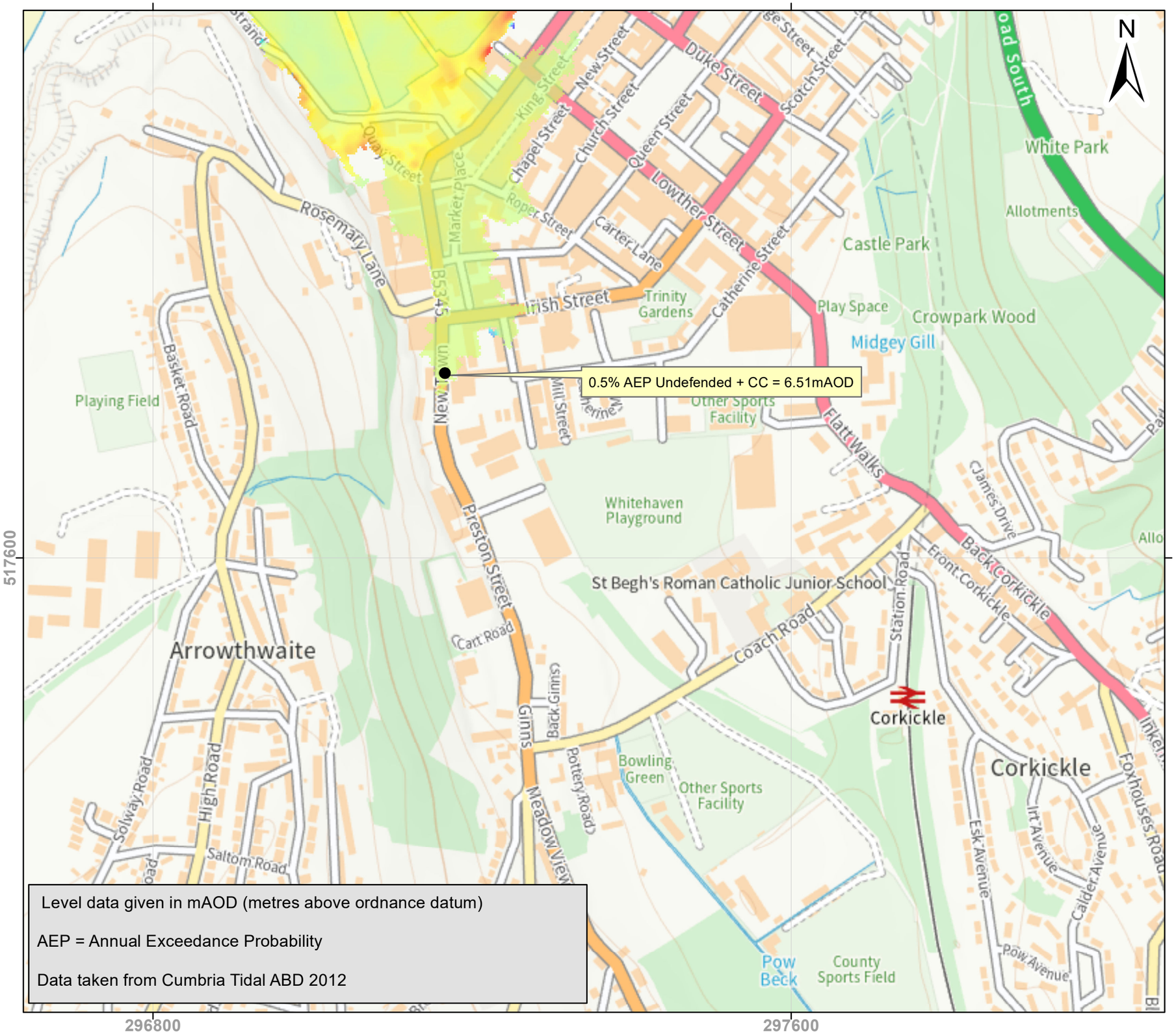

Level data given in mAOD (metres above ordnance datum)

AEP = Annual Exceedance Probability

Data taken from Cumbria Tidal ABD 2012

Environment Agency

Modelled 2d Data Map:
Preston Street, Whitehaven

Produced: 2/2/2023
Our Ref: CL291634
NGR: NX 97294 17548
Whitehaven Tidal 2012

Key

0.5% Undefended + CC (600mm SLR)

mAOD

High :10.0

Low : 0

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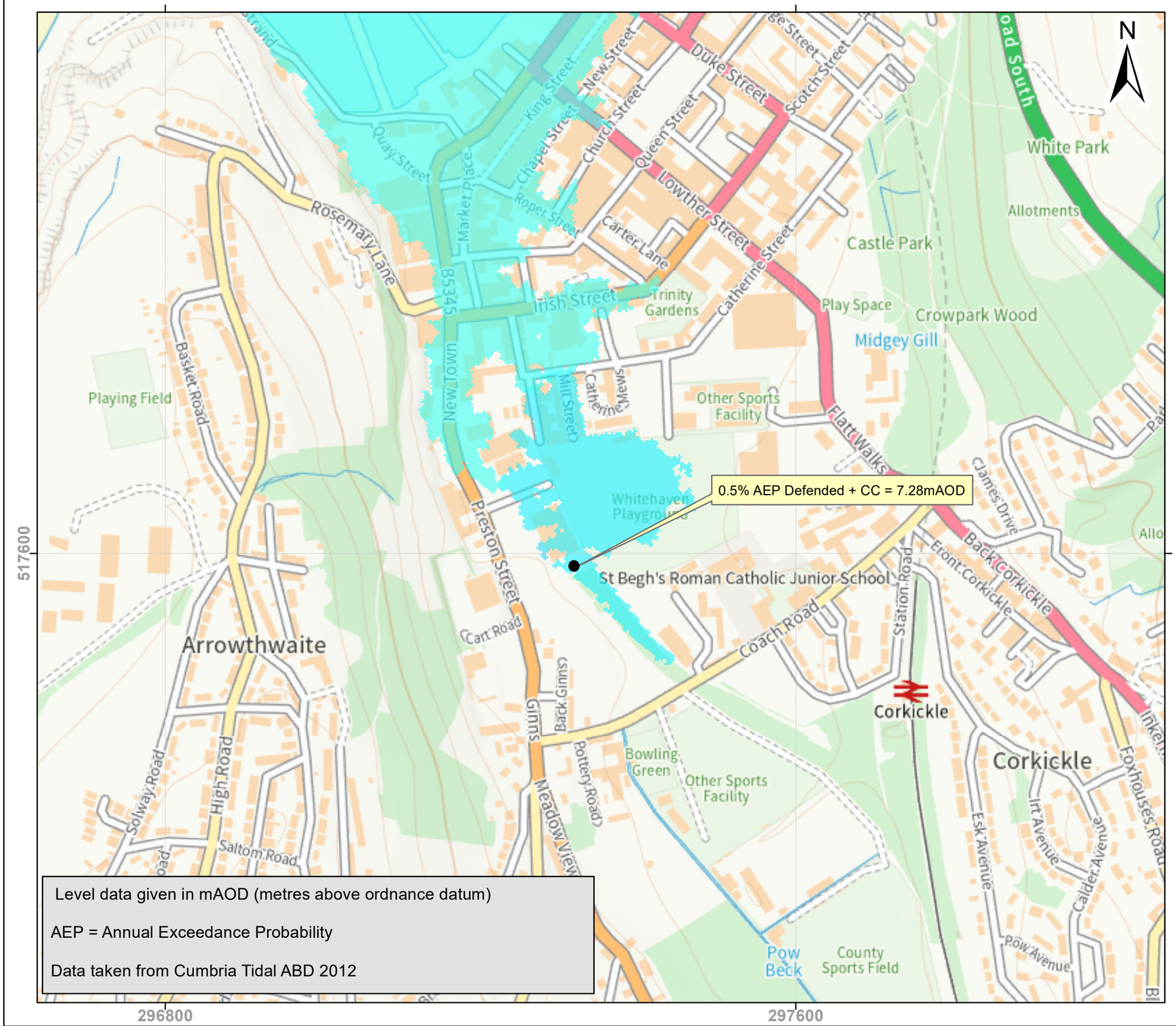

Level data given in mAOD (metres above ordnance datum)

AEP = Annual Exceedance Probability

Data taken from Cumbria Tidal ABD 2012

Environment Agency

Modelled 2d Data Map:
Preston Street, Whitehaven

Produced: 2/2/2023
Our Ref: CL291634
NGR: NX 97294 17548
Whitehaven Tidal 2012

Key

0.5% AEP Defended + CC (600mm SLR)

mAOD

High : 10.0

Low : 0

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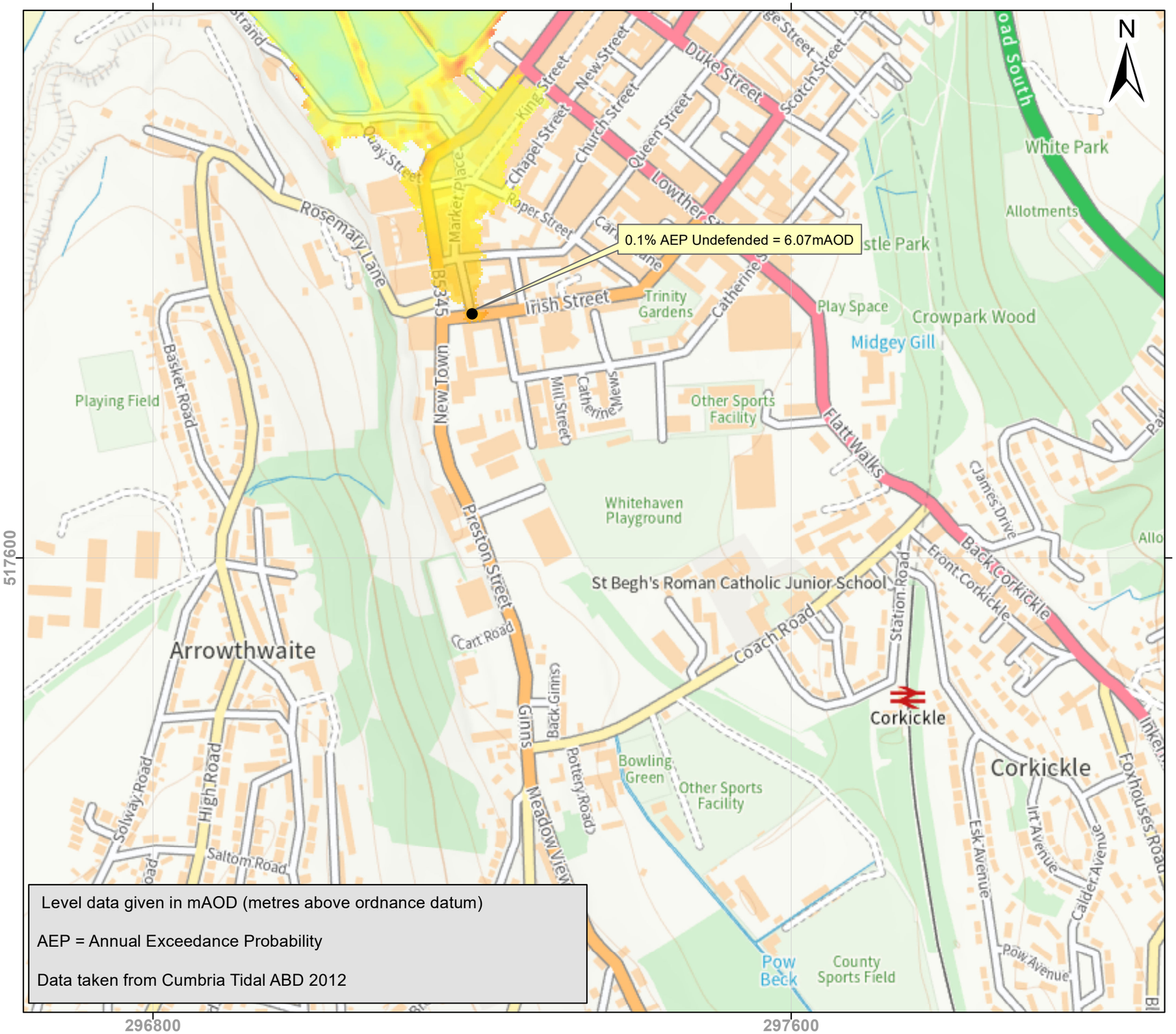

Environment Agency

Modelled 2d Data Map:
Preston Street, Whitehaven

Produced: 2/2/2023
Our Ref: CL291634
NGR: NX 97294 17548
Whitehaven Tidal 2012

Key

0.1% AEP Undefended

mAOD

High : 10.0

Low :0

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

Strategic flood risk assessments

We recommend that you check the relevant local authority's strategic flood risk assessment (SFRA) as part of your work to prepare a site specific flood risk assessment.

This should give you information about:

- the potential impacts of climate change in this catchment
- areas defined as functional floodplain
- flooding from other sources, such as surface water, ground water and reservoirs

About this data

This data has been generated by strategic scale flood models and is not intended for use at the individual property scale. If you're intending to use this data as part of a flood risk assessment, please include an appropriate modelling tolerance as part of your assessment. The Environment Agency regularly updates its modelling. We recommend that you check the data provided is the most recent, before submitting your flood risk assessment.

Flood risk activity permits

Under the Environmental Permitting (England and Wales) Regulations 2016 some developments may require an environmental permit for flood risk activities from the Environment Agency. This includes any permanent or temporary works that are in, over, under, or nearby a designated main river or flood defence structure.

Find out more about flood risk activity permits

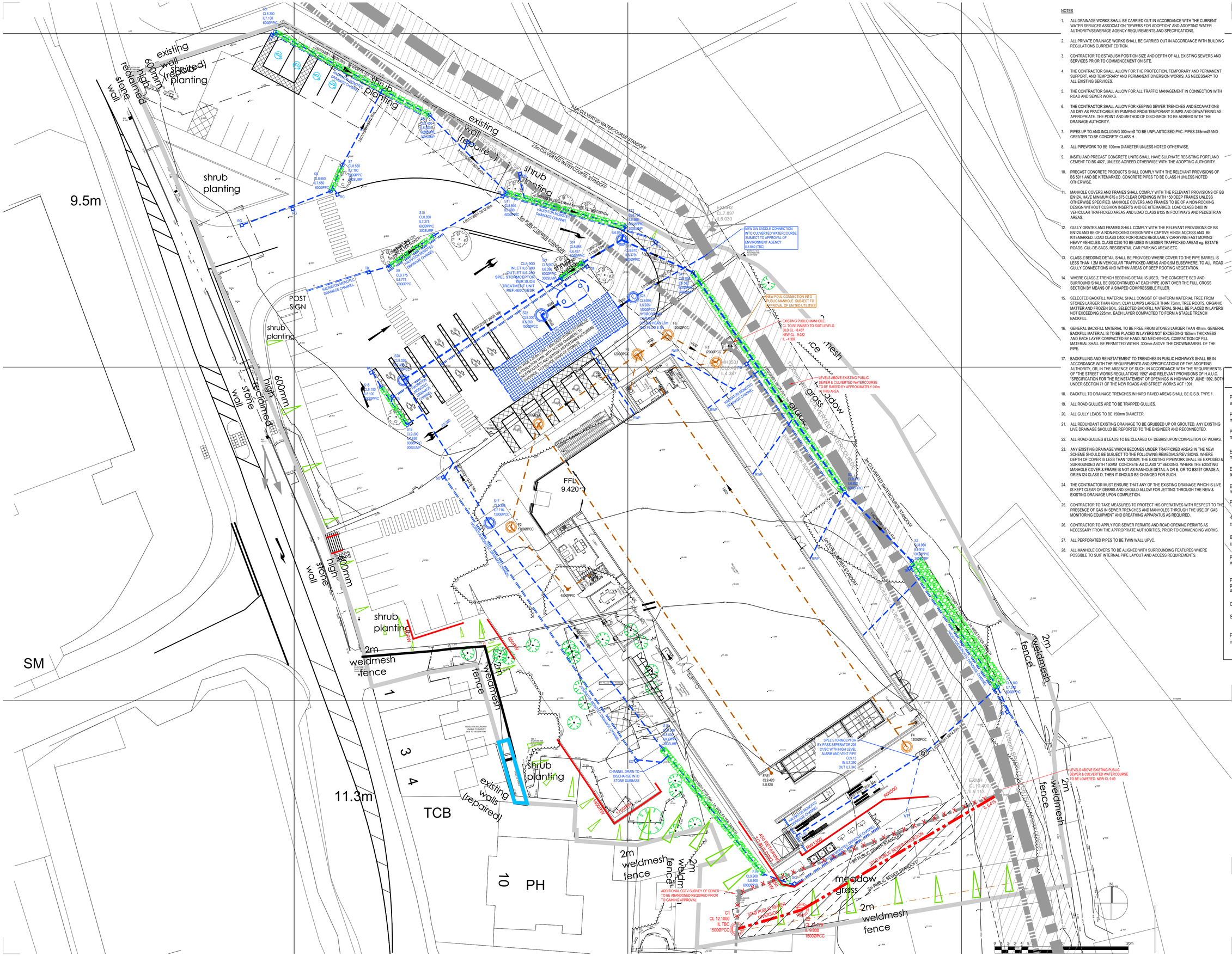
Help and advice

Contact the Cumbria and Lancashire Environment Agency team at inforequests.cmblnc@environment-agency.gov.uk for:

- more information about getting a product 5, 6, 7 or 8
- general help and advice about the site you're requesting data for

Appendix D - Proposed Drainage Details

Reference	Title
79-EXXXX-3E-ZZ-XX-DR-C-Ro-50-20-11-1000-S2-P02	Existing Drainage Layout Plan



NOTES

1. ALL DRAINAGE WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH THE CURRENT WATER SERVICES ASSOCIATION "SEWERS FOR ADOPTION" AND ADOPTING WATER AUTHORITY/SEWERAGE AGENCY REQUIREMENTS AND SPECIFICATIONS.
2. ALL PRIVATE DRAINAGE WORKS SHALL BE CARRIED OUT IN ACCORDANCE WITH BUILDING REGULATIONS CURRENT EDITION.
3. CONTRACTOR TO ESTABLISH POSITION SIZE AND DEPTH OF ALL EXISTING SEWERS AND SERVICES PRIOR TO COMMENCEMENT ON SITE.
4. THE CONTRACTOR SHALL ALLOW FOR THE PROTECTION, TEMPORARY AND PERMANENT SUPPORT, AND TEMPORARY AND PERMANENT DIVERSION WORKS, AS NECESSARY TO ALL EXISTING SERVICES.
5. THE CONTRACTOR SHALL ALLOW FOR ALL TRAFFIC MANAGEMENT IN CONNECTION WITH ROAD AND SEWER WORKS.
6. THE CONTRACTOR SHALL ALLOW FOR KEEPING SEWER TRENCHES AND EXCAVATIONS AS DRY AS PRACTICABLE BY PUMPING FROM TEMPORARY SUMPS AND DEWATERING AS APPROPRIATE. THE POINT AND METHOD OF DISCHARGE TO BE AGREED WITH THE DRAINAGE AUTHORITY.
7. PIPES UP TO AND INCLUDING 300mmØ TO BE UNPLASTICISED PVC. PIPES 375mmØ AND GREATER TO BE CONCRETE CLASS H.
8. ALL PIPEWORK TO BE 100mm DIAMETER UNLESS NOTED OTHERWISE.
9. INSITU AND PRECAST CONCRETE UNITS SHALL HAVE SULPHATE RESISTING PORTLAND CEMENT TO BS 4027, UNLESS AGREED OTHERWISE WITH THE ADOPTING AUTHORITY.
10. PRECAST CONCRETE PRODUCTS SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS 5911 AND BE KITEMARKED. CONCRETE PIPES TO BE CLASS H UNLESS NOTED OTHERWISE.
11. MANHOLE COVERS AND FRAMES SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN124, HAVE MINIMUM 675 x 675 CLEAR OPENINGS WITH 150 DEEP FRAMES UNLESS OTHERWISE SPECIFIED. MANHOLE COVERS AND FRAMES TO BE OF A NON-ROCKING DESIGN WITHOUT CUSHION INSERTS AND BE KITEMARKED. LOAD CLASS D400 IN VEHICULAR TRAFFICKED AREAS AND LOAD CLASS B125 IN FOOTWAYS AND PEDESTRIAN AREAS.
12. GULLY GRATES AND FRAMES SHALL COMPLY WITH THE RELEVANT PROVISIONS OF BS EN124 AND BE OF A NON-ROCKING DESIGN WITH CAPTIVE HINGE ACCESS AND BE KITEMARKED. LOAD CLASS D400 FOR ROADS REGULARLY CARRYING FAST MOVING HEAVY VEHICLES. CLASS C250 TO BE USED IN LESSER TRAFFICKED AREAS eg. ESTATE ROADS, CUL-DE-SACS, RESIDENTIAL CAR PARKING AREAS ETC.
13. CLASS Z BEDDING DETAIL SHALL BE PROVIDED WHERE COVER TO THE PIPE BARREL IS LESS THAN 1.2M IN VEHICULAR TRAFFICKED AREAS AND 0.9M ELSEWHERE, TO ALL ROAD GULLY CONNECTIONS AND WITHIN AREAS OF DEEP ROOTING VEGETATION.
14. WHERE CLASS Z TRENCH BEDDING DETAIL IS USED, THE CONCRETE BED AND SURROUND SHALL BE DISCONTINUED AT EACH PIPE JOINT OVER THE FULL CROSS SECTION BY MEANS OF A SHAPED COMPRESSIBLE FILLER.
15. SELECTED BACKFILL MATERIAL SHALL CONSIST OF UNIFORM MATERIAL FREE FROM STONES LARGER THAN 40mm, CLAY LUMPS LARGER THAN 75mm, TREE ROOTS, ORGANIC MATTER AND FROZEN SOIL. SELECTED BACKFILL MATERIAL SHALL BE PLACED IN LAYERS NOT EXCEEDING 225mm, EACH LAYER COMPACTED TO FORM A STABLE TRENCH BACKFILL.
16. GENERAL BACKFILL MATERIAL TO BE FREE FROM STONES LARGER THAN 40mm. GENERAL BACKFILL MATERIAL IS TO BE PLACED IN LAYERS NOT EXCEEDING 150mm THICKNESS AND EACH LAYER COMPACTED BY HAND. NO MECHANICAL COMPACTION OF FILL MATERIAL SHALL BE PERMITTED WITHIN 300mm ABOVE THE CROWN/BARREL OF THE PIPE.
17. BACKFILLING AND REINSTATEMENT TO TRENCHES IN PUBLIC HIGHWAYS SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS AND SPECIFICATIONS OF THE ADOPTING AUTHORITY, OR, IN THE ABSENCE OF SUCH, IN ACCORDANCE WITH THE REQUIREMENTS OF "THE STREET WORKS REGULATIONS 1992" AND RELEVANT PROVISIONS OF H.A.U.C. "SPECIFICATION FOR THE REINSTATEMENT OF OPENINGS IN HIGHWAYS" JUNE 1992, BOTH UNDER SECTION 71 OF THE NEW ROADS AND STREET WORKS ACT 1991.
18. BACKFILL TO DRAINAGE TRENCHES IN HARD PAVED AREAS SHALL BE G.S.B. TYPE 1.
19. ALL ROAD GULLIES ARE TO BE TRAPPED GULLIES.
20. ALL GULLY LEADS TO BE 150mm DIAMETER.
21. ALL REDUNDANT EXISTING DRAINAGE TO BE GRUBBED UP OR GROUTED. ANY EXISTING LIVE DRAINAGE SHOULD BE REPORTED TO THE ENGINEER AND RECONNECTED.
22. ALL ROAD GULLIES & LEADS TO BE CLEARED OF DEBRIS UPON COMPLETION OF WORKS.
23. ANY EXISTING DRAINAGE WHICH BECOMES UNDER TRAFFICKED AREAS IN THE NEW SCHEME SHOULD BE SUBJECT TO THE FOLLOWING REMEDIALS/REVISIONS. WHERE DEPTH OF COVER IS LESS THAN 1200MM, THE EXISTING PIPEWORK SHALL BE EXPOSED & SURROUNDED WITH 150MM CONCRETE AS CLASS "Z" BEDDING. WHERE THE EXISTING MANHOLE COVER & FRAME IS NOT AS MANHOLE DETAIL A OR B, OR TO BS497 GRADE A, OR EN124 CLASS D, THEN IT SHOULD BE CHANGED FOR SUCH.
24. THE CONTRACTOR MUST ENSURE THAT ANY OF THE EXISTING DRAINAGE WHICH IS LIVE IS KEPT CLEAR OF DEBRIS AND SHOULD ALLOW FOR JETTING THROUGH THE NEW & EXISTING DRAINAGE UPON COMPLETION.
25. CONTRACTOR TO TAKE MEASURES TO PROTECT HIS OPERATIVES WITH RESPECT TO THE PRESENCE OF GAS IN SEWER TRENCHES AND MANHOLES THROUGH THE USE OF GAS MONITORING EQUIPMENT AND BREATHING APPARATUS AS REQUIRED.
26. CONTRACTOR TO APPLY FOR SEWER PERMITS AND ROAD OPENING PERMITS AS NECESSARY FROM THE APPROPRIATE AUTHORITIES, PRIOR TO COMMENCING WORKS.
27. ALL PERFORATED PIPES TO BE TWIN WALL UPVC.
28. ALL MANHOLE COVERS TO BE ALIGNED WITH SURROUNDING FEATURES WHERE POSSIBLE TO SUIT INTERNAL PIPE LAYOUT AND ACCESS REQUIREMENTS.

REV	DATE	DESCRIPTION	DRW	CHK
P01	11/01/2021	PRELIMINARY ISSUE	GS	MP
P02	16/10/2023	LAYOUT UPDATED	GS	MP

HEALTH & SAFETY

1. CONTRACTOR SHOULD BE AWARE OF GENERAL CONSTRUCTION RISKS TO PREVENT SLIPS, TRIPS AND FALLS AND TAKE NECESSARY PRECAUTIONS WITHOUT SPECIAL INSTRUCTION.

ROADS & DRAINAGE

2. CONTRACTOR TO PROVIDE TRENCH SUPPORTS AS APPROPRIATE AND ENSURE THAT PLANT REMAINS A SAFE DISTANCE FROM TRENCHES PRIOR TO INSTALLING DRAINAGE
3. THE TIME THAT EXCAVATIONS ARE OPEN ON SITE SHOULD BE KEPT TO A MINIMUM AND ALL TRENCHES SHOULD BE SURROUNDED BY A BARRIER.
4. CONNECTIONS TO EXISTING SEWERS TO BE MADE BY NWL APPROVED CONTRACTOR ONLY.
5. CONTRACTOR TO MAKE OPERATIVES AWARE OF ASSOCIATED DANGERS TO HEALTH SUCH AS LEPTOSPIROSIS (WEILS DISEASE) AND RECOMMENDED PRECAUTIONS. ADEQUATE WELFARE FACILITIES AND PROTECTIVE CLOTHING TO BE PROVIDED AS REQUIRED.
6. UNFINISHED MANHOLES MUST BE COVERED WITH LOAD BEARING MATERIALS AND SURROUNDED WITH BARRIER.

PIPES & CABLES

7. SERVICE RECORDS TO BE REFERRED TO PRIOR TO WORK COMMENCING. CONTRACTOR TO PROCEED WITH CAUTION AND SERVICES TO BE LOCATED BY HAND DIG AND PROTECTED ACCORDINGLY.

EXCAVATION/FILL

8. CONTRACTOR TO ENSURE RELEVANT MEASURES ARE TAKEN TO KEEP PLANT AND PEOPLE A SAFE DISTANCE FROM STEEP SLOPES DURING THE WORKS.
9. CONTRACTOR TO ENSURE THAT PROCEDURES ARE IN PLACE TO KEEP PEOPLE A SAFE DISTANCE FROM WORKING PLANT WHERE NECESSARY.
10. CONTRACTOR TO REFER TO GROUND INVESTIGATION REPORT FOR CONTAMINATION TESTS AND TO PROVIDE ADEQUATE WELFARE FACILITIES AND PROTECTIVE CLOTHING AS REQUIRED.

Drainage Key

- Proposed Foul drain and manhole
- Proposed Storm drain and manhole
- Proposed Combined drain and manhole
- Existing Foul sewer and manhole — Ex 375Ø FW Sewer
- Existing Surface Water sewer and manhole — Ex 375Ø SW Sewer
- Existing Combined sewer and manhole — Ex 375Ø CW Sewer
- Private storm rodding eye
- 450mm dia. private inspection chamber.
- 600mm dia. private inspection chamber.
- Proposed road gully & connecting pipe work. 150Ø pipe unless noted otherwise — RG 150Ø
- Proposed channel drain with D400 rated pedestrian type covers with sump outlet units — SO
- Condensate Drain 100Ø pipe unless noted otherwise — CD
- Soil Stack 100Ø pipe unless noted otherwise — SS
- Filter drain with perforated pipe wrapped in impermeable membrane and clean stone aggregate.

CONTRACTOR TO PROVIDE CCTV SURVEY OF ALL NEW DRAINAGE UPON COMPLETION

Client
Aldi Stores Ltd.

Project Title
Aldi - Whitehaven

Project Address
Preston Street Whitehaven

Drawing Title
Proposed Drainage Layout

Job No.	Originator	Zone	Level	Type	Role
79-EXXX	3E	ZZ	XX	DR	C

System Classification	Drawing No.	Suitability	Revision
Ro_50_20_11	-1000	S2	P02

Drawn	Checked	Date	Scale	Size
GS	MP	Jan 2021	1:250	A1

Hydrock

2nd Floor, 2 Esh Plaza,
Sir Bobby Robson Way, Great Park
Newcastle
NE13 9BA
t: +44(0)191 230 2993
e: newcastle@3econsult.com

Appendix E - Proposed Drainage Calculations

Reference	Title
	Causeway Flow Drainage Model Results

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	17.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
LB	0.021	5.00	8.120	150	297325.211	517479.748	0.300
S1	0.042	5.00	9.100	600	297355.406	517502.017	2.030
S2	0.093	5.00	8.960	600	297342.571	517520.892	2.042
S3	0.045	5.00	9.250	600	297332.495	517531.237	2.428
S4	0.123	5.00	8.835	600	297309.749	517564.203	2.253
S5	0.063	5.00	8.300	600	297247.139	517600.239	1.200
S6	0.030	5.00	8.650	600	297255.495	517576.410	1.100
S7	0.000		8.550	600	297257.223	517580.279	1.450
S8	0.000		8.400	600	297270.285	517587.802	1.600
S9	0.028		9.775	600	297264.290	517565.139	
S10	0.023		8.850	600	297270.966	517569.748	
S11	0.018	5.00	8.540	600	297281.847	517576.151	1.849
S12	0.000		8.728	600	297299.612	517571.071	2.160
S13	0.034	5.00	8.670	1200	297299.093	517569.084	2.191
S14	0.000		8.850	600	297293.286	517565.662	2.423
S15	0.007	5.00	9.900	600	297321.999	517474.029	1.000
S16	0.040	5.00	9.370	600	297305.209	517492.798	1.370
S17	0.000		9.300	1200	297279.293	517526.633	1.584
S18	0.015	5.00	9.100	600	297262.999	517547.041	1.000
S19	0.021	5.00	9.200	600	297266.889	517541.393	1.350
S20	0.055	5.00	9.020	1200	297266.297	517548.039	1.530
S21	0.000		8.960	600	297289.933	517563.389	2.565
S22			8.980	1500	297287.037	517557.786	2.720
TANK	0.000		8.885	600	297287.037	517557.786	2.945
S23	0.000		8.895	1500	297300.793	517560.462	2.970

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Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	LB	S1	37.519	0.600	7.820	7.070	0.750	50.0	150	5.44	39.0
1.001	S1	S2	22.825	0.600	7.070	6.918	0.152	150.0	150	5.90	37.7
1.002	S2	S3	14.441	0.600	6.918	6.822	0.096	150.0	225	6.13	37.1
1.003	S3	S4	40.052	0.600	6.822	6.582	0.240	167.0	225	6.79	35.5
1.004	S4	S13	11.721	0.600	6.582	6.479	0.103	113.8	225	6.95	35.1
2.000	S5	S8	26.276	0.600	7.100	6.925	0.175	150.0	150	5.54	38.7
3.000	S6	S7	4.237	0.600	7.550	7.100	0.450	9.4	150	5.02	40.3
3.001	S7	S8	15.074	0.600	7.100	6.800	0.300	50.2	150	5.20	39.7
2.001	S8	S11	16.414	0.600	6.800	6.691	0.109	150.0	150	5.87	37.8
2.002	S11	S12	18.477	0.600	6.691	6.568	0.123	150.0	150	6.25	36.8
2.003	S12	S13	2.054	0.600	6.568	6.554	0.014	150.0	150	6.29	36.7
1.005	S13	S14	6.740	0.600	6.479	6.427	0.052	129.6	225	7.05	34.9
1.006	S14	S21	4.051	0.600	6.427	6.396	0.031	130.7	225	7.11	34.8
5.000	S15	S16	25.183	0.600	8.900	8.000	0.900	28.0	150	5.22	39.7
5.001	S16	S17	42.620	0.600	8.000	7.716	0.284	150.0	150	6.09	37.2
5.002	S17	S20	25.042	0.600	7.716	7.490	0.226	110.8	150	6.53	36.1
6.000	S18	S19	6.858	0.600	8.100	7.850	0.250	27.4	150	5.06	40.2
6.001	S19	S20	6.672	0.600	7.850	7.783	0.067	99.6	150	5.17	39.8
5.003	S20	S21	28.183	0.600	7.490	6.395	1.095	25.7	150	6.76	35.6
1.007	S21	S22	6.307	0.600	6.395	6.260	0.135	46.7	300	7.15	34.7
1.008	S22	TANK	2.750	0.600	6.260	6.240	0.020	137.5	300	7.19	34.6
1.009	TANK	S23	2.750	0.600	5.940	5.925	0.015	183.3	300	7.23	34.5

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.426	25.2	2.2	0.150	1.880	0.021	0.0	30	0.883
1.001	0.818	14.5	6.4	1.880	1.892	0.063	0.0	70	0.794
1.002	1.065	42.3	15.7	1.817	2.203	0.156	0.0	94	0.986
1.003	1.009	40.1	19.3	2.203	2.028	0.201	0.0	110	1.000
1.004	1.225	48.7	30.9	2.028	1.966	0.324	0.0	131	1.295
2.000	0.818	14.5	6.6	1.050	1.325	0.063	0.0	71	0.800
3.000	3.303	58.4	3.3	0.950	1.300	0.030	0.0	24	1.799
3.001	1.422	25.1	3.2	1.300	1.450	0.030	0.0	36	0.978
2.001	0.818	14.5	9.5	1.450	1.699	0.093	0.0	89	0.872
2.002	0.818	14.5	11.1	1.699	2.010	0.111	0.0	99	0.901
2.003	0.818	14.5	11.0	2.010	1.966	0.111	0.0	98	0.899
1.005	1.147	45.6	44.4	1.966	2.198	0.469	0.0	180	1.301
1.006	1.142	45.4	44.2	2.198	2.339	0.469	0.0	181	1.295
5.000	1.910	33.8	0.8	0.850	1.220	0.007	0.0	16	0.780
5.001	0.818	14.5	4.7	1.220	1.434	0.047	0.0	59	0.732
5.002	0.954	16.9	4.6	1.434	1.380	0.047	0.0	54	0.814
6.000	1.930	34.1	1.6	0.850	1.200	0.015	0.0	23	1.001
6.001	1.007	17.8	3.9	1.200	1.087	0.036	0.0	48	0.809
5.003	1.992	35.2	13.3	1.380	2.415	0.138	0.0	64	1.852
1.007	2.306	163.0	57.1	2.265	2.420	0.607	0.0	122	2.107
1.008	1.339	94.6	57.0	2.420	2.345	0.607	0.0	168	1.398
1.009	1.158	81.8	56.8	2.645	2.670	0.607	0.0	184	1.247

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Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	37.519	50.0	150	Circular	8.120	7.820	0.150	9.100	7.070	1.880
1.001	22.825	150.0	150	Circular	9.100	7.070	1.880	8.960	6.918	1.892
1.002	14.441	150.0	225	Circular	8.960	6.918	1.817	9.250	6.822	2.203
1.003	40.052	167.0	225	Circular	9.250	6.822	2.203	8.835	6.582	2.028
1.004	11.721	113.8	225	Circular	8.835	6.582	2.028	8.670	6.479	1.966
2.000	26.276	150.0	150	Circular	8.300	7.100	1.050	8.400	6.925	1.325
3.000	4.237	9.4	150	Circular	8.650	7.550	0.950	8.550	7.100	1.300
3.001	15.074	50.2	150	Circular	8.550	7.100	1.300	8.400	6.800	1.450
2.001	16.414	150.0	150	Circular	8.400	6.800	1.450	8.540	6.691	1.699
2.002	18.477	150.0	150	Circular	8.540	6.691	1.699	8.728	6.568	2.010
2.003	2.054	150.0	150	Circular	8.728	6.568	2.010	8.670	6.554	1.966
1.005	6.740	129.6	225	Circular	8.670	6.479	1.966	8.850	6.427	2.198
1.006	4.051	130.7	225	Circular	8.850	6.427	2.198	8.960	6.396	2.339
5.000	25.183	28.0	150	Circular	9.900	8.900	0.850	9.370	8.000	1.220
5.001	42.620	150.0	150	Circular	9.370	8.000	1.220	9.300	7.716	1.434
5.002	25.042	110.8	150	Circular	9.300	7.716	1.434	9.020	7.490	1.380
6.000	6.858	27.4	150	Circular	9.100	8.100	0.850	9.200	7.850	1.200
6.001	6.672	99.6	150	Circular	9.200	7.850	1.200	9.020	7.783	1.087
5.003	28.183	25.7	150	Circular	9.020	7.490	1.380	8.960	6.395	2.415
1.007	6.307	46.7	300	Circular	8.960	6.395	2.265	8.980	6.260	2.420
1.008	2.750	137.5	300	Circular	8.980	6.260	2.420	8.885	6.240	2.345
1.009	2.750	183.3	300	Circular	8.885	5.940	2.645	8.895	5.925	2.670

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	LB	150	Manhole	Adoptable	S1	600	Manhole	Adoptable
1.001	S1	600	Manhole	Adoptable	S2	600	Manhole	Adoptable
1.002	S2	600	Manhole	Adoptable	S3	600	Manhole	Adoptable
1.003	S3	600	Manhole	Adoptable	S4	600	Manhole	Adoptable
1.004	S4	600	Manhole	Adoptable	S13	1200	Manhole	Adoptable
2.000	S5	600	Manhole	Adoptable	S8	600	Manhole	Adoptable
3.000	S6	600	Manhole	Adoptable	S7	600	Manhole	Adoptable
3.001	S7	600	Manhole	Adoptable	S8	600	Manhole	Adoptable
2.001	S8	600	Manhole	Adoptable	S11	600	Manhole	Adoptable
2.002	S11	600	Manhole	Adoptable	S12	600	Manhole	Adoptable
2.003	S12	600	Manhole	Adoptable	S13	1200	Manhole	Adoptable
1.005	S13	1200	Manhole	Adoptable	S14	600	Manhole	Adoptable
1.006	S14	600	Manhole	Adoptable	S21	600	Manhole	Adoptable
5.000	S15	600	Manhole	Adoptable	S16	600	Manhole	Adoptable
5.001	S16	600	Manhole	Adoptable	S17	1200	Manhole	Adoptable
5.002	S17	1200	Manhole	Adoptable	S20	1200	Manhole	Adoptable
6.000	S18	600	Manhole	Adoptable	S19	600	Manhole	Adoptable
6.001	S19	600	Manhole	Adoptable	S20	1200	Manhole	Adoptable
5.003	S20	1200	Manhole	Adoptable	S21	600	Manhole	Adoptable
1.007	S21	600	Manhole	Adoptable	S22	1500	Manhole	Adoptable
1.008	S22	1500	Manhole	Adoptable	TANK	600	Manhole	Adoptable
1.009	TANK	600	Manhole	Adoptable	S23	1500	Manhole	Adoptable

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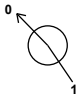
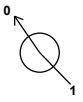
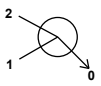
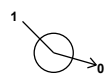
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
LB	297325.211	517479.748	8.120	0.300	150				
						0	1.000	7.820	150
S1	297355.406	517502.017	9.100	2.030	600		1	1.000	7.070	150
						0	1.001	7.070	150
S2	297342.571	517520.892	8.960	2.042	600		1	1.001	6.918	150
						0	1.002	6.918	225
S3	297332.495	517531.237	9.250	2.428	600		1	1.002	6.822	225
						0	1.003	6.822	225
S4	297309.749	517564.203	8.835	2.253	600		1	1.003	6.582	225
						0	1.004	6.582	225
S5	297247.139	517600.239	8.300	1.200	600				
						0	2.000	7.100	150
S6	297255.495	517576.410	8.650	1.100	600				
						0	3.000	7.550	150
S7	297257.223	517580.279	8.550	1.450	600		1	3.000	7.100	150
						0	3.001	7.100	150
S8	297270.285	517587.802	8.400	1.600	600		1	3.001	6.800	150
							2	2.000	6.925	150
						0	2.001	6.800	150
S9	297264.290	517565.139	9.775		600				
S10	297270.966	517569.748	8.850		600				
S11	297281.847	517576.151	8.540	1.849	600		1	2.001	6.691	150
						0	2.002	6.691	150
S12	297299.612	517571.071	8.728	2.160	600		1	2.002	6.568	150
						0	2.003	6.568	150

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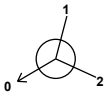
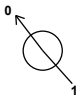
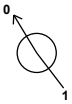
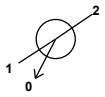
Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
S13	297299.093	517569.084	8.670	2.191	1200		1	2.003	6.554	150
							2	1.004	6.479	225
							0	1.005	6.479	225
S14	297293.286	517565.662	8.850	2.423	600		1	1.005	6.427	225
							0	1.006	6.427	225
S15	297321.999	517474.029	9.900	1.000	600		0	5.000	8.900	150
S16	297305.209	517492.798	9.370	1.370	600		1	5.000	8.000	150
							0	5.001	8.000	150
S17	297279.293	517526.633	9.300	1.584	1200		1	5.001	7.716	150
							0	5.002	7.716	150
S18	297262.999	517547.041	9.100	1.000	600		0	6.000	8.100	150
S19	297266.889	517541.393	9.200	1.350	600		1	6.000	7.850	150
							0	6.001	7.850	150
S20	297266.297	517548.039	9.020	1.530	1200		1	6.001	7.783	150
							2	5.002	7.490	150
							0	5.003	7.490	150
S21	297289.933	517563.389	8.960	2.565	600		1	5.003	6.395	150
							2	1.006	6.396	225
							0	1.007	6.395	300
S22	297287.037	517557.786	8.980	2.720	1500		1	1.007	6.260	300
							0	1.008	6.260	300
TANK	297287.037	517557.786	8.885	2.945	600		1	1.008	6.240	300
							0	1.009	5.940	300
S23	297300.793	517560.462	8.895	2.970	1500		1	1.009	5.925	300

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Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Detailed
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	17.000	Drain Down Time (mins)	240
Ratio-R	0.300	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	0	0	0
100	30	0	0
100	45	0	0

Node S23 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	5.925	Product Number	CTL-SHE-0099-6100-2200-6100
Design Depth (m)	2.200	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	6.1	Min Node Diameter (mm)	1200

Node TANK Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	5.940
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.96	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	138.9	0.0	1.980	138.9	0.0	1.981	0.0	0.0

Node S2 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	6.918	Slope (1:X)	150.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	120	Depth (m)	
Safety Factor	2.0	Width (m)	2.000	Inf Depth (m)	
Porosity	0.30	Length (m)	22.800		

Node S4 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	6.582	Slope (1:X)	167.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	248	Depth (m)	
Safety Factor	2.0	Width (m)	1.000	Inf Depth (m)	
Porosity	0.30	Length (m)	39.800		

Node S12 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	6.568	Slope (1:X)	150.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	
Safety Factor	2.0	Width (m)	1.000	Inf Depth (m)	
Porosity	0.30	Length (m)	18.500		

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Node S8 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	6.800	Slope (1:X)	150.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	
Safety Factor	2.0	Width (m)	1.000	Inf Depth (m)	
Porosity	0.30	Length (m)	26.300		

Node S7 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	7.100	Slope (1:X)	20.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	184	Depth (m)	
Safety Factor	2.0	Width (m)	1.000	Inf Depth (m)	
Porosity	0.30	Length (m)	4.000		

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Results for 1 year Critical Storm Duration. Lowest mass balance: 98.97%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	LB	10	7.850	0.030	2.3	0.0426	0.0000	OK
15 minute winter	S1	11	7.141	0.071	6.8	0.0493	0.0000	OK
15 minute winter	S2	11	7.021	0.103	16.5	0.6053	0.0000	OK
15 minute winter	S3	11	6.934	0.112	20.6	0.0734	0.0000	OK
15 minute winter	S4	12	6.745	0.163	33.0	0.8997	0.0000	OK
15 minute winter	S5	10	7.173	0.073	6.8	0.0969	0.0000	OK
15 minute winter	S6	10	7.574	0.024	3.3	0.0201	0.0000	OK
15 minute winter	S7	10	7.136	0.036	3.3	0.0176	0.0000	OK
15 minute winter	S8	11	6.894	0.094	9.8	0.2333	0.0000	OK
	S9							
	S10							
15 minute winter	S11	11	6.794	0.103	11.4	0.0490	0.0000	OK
15 minute winter	S12	12	6.725	0.157	11.4	0.5813	0.0000	SURCHARGED
15 minute winter	S13	12	6.709	0.230	43.0	0.3320	0.0000	SURCHARGED
15 minute winter	S14	12	6.636	0.209	42.9	0.0591	0.0000	OK
15 minute winter	S15	10	8.916	0.016	0.8	0.0066	0.0000	OK
15 minute winter	S16	11	8.062	0.062	5.1	0.0538	0.0000	OK
15 minute winter	S17	11	7.771	0.055	5.0	0.0620	0.0000	OK
15 minute winter	S18	10	8.122	0.022	1.6	0.0129	0.0000	OK
15 minute winter	S19	10	7.900	0.050	3.9	0.0297	0.0000	OK
15 minute winter	S20	11	7.556	0.066	14.1	0.1226	0.0000	OK
15 minute winter	S21	12	6.552	0.157	55.9	0.0443	0.0000	OK
15 minute winter	S22	12	6.455	0.195	55.9	0.3442	0.0000	OK
240 minute winter	TANK	180	6.308	0.368	16.2	49.1871	0.0000	SURCHARGED
240 minute winter	S23	180	6.308	0.383	5.0	0.6766	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	LB	1.000	S1	2.2	0.431	0.088	0.1996	
15 minute winter	S1	1.001	S2	6.6	0.629	0.456	0.2401	
15 minute winter	S2	1.002	S3	16.0	0.853	0.377	0.2706	
15 minute winter	S3	1.003	S4	20.4	0.832	0.508	1.0040	
15 minute winter	S4	1.004	S13	30.2	0.883	0.620	0.4135	
15 minute winter	S5	2.000	S8	6.6	0.793	0.455	0.2179	
15 minute winter	S6	3.000	S7	3.3	1.294	0.056	0.0109	
15 minute winter	S7	3.001	S8	3.2	0.473	0.129	0.1121	
15 minute winter	S8	2.001	S11	9.6	0.786	0.666	0.2011	
15 minute winter	S11	2.002	S12	11.4	0.785	0.789	0.2787	
15 minute winter	S12	2.003	S13	11.1	0.756	0.769	0.0362	
15 minute winter	S13	1.005	S14	42.9	1.085	0.940	0.2637	
15 minute winter	S14	1.006	S21	42.7	1.196	0.941	0.1435	
15 minute winter	S15	5.000	S16	0.8	0.212	0.022	0.0984	
15 minute winter	S16	5.001	S17	5.0	0.787	0.343	0.2705	
15 minute winter	S17	5.002	S20	4.8	0.742	0.286	0.1668	
15 minute winter	S18	6.000	S19	1.6	0.488	0.046	0.0231	
15 minute winter	S19	6.001	S20	3.8	0.771	0.213	0.0328	
15 minute winter	S20	5.003	S21	14.2	1.049	0.403	0.3538	
15 minute winter	S21	1.007	S22	55.9	1.305	0.343	0.2700	
15 minute winter	S22	1.008	TANK	56.0	1.275	0.592	0.1207	
30 minute winter	TANK	1.009	S23	5.1	0.378	0.063	0.1793	
240 minute winter	S23	Hydro-Brake®		5.0				90.5

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Results for 30 year Critical Storm Duration. Lowest mass balance: 98.97%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	LB	10	7.867	0.047	5.5	0.0669	0.0000	OK
15 minute winter	S1	12	7.397	0.327	16.5	0.2276	0.0000	SURCHARGED
15 minute winter	S2	13	7.295	0.377	36.6	4.5719	0.0000	SURCHARGED
15 minute winter	S3	13	7.257	0.435	40.6	0.2838	0.0000	SURCHARGED
15 minute winter	S4	13	7.109	0.527	62.4	5.5967	0.0000	SURCHARGED
15 minute winter	S5	12	7.367	0.267	16.6	0.3565	0.0000	SURCHARGED
15 minute winter	S6	10	7.587	0.037	7.9	0.0309	0.0000	OK
15 minute winter	S7	14	7.248	0.148	7.9	0.1174	0.0000	OK
15 minute winter	S8	14	7.242	0.442	23.2	2.9284	0.0000	SURCHARGED
	S9							
	S10							
15 minute winter	S11	13	7.145	0.454	16.6	0.2165	0.0000	SURCHARGED
360 minute winter	S12	336	6.999	0.431	5.1	2.1758	0.0000	SURCHARGED
360 minute winter	S13	336	6.999	0.520	21.6	0.7497	0.0000	SURCHARGED
360 minute winter	S14	336	6.999	0.572	21.5	0.1618	0.0000	SURCHARGED
15 minute winter	S15	10	8.923	0.023	1.8	0.0099	0.0000	OK
15 minute winter	S16	11	8.108	0.108	12.4	0.0932	0.0000	OK
15 minute winter	S17	11	7.809	0.093	12.0	0.1046	0.0000	OK
15 minute winter	S18	10	8.135	0.035	4.0	0.0202	0.0000	OK
15 minute winter	S19	10	7.935	0.085	9.5	0.0503	0.0000	OK
15 minute winter	S20	12	7.663	0.173	34.8	0.3201	0.0000	SURCHARGED
360 minute winter	S21	336	6.998	0.603	27.6	0.1708	0.0000	SURCHARGED
360 minute winter	S22	336	6.998	0.738	26.9	1.3044	0.0000	SURCHARGED
360 minute winter	TANK	336	6.998	1.058	26.5	141.3822	0.0000	SURCHARGED
360 minute winter	S23	336	6.998	1.073	5.3	1.8958	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	LB	1.000	S1	5.4	0.502	0.214	0.4191	
15 minute winter	S1	1.001	S2	13.1	0.773	0.907	0.4018	
15 minute winter	S2	1.002	S3	29.4	0.915	0.694	0.5743	
15 minute summer	S3	1.003	S4	33.8	0.893	0.844	1.5929	
15 minute winter	S4	1.004	S13	47.8	1.201	0.981	0.4662	
15 minute winter	S5	2.000	S8	15.4	0.931	1.063	0.4626	
15 minute winter	S6	3.000	S7	7.9	1.655	0.135	0.0419	
15 minute winter	S7	3.001	S8	7.8	0.564	0.311	0.2652	
15 minute winter	S8	2.001	S11	12.9	0.787	0.896	0.2890	
15 minute winter	S11	2.002	S12	14.5	0.822	1.001	0.3253	
15 minute winter	S12	2.003	S13	17.1	0.970	1.182	0.0362	
15 minute winter	S13	1.005	S14	67.6	1.700	1.482	0.2681	
15 minute winter	S14	1.006	S21	67.9	1.708	1.496	0.1611	
15 minute winter	S15	5.000	S16	1.8	0.243	0.052	0.1919	
15 minute winter	S16	5.001	S17	12.0	0.968	0.830	0.5309	
15 minute winter	S17	5.002	S20	11.9	0.872	0.705	0.3590	
15 minute winter	S18	6.000	S19	4.0	0.608	0.116	0.0457	
15 minute winter	S19	6.001	S20	9.3	0.965	0.524	0.0645	
15 minute winter	S20	5.003	S21	33.4	1.919	0.948	0.4962	
15 minute winter	S21	1.007	S22	97.1	1.407	0.596	0.4233	
15 minute winter	S22	1.008	TANK	97.7	1.435	1.032	0.1807	
15 minute winter	TANK	1.009	S23	6.2	0.480	0.076	0.1937	
15 minute summer	S23	Hydro-Brake®		5.0				61.1

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Results for 100 year Critical Storm Duration. Lowest mass balance: 98.97%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	LB	10	7.874	0.054	7.1	0.0765	0.0000	OK
15 minute winter	S1	13	7.676	0.606	21.2	0.4225	0.0000	SURCHARGED
15 minute winter	S2	14	7.528	0.610	46.8	8.0442	0.0000	SURCHARGED
15 minute winter	S3	14	7.476	0.654	40.5	0.4268	0.0000	SURCHARGED
360 minute winter	S4	344	7.327	0.745	19.4	8.4957	0.0000	SURCHARGED
15 minute winter	S5	12	7.634	0.534	21.4	0.7118	0.0000	SURCHARGED
15 minute winter	S6	10	7.592	0.042	10.2	0.0351	0.0000	OK
30 minute winter	S7	23	7.466	0.366	8.3	0.4326	0.0000	SURCHARGED
30 minute winter	S8	23	7.456	0.656	21.6	4.6724	0.0000	SURCHARGED
	S9							
	S10							
30 minute winter	S11	23	7.335	0.644	16.6	0.3074	0.0000	SURCHARGED
360 minute winter	S12	344	7.326	0.758	6.3	4.0784	0.0000	SURCHARGED
360 minute winter	S13	344	7.326	0.847	25.4	1.2206	0.0000	SURCHARGED
360 minute winter	S14	344	7.325	0.898	25.2	0.2542	0.0000	SURCHARGED
15 minute winter	S15	10	8.927	0.027	2.4	0.0114	0.0000	OK
15 minute winter	S16	12	8.304	0.304	15.9	0.2639	0.0000	SURCHARGED
15 minute winter	S17	12	8.096	0.380	15.2	0.4299	0.0000	SURCHARGED
15 minute winter	S18	10	8.139	0.039	5.1	0.0228	0.0000	OK
15 minute winter	S19	12	8.007	0.157	12.2	0.0934	0.0000	SURCHARGED
15 minute winter	S20	12	7.980	0.490	40.3	0.9058	0.0000	SURCHARGED
360 minute winter	S21	344	7.325	0.930	32.4	0.2631	0.0000	SURCHARGED
360 minute winter	S22	344	7.325	1.065	31.6	1.8811	0.0000	SURCHARGED
360 minute winter	TANK	344	7.324	1.384	31.1	184.9847	0.0000	SURCHARGED
360 minute winter	S23	344	7.324	1.399	5.3	2.4723	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	LB	1.000	S1	7.0	0.514	0.277	0.4372	
15 minute winter	S1	1.001	S2	16.0	0.907	1.105	0.4018	
15 minute winter	S2	1.002	S3	28.6	0.933	0.676	0.5743	
15 minute winter	S3	1.003	S4	33.3	0.892	0.831	1.5929	
15 minute winter	S4	1.004	S13	53.4	1.344	1.097	0.4662	
15 minute winter	S5	2.000	S8	18.3	1.038	1.264	0.4626	
15 minute winter	S6	3.000	S7	10.2	1.742	0.174	0.0456	
15 minute winter	S7	3.001	S8	9.3	0.645	0.368	0.2654	
30 minute winter	S8	2.001	S11	14.1	0.801	0.975	0.2890	
30 minute winter	S11	2.002	S12	16.2	0.921	1.122	0.3253	
15 minute winter	S12	2.003	S13	20.3	1.156	1.407	0.0362	
30 minute winter	S13	1.005	S14	76.1	1.913	1.668	0.2681	
30 minute winter	S14	1.006	S21	76.7	1.929	1.690	0.1611	
15 minute winter	S15	5.000	S16	2.4	0.257	0.070	0.2477	
15 minute winter	S16	5.001	S17	15.2	0.992	1.053	0.7503	
15 minute winter	S17	5.002	S20	16.0	0.981	0.952	0.4409	
15 minute winter	S18	6.000	S19	5.1	0.633	0.149	0.0711	
15 minute winter	S19	6.001	S20	12.0	1.020	0.675	0.1175	
15 minute winter	S20	5.003	S21	34.9	1.984	0.992	0.4962	
15 minute winter	S21	1.007	S22	107.1	1.521	0.657	0.4441	
15 minute winter	S22	1.008	TANK	107.0	1.532	1.131	0.1937	
15 minute winter	TANK	1.009	S23	6.3	0.532	0.078	0.1937	
15 minute summer	S23	Hydro-Brake®		5.0				70.8

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Results for 100 year +30% CC Critical Storm Duration. Lowest mass balance: 98.97%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	LB	13	8.083	0.263	9.3	0.3730	0.0000	FLOOD RISK
15 minute winter	S1	13	8.042	0.972	27.6	0.6774	0.0000	SURCHARGED
30 minute winter	S2	23	7.877	0.959	50.8	13.2283	0.0000	SURCHARGED
30 minute winter	S3	23	7.811	0.989	38.0	0.6457	0.0000	SURCHARGED
480 minute winter	S4	456	7.771	1.189	18.9	14.4055	0.0000	SURCHARGED
15 minute winter	S5	12	8.052	0.952	27.8	1.2696	0.0000	FLOOD RISK
30 minute winter	S6	23	7.797	0.247	10.8	0.2041	0.0000	SURCHARGED
30 minute winter	S7	23	7.791	0.691	10.8	0.9151	0.0000	SURCHARGED
30 minute winter	S8	23	7.778	0.978	27.5	7.3000	0.0000	SURCHARGED
	S9							
	S10							
480 minute winter	S11	456	7.771	1.080	6.2	0.5153	0.0000	SURCHARGED
480 minute winter	S12	456	7.770	1.202	5.7	6.6653	0.0000	SURCHARGED
480 minute winter	S13	456	7.770	1.291	23.1	1.8606	0.0000	SURCHARGED
480 minute winter	S14	456	7.769	1.342	22.5	0.3799	0.0000	SURCHARGED
15 minute winter	S15	10	8.931	0.031	3.1	0.0129	0.0000	OK
15 minute winter	S16	13	8.814	0.814	20.7	0.7058	0.0000	SURCHARGED
15 minute winter	S17	13	8.551	0.835	13.6	0.9439	0.0000	SURCHARGED
15 minute winter	S18	13	8.421	0.321	6.6	0.1874	0.0000	SURCHARGED
15 minute winter	S19	13	8.415	0.565	15.7	0.3356	0.0000	SURCHARGED
15 minute winter	S20	13	8.381	0.891	43.5	1.6477	0.0000	SURCHARGED
480 minute winter	S21	456	7.769	1.374	30.1	0.3888	0.0000	SURCHARGED
480 minute winter	S22	456	7.768	1.508	29.7	2.6653	0.0000	SURCHARGED
480 minute winter	TANK	456	7.768	1.828	29.4	244.2841	0.0000	SURCHARGED
480 minute winter	S23	456	7.768	1.843	5.6	3.2563	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	LB	1.000	S1	9.1	0.638	0.363	0.6605	
15 minute summer	S1	1.001	S2	19.1	1.083	1.318	0.4018	
15 minute winter	S2	1.002	S3	32.6	0.934	0.770	0.5743	
30 minute winter	S3	1.003	S4	37.9	0.954	0.946	1.5929	
30 minute winter	S4	1.004	S13	61.9	1.556	1.271	0.4662	
15 minute winter	S5	2.000	S8	23.2	1.318	1.605	0.4626	
15 minute winter	S6	3.000	S7	13.0	1.776	0.223	0.0746	
15 minute summer	S7	3.001	S8	11.0	0.735	0.437	0.2654	
30 minute winter	S8	2.001	S11	15.7	0.889	1.083	0.2890	
30 minute winter	S11	2.002	S12	18.5	1.049	1.277	0.3253	
15 minute winter	S12	2.003	S13	22.9	1.303	1.587	0.0362	
30 minute winter	S13	1.005	S14	85.4	2.147	1.872	0.2681	
30 minute winter	S14	1.006	S21	85.3	2.144	1.878	0.1611	
15 minute winter	S15	5.000	S16	3.1	0.259	0.091	0.2540	
15 minute summer	S16	5.001	S17	15.3	0.988	1.058	0.7503	
30 minute summer	S17	5.002	S20	16.8	0.982	0.995	0.4409	
15 minute winter	S18	6.000	S19	6.4	0.650	0.188	0.1207	
15 minute winter	S19	6.001	S20	13.9	1.004	0.783	0.1175	
15 minute winter	S20	5.003	S21	39.1	2.224	1.112	0.4962	
15 minute winter	S21	1.007	S22	122.3	1.736	0.750	0.4441	
15 minute winter	S22	1.008	TANK	122.3	1.739	1.293	0.1937	
15 minute winter	TANK	1.009	S23	6.5	0.520	0.080	0.1937	
480 minute winter	S23	Hydro-Brake®		5.6				205.2

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Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 98.97%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	LB	20	8.120	0.300	8.4	0.4254	1.1435	FLOOD
15 minute winter	S1	12	8.125	1.055	28.7	0.7353	0.0000	SURCHARGED
480 minute winter	S2	448	8.121	1.203	10.6	16.8678	0.0000	SURCHARGED
480 minute winter	S3	448	8.121	1.299	13.0	0.8485	0.0000	SURCHARGED
480 minute winter	S4	448	8.121	1.539	19.9	19.0679	0.0000	SURCHARGED
15 minute winter	S5	12	8.276	1.176	31.0	1.5678	0.0000	FLOOD RISK
480 minute winter	S6	448	8.123	0.573	2.1	0.4743	0.0000	SURCHARGED
480 minute winter	S7	448	8.123	1.023	2.1	1.4069	0.0000	SURCHARGED
480 minute winter	S8	448	8.123	1.323	6.3	10.1179	0.0000	FLOOD RISK
	S9							
	S10							
480 minute winter	S11	448	8.122	1.431	6.4	0.6826	0.0000	SURCHARGED
480 minute winter	S12	448	8.121	1.553	5.9	8.7080	0.0000	SURCHARGED
480 minute winter	S13	448	8.121	1.642	23.3	2.3656	0.0000	SURCHARGED
480 minute winter	S14	448	8.120	1.693	22.9	0.4791	0.0000	SURCHARGED
15 minute winter	S15	13	9.017	0.117	5.6	0.0496	0.0000	OK
15 minute winter	S16	13	9.028	1.028	23.1	0.8909	0.0000	SURCHARGED
15 minute winter	S17	13	8.760	1.044	14.5	1.1805	0.0000	SURCHARGED
15 minute winter	S18	13	8.648	0.548	7.4	0.3196	0.0000	SURCHARGED
15 minute winter	S19	13	8.640	0.790	16.5	0.4695	0.0000	SURCHARGED
15 minute winter	S20	13	8.599	1.109	45.9	2.0511	0.0000	SURCHARGED
480 minute winter	S21	448	8.119	1.724	31.9	0.4880	0.0000	SURCHARGED
480 minute winter	S22	448	8.119	1.859	31.5	3.2845	0.0000	SURCHARGED
480 minute winter	TANK	448	8.119	2.179	31.2	264.7043	0.0000	SURCHARGED
480 minute winter	S23	448	8.118	2.193	6.1	3.8755	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	LB	1.000	S1	9.3	0.647	0.369	0.6605	
15 minute winter	S1	1.001	S2	20.2	1.148	1.397	0.4018	
15 minute winter	S2	1.002	S3	33.4	0.932	0.789	0.5743	
30 minute winter	S3	1.003	S4	39.1	0.983	0.975	1.5929	
30 minute winter	S4	1.004	S13	65.9	1.658	1.354	0.4662	
15 minute winter	S5	2.000	S8	25.6	1.456	1.774	0.4626	
15 minute winter	S6	3.000	S7	14.5	1.821	0.248	0.0746	
15 minute winter	S7	3.001	S8	10.9	0.741	0.435	0.2654	
30 minute winter	S8	2.001	S11	16.5	0.936	1.140	0.2890	
30 minute winter	S11	2.002	S12	19.5	1.109	1.351	0.3253	
15 minute winter	S12	2.003	S13	23.1	1.313	1.599	0.0362	
30 minute winter	S13	1.005	S14	90.7	2.282	1.990	0.2681	
30 minute winter	S14	1.006	S21	90.6	2.277	1.995	0.1611	
15 minute winter	S15	5.000	S16	3.9	0.274	0.115	0.4077	
30 minute summer	S16	5.001	S17	15.7	0.989	1.086	0.7503	
15 minute winter	S17	5.002	S20	16.2	1.230	0.963	0.4409	
15 minute winter	S18	6.000	S19	6.8	0.655	0.200	0.1207	
15 minute summer	S19	6.001	S20	14.7	1.006	0.825	0.1175	
15 minute winter	S20	5.003	S21	41.3	2.346	1.173	0.4962	
30 minute winter	S21	1.007	S22	129.7	1.842	0.796	0.4441	
15 minute winter	S22	1.008	TANK	129.4	1.840	1.368	0.1937	
15 minute winter	TANK	1.009	S23	6.6	0.489	0.081	0.1937	
480 minute winter	S23	Hydro-Brake®		6.1				216.1

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Appendix F - United Utilities Records

Reference	Title
	UU Sewer Records

Refno	Cover	Func	Invert	Size.x	Size.y	Shape	Matl	Length	Grad
0001	74.7	CO							
0002		CO							
0003	76.12	CO							
0005		CO							
0007		CO							
0008		CO							
0009		CO							
0011		CO							
0101	72.96	CO	72.25	300		CI	VC	96.42	
0102	82.93	CO							
0201	72.92	CO							
0202		CO							
0203	81.9	CO	79.46	225		CI	VC	1	
0204	81.44	CO							
0210	83.4	CO	0	225		CI	VC	4.47	
0301	73.57	CO	71.74	300		CI	VC	105.54	
0302	78.98	CO							
0303	80.72	SW							
0304	79.62	CO	78.44	100		CI	VC	14.32	13
0305	79.52	CO	78.65	100		CI	VC	9.06	50
0306	79.51	CO	78.78	100		CI	VC	11.05	100
0307	79.47	CO	78.95	100		CI	VC	10	71
0308	80.41	CO							
0401		CO	0	300		CI	VC	35.9	
0402	77.74	CO							
0403	78.69	CO							
0404	73.72	CO	71.31	300		CI	VC	38.28	93
2101	46.29	CO	45.09	300		CI	VC	115.88	10
2102	37.53	CO							
2103		CO	0	100		CI	VC	20.62	
2105	36.96	CO							
2107		CO							
2201	25.02	CO							
2202	28.8	CO							
2203	31.84	CO							
2204	34.67	CO							
2205	36.02	CO							
2301	20.59	CO	17.55	600	800	EG	BR	41.3	
2302	21.88	CO							
2401	16.28	CO	0	800	600	EG	BR	50.57	
3001	21.51	CO							
3101	22.01	CO	21.13	150		CI	VC	14.32	
3102	20.63	CO							
3103	23.07	CO							
3105		CO	0	150		CI	VC	2.83	
3201		CO							
3301	8.88	CO							
3302	8.85	CO							
3303		CO	0	375		CI	CO	5	
3304	8.93	CO							
3305	8.64	CO							
3306	13.79	CO							
3401		CO							
3403	12.43	CO							
3405	12.02	CO	10.52	150		CI	VC	9	
3406	10.16	CO	4.93	800	600	EG	BR	78.23	782
3410		SW							
3412		CO							
0010		CO							
0009		CO							
0310		CO							
1003		CO							
1007		CO							
2104		CO							
2111		CO	0	800		CI	VC	18.38	
2206		CO	0	800		CI	VC	18.97	
2206		CO							
2207		CO	33.88	100		CI	VC	4.24	14
2208		CO	0	800		CI	VC	18.03	
2209		CO	0	600	800	EG	BR	42.72	
2210		CO	0	800		CI	VC	18.68	
2305		CO	0	800	600	EG	BR	166.69	
2306		CO							
3002		CO	0	150		CI	VC	6.4	
3003		CO							
3104		CO							
3106		CO	0	150		CI	VC	2.24	
3108		CO	0	100		CI	VC	29.55	
3111		CO	0	800		CI	VC	17.46	
3307		CO							
3308		CO	6.2	800	600	EG	BR	18.03	14
3407		CO	0	800		CI	VC	15.56	
4305		CO							
4306		CO							
4411		CO							
4414		CO							
4415		CO							
4419		CO							
4420		CO							
0006		CO							
0103		CO							
0205		CO							
0206		CO	0	225		CI	VC	35.01	
0208		CO	0	225		CI	VC	20.03	
0211		CO							
0309		CO							
1001		CO							
1004		CO							
1006		CO							
2211		CO							
2304		CO							
3107		CO							
3109		CO							
3110		CO							
3113		CO							
3204		CO							
3205		CO							
3206		CO							
3404		CO							
3408		CO							
3409		CO							
3411		SW		610			BR	519.98	
3414		CO							
4102		CO							
4304		CO							
4416		CO							
4417		CO							
4418		CO							
3315		SW	0					107.69	

Refno	Cover	Func	Invert	Size.x	Size.y	Shape	Matl	Length	Grad
4101		CO	0	900		CI	CO	21.26	
4201	7.31	CO							
4202	7.51	CO							
4203		CO							
4301	7.45	CO	0	1000		CI	CO	17.49	
4302	7.42	CO							
4303		CO							
4401		SW	9.65	600		CI	CO	12.21	203
4402	7.45	CO	5.27	600		CI	CO	59.36	180
4403	7.24	CO							
4404	7.37	CO	4.93	1000		CI	CO	18.36	
4405		CO							
4406		CO	8.81	150		CI	VC	14.39	103
4407		CO	8.67	150		CI	CO	19.38	108
4408		CO	6.41	225		CI	CO	18.3	114
4409		CO	0	375		CI	CO	10	
4410		CO							
4412		CO							

WASTE WATER SYMBOLOGY

Foul Surface Combined Overflow

Manhole
Manhole, Side Entry
MainSewer, Public
MainSewer, Private
MainSewer, S104
Rising Main, Public
Rising Main, Private
Rising Main, S104
Highway Drain, Private

Foul Surface Combined

WW Site Termination
Air Valve
Cascade
Non Return Valve
Extent of Survey
Flow Meter
Gulley
Hatch Box
Head of System
Hydrobrake / Vortex
Inlet
Inspection Chamber
Bifurcation
Catchpit
Contaminated Surface Water
WW Pumping Station
Sludge Pumping Station
Sewer Overflow
T Junction/Saddle
LampHole
OilInterceptor
PenStock
Pump
RoddingEye
Soakaway
Summit
Valve
Valve Chamber
Washout Chamber
DropShaft
WW Treatment Works
Septic Tank
Vent Column
Network Storage Tank
Orifice Plate
Vortex Chamber
Penstock Chamber
Blind Manhole
Foul Surface Combined Overflow
Screen Chamber
Discharge Point
Outfall
Control Kiosk
Unspecified

Sludge Main, Public
Sludge Main, Private
Sludge Main, S104

ABANDONED PIPE

MainSewer
Rising Main
Highway Drain
Sludge Main

LEGEND

MANHOLE FUNCTION

FO	Foul		
SW	Surface Water		
CO	Combined		
OV	Overflow		

SEWER SHAPE

CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	HorseShoe
RE	Rectangular	UN	Unspecified
SQ	Square		

SEWER MATERIAL

AC	Asbestos Cement	DI	Ductile Iron
BR	Brick	PVC	Polyvinyl Chloride
PE	Polyethylene	CI	Cast Iron
RP	Reinforced Plastic Matrix	SI	Spun Iron
CO	Concrete	ST	Steel
CSB	Concrete Segment Bolted	VC	Vitrified Clay
CSU	Concrete Segment Unbolted	PP	Polypropylene
CC	Concrete Box Culverted	PF	Pitch Fibre
PSC	Plastic/Steel Composite	MAC	Masonry, Coursed
GRC	Glass Reinforced Concrete	MAR	Masonry, Random
GRP	Glass Reinforced Plastic	U	Unspecified

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Scale: 1: 1250 Date: 10/10/2016
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Sheet 1 of 1

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SEWER RECORDS

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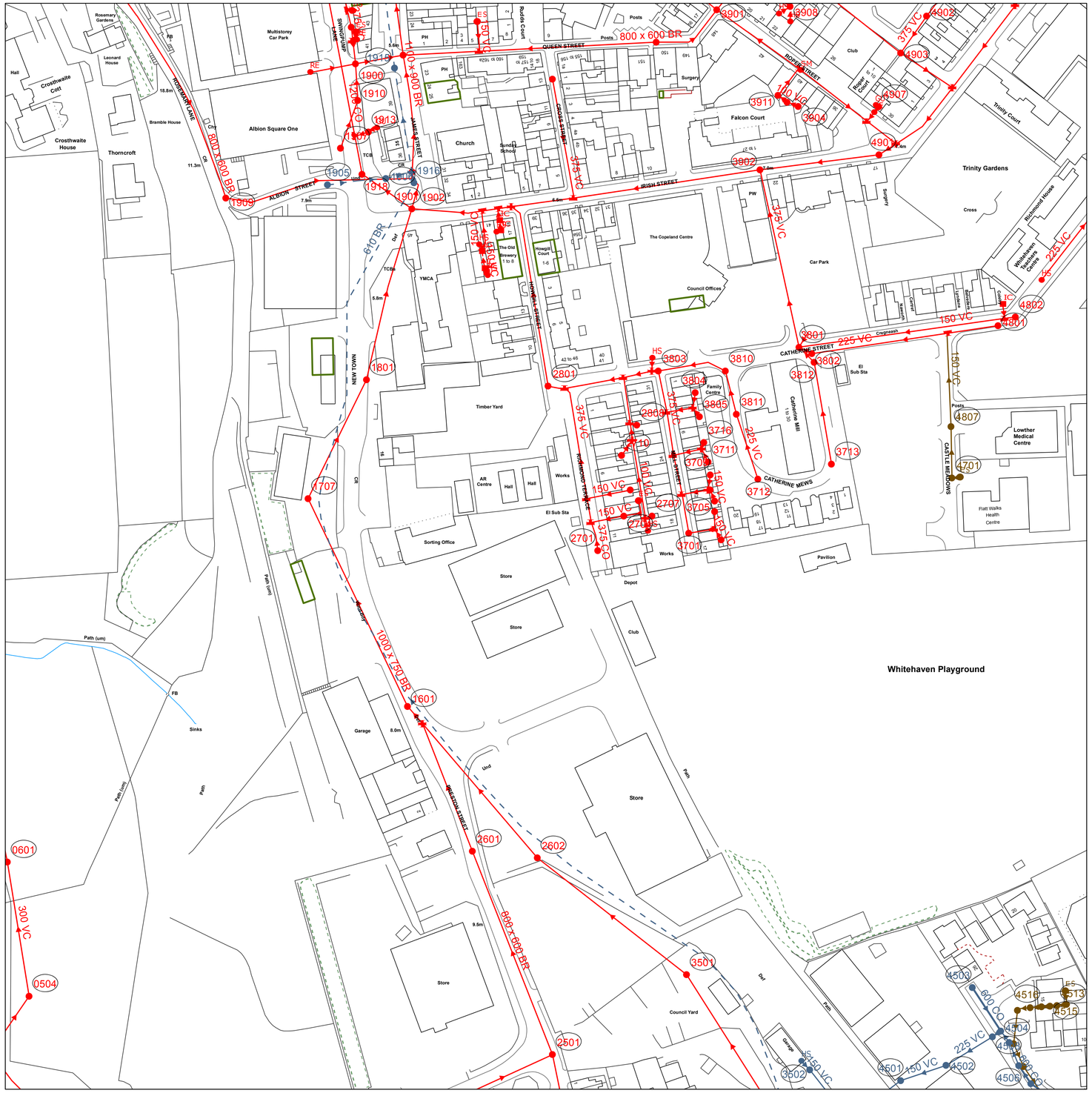
OS Sheet No: NX9717SW

Scale: 1: 1250 Date: 10/10/2016



Refno	Cover	Func	Invert	Size.x	Size.y	Shape	Matl	Length	Grad
0504	71.62	CO							
0601	71.1	CO	69.29	300		CI	VC	55.11	52
1601	7.94	CO	4.43	1000	750	EG	BR	106.45	
1707		CO	0	1000	750	EG	BR	61.27	
1801	6.37	CO	2.56	1000	750	EG	BR	81.79	282
1900	5.42	CO							
1901	6.02	CO	2.85	1200		CI	CO	28.02	104
1902	5.94	CO	2.04	1200	900	EG	BR	39.13	43
1903	5.61	CO							
1905	7.12	SW	6.19	600		CI	CO	14.14	22
1906	6.02	SW							
1907	6.34	CO	3.36	375		CI	VC	23.41	213
1908	5.62	CO	3.56	375		CI	VC	17.12	23
1909	10.44	CO	7.68	800	600	EG	BR	87.8	
1910	5.66	CO							
1913		CO							
1915		SW							
1916		SW							
1917		CO							
1918	6.29	CO							
2501	10.69	CO							
2601	9.01	CO	0	800	600	EG	BR	83.32	
2602	8.68	CO	4.38	800	600	EG	BR	81.57	
2701	6.9	CO	4.9	375		CI	CO	7.07	
2704	7.17	CO							
2707		CO	0	100		CI	VC	3.16	
2709	6.98	CO	6.51	150		CI	VC	20.4	
2710		CO	0	100		CI	VC	8.6	
2801	7.02	CO	4.09	800	600	EG	BR	86.05	
2808		CO							
2901	7.5	CO							
3501	8.49	CO							
3502		SW							
3701	6.98	CO							
3703	7.04	CO	6.28	150		CI	VC	5.83	
3705	7.06	CO	0	225		CI	VC	20.17	
3706	7.09	CO	6.32	150		CI	VC	5.39	28
3707	7.01	CO	6.11	150		CI	VC	1	
3709	7.14	CO	6.28	150		CI	VC	7.07	
3711	7.09	CO	6.24	100		CI	VC	6.71	
3712	7.54	CO	5.98	225		CI	VC	31.62	99
3713	7.67	CO	6.28	225		CI	VC	47.66	191
3716	7.24	CO	6.26	150		CI	VC	3.16	
3801	7.61	CO	5.81	150		CI	VC	41.98	44
3802	7.61	CO	6.01	225		CI	VC	6.71	224
3803	7.43	CO							
3804	7.25	CO	6.15	150		CI	VC	7.07	
3805	7.1	CO	6.18	150		CI	VC	5	
3810	7.49	CO							
3811	7.33	CO	5.66	225		CI	VC	20.62	50
3812	7.55	CO	6.03	225		CI	VC	9.9	99
3901	7.6	CO							
3902	7	CO							
3903	7.87	CO	5.33	800	600	EG	BR	117.15	45
3904		CO							
3905		CO							
3908		CO							
3911		CO							
4501		SW							
4502	10.29	SW	0	150		CI	VC	22.14	
4503		SW	9.57	600		CI	CO	23.91	199
4504		SW							
4505		SW	9.48	600		CI	CO	6.55	218
4506		SW	9.54	600		CI	CO	11.63	194
4507		SW	9.59	600		CI	CO	10.11	202
4508		SW	9.42	225		CI	VC	25.25	316
4509	9.3	FO		150		CI	VC	11.46	
4510	9.16	FO							
4512		FO		100		CI	PVC	4.57	
4513		FO		100		CI	PVC	3.2	
4514		FO		100		CI	PVC	6.21	
4515		FO		100		CI	PVC	3.92	
4516		FO		100		CI	PVC	5.19	
4517		FO		100		CI	PVC	15.48	
4701		FO							
4801	7.49	CO	6.25	225		CI	VC	86.98	378
4802	7.5	CO	6.95	150		CI	VC	100.98	89
4807	0	FO							
4901	7.3	CO	4.17	800	600	EG	BR	55.44	168
4902	7.99	CO	5.45	375		CI	VC	30	
4903	7.92	CO							
4907		CO							
0905		CO	0	800	600	EG	BR	93.93	
1914		CO							
1919		CO							
1920		SW							
1921		CO							
1927		CO							
2702		CO	0	375		CI	VC	69.98	
2705		CO	0	100		CI	VC	6.08	
2802		CO							
2802		CO							
2806		CO	0	375		CI	VC	6	
2813		CO							
2902		CO							
3504		SW	0	150		CI	VC	5.66	
3808		CO	4.85	375		CI	VC	41.98	44
3809		CO							
3906		CO	0	800	600	EG	BR	48.01	
3909		CO		150		CI	VC	7.02	
3910		CO		150		CI	VC	6.31	
4803		CO	0	225		CI	VC	63.41	
4805		CO							
4905		CO							
1602		CO	0	800	600	EG	BR	10.63	
1911		CO							
1912		SW							
1922		CO							
1925		CO							
1926		CO		100		CI	VC	0.73	
2703		CO							
2706		CO							
2708		CO							
2711		CO							
2803		CO							
2805		CO							
2807		CO	0	375		CI	VC	13.34	
2809		CO							
2812		CO							
2902		CO							
2903		CO							
2904		CO	0	800	600	EG	BR	46.3	
2905		CO							
2908		CO							
3704		CO							
3708		CO							
3710		CO							
3714		CO							
3715		CO							
3806		CO							
3807		CO							
3907		CO							
3912		CO							
4806		CO							
4808		CO							
4904		CO	0	800	600	EG	BR	37.23	
4906		CO							
4006		CO							

WASTE WATER SYMBOLOGY

Foul Surface Combined Overflow

Manhole
Manhole, Side Entry
MainSewer, Public
MainSewer, Private
MainSewer, S104
Rising Main, Public
Rising Main, Private
Rising Main, S104
Highway Drain, Private

Foul Surface Combined

WW Site Termination
Air Valve
Cascade
Non Return Valve
Extent of Survey
Flow Meter
Gulley
Hatch Box
Head of System
Hydrobrake / Vortex
Inlet
Inspection Chamber
Bifurcation
Catchpit
Contaminated Surface Water
WW Pumping Station
Sludge Pumping Station
Sewer Overflow
TJunction/Saddle
LampHole
OilInterceptor
PenStock
Pump
RoddingEye
Soakaway
Summit
Valve
Valve Chamber
Washout Chamber
DropShaft
WW Treatment Works
Septic Tank
Vent Column
Network Storage Tank
Orifice Plate
Vortex Chamber
Penstock Chamber
Blind Manhole
Screen Chamber
Discharge Point
Outfall

Sludge Main, Public
Sludge Main, Private
Sludge Main, S104

ABANDONED PIPE
MainSewer
Rising Main
Highway Drain
Sludge Main

Control Kiosk
Unspecified

LEGEND

MANHOLE FUNCTION

FO	Foul
SW	Surface Water
CO	Combined
OV	Overflow

SEWER SHAPE

CI	Circular	TR	Trapezoidal
EG	Egg	AR	Arch
OV	Oval	BA	Barrel
FT	Flat Top	HO	HorseShoe
RE	Rectangular	UN	Unspecified
SQ	Square		

SEWER MATERIAL

AC	Asbestos Cement	DI	Ductile Iron
BR	Brick	PVC	Polyvinyl Chloride
PE	Polyethylene	CI	Cast Iron
RP	Reinforced Plastic Matrix	SI	Spun Iron
CO	Concrete	ST	Steel
CSB	Concrete Segment Bolted	VC	Vitrified Clay
CSU	Concrete Segment Unbolted	PP	Polypropylene
CC	Concrete Box Culverted	PF	Pitch Fibre
PSC	Plastic/Steel Composite	MAC	Masonry, Coursed
GRC	Glass Reinforced Concrete	MAR	Masonry, Random
GRP	Glass Reinforced Plastic	U	Unspecified

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Scale: 1: 1250 Date: 10/10/2016
138 Nodes
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SEWER RECORDS

OS Sheet No: NX9717NW

Scale: 1: 1250 Date: 10/10/2016

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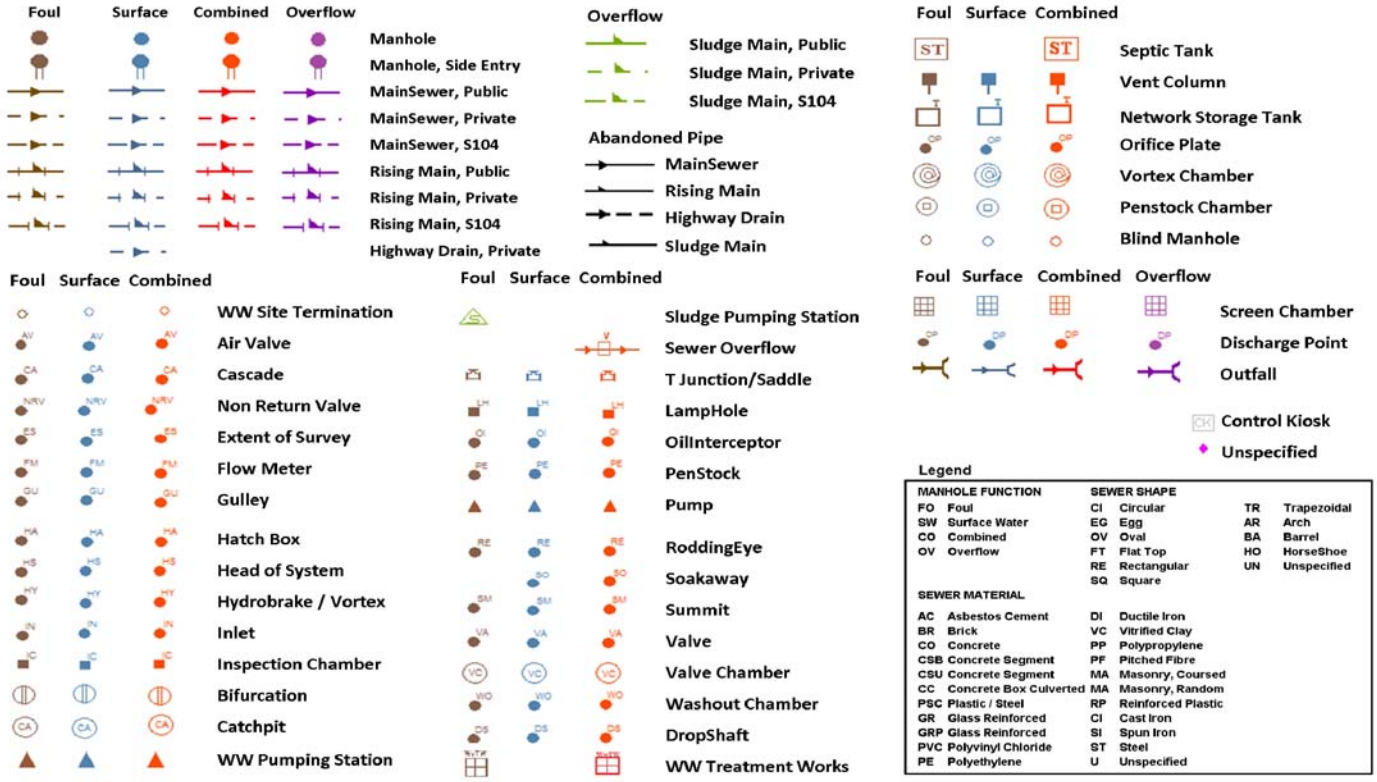
WASTE WATER SYMBOLOGY



Legend

MANHOLE FUNCTION		SEWER SHAPE			
FO	Foul	CI	Circular	TR	Trapezoidal
SW	Surface Water	EG	Egg	AR	Arch
CO	Combined	OV	Oval	BA	Barrel
OV	Overflow	FT	Flat Top	HO	HorseShoe
		RE	Rectangular	UN	Unspecified
		SQ	Square		

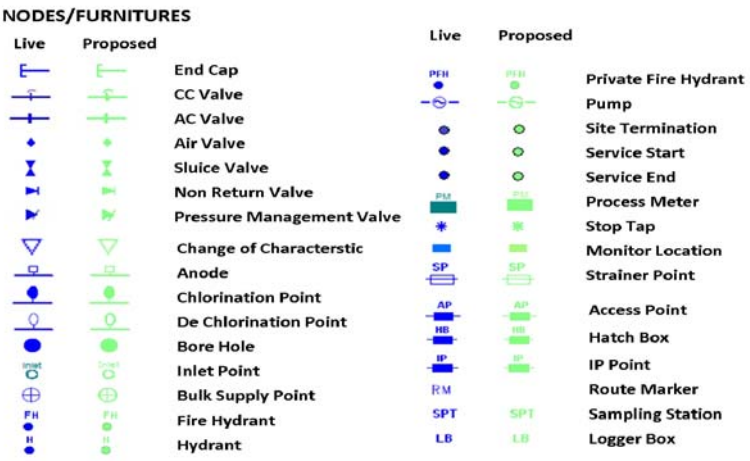
SEWER MATERIAL			
AC	Asbestos Cement	DI	Ductile Iron
BR	Brick	VC	Vitrified Clay
CO	Concrete	PP	Polypropylene
CSB	Concrete Segment	PF	Pitched Fibre
CSU	Concrete Segment	MA	Masonry, Coursed
CC	Concrete Box Culverted	MA	Masonry, Random
PSC	Plastic / Steel	RP	Reinforced Plastic
GR	Glass Reinforced	CI	Cast Iron
GRP	Glass Reinforced	SI	Spun Iron
PVC	Polyvinyl Chloride	ST	Steel
PE	Polyethylene	U	Unspecified

CLEAN WATER SYMBOLOGY

PIPE WORK

ABANDONED PIPE

NODES/FURNITURES



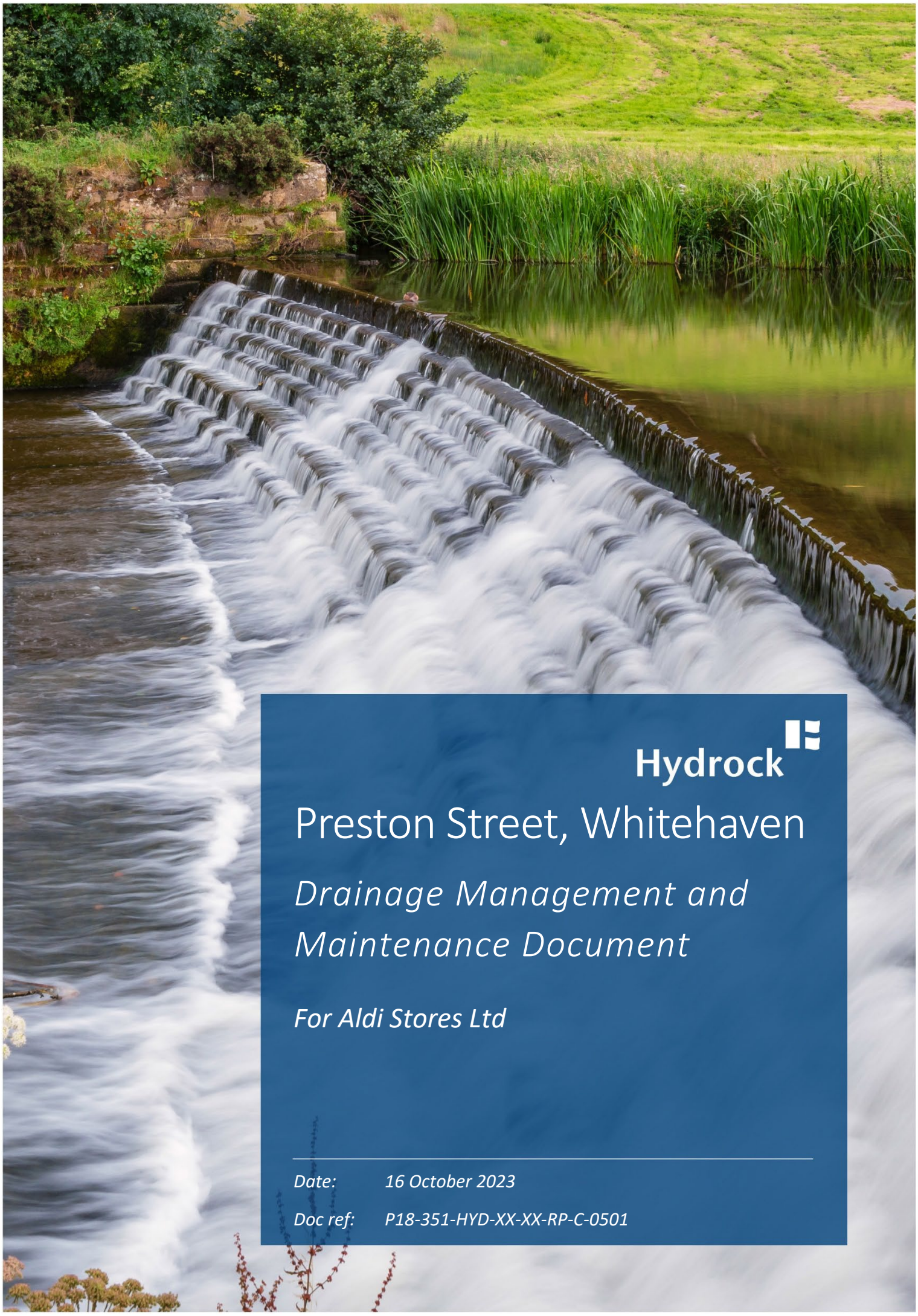
PROPERTY TYPES

Legend

MATERIAL TYPES		LINING TYPES	
AC	ASBESTOS CEMENT	CL	CEMENT LINING
CI	CAST IRON	TB	TAR OR BITUMEN
CU	COPPER	ERL	EPOXY RESIN
CO	CONCRETE		
DI	DUCTILE IRON	INSERTION TYPES	
GI	GALVANISED IRON		
GR	GREY IRON	DD	DIE DRAWN
OT	OTHERS	DR	DIRECTIONAL DRILLING
PB	LEAD	MO	MOLING
PV	uPVC	PI	PIPELINE
SI	SPUN IRON	SL	SLIP LINED
ST	STEEL		
UN	UNKONWN		
PE	POLYETHYLENE		

Appendix G - Drainage Maintenance Plan

Reference	Title
P18-351-HYD-XX-XX-DR-C-0051 Rev P01	Proposed Drainage Maintenance Plan



Hydrock

Preston Street, Whitehaven

Drainage Management and Maintenance Document

For Aldi Stores Ltd

Date: *16 October 2023*

Doc ref: *P18-351-HYD-XX-XX-RP-C-0501*

DOCUMENT CONTROL SHEET

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Project name	Preston Street, Whitehaven	
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Document Production Record		
Issue Number	P01	Name
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P01	S2	16/10/2023	First Issue

Hydrock Consultants Limited has prepared this report in accordance with the instructions of the above-named client for their sole and specific use. Any third parties who may use the information contained herein do so at their own risk.

CONTENTS

1. INTRODUCTION

This Drainage Management and Maintenance Plan has been prepared by Hydrock Consultants Limited (Hydrock) on behalf of our client Aldi Stores Ltd as a guide to the implementation, management, and maintenance of the drainage system for Preston Street, Whitehaven.

This document should be read in conjunction with Hydrock's Proposed Drainage Layout drawing 79-EXXX-3E-ZZ-XX-DR-C-Ro-50-20-11-1000.

2. OPERATION AND MAINTENANCE REQUIREMENTS

Proprietary Treatment Systems

The responsibility for this maintenance will be placed with Aldi Stores Ltd.

Proprietary treatment systems will require routine maintenance to ensure continuing operation to design performance standards.

Many proprietary systems are beneath the ground, and malfunctioning is not easy to detect, and it is therefore often ignored unless alarms are provided or the system is designed to cause localised surface ponding if full. If systems lead to other surface features, early warning of maintenance being required may be easily observed at the inlet to the feature which should be designed to prevent it entering the main part of the component.

Lack of routine maintenance is more likely to cause poor outflow water quality than with other SuDS due to resuspension of solids and anaerobic conditions developing within the device. For example, anaerobic conditions can develop in deep sumps and catchpits that result in nutrients and metals being released from captured sediments.

During the first few months after installation, subsurface treatment units should be visually inspected after rainfall events, and the amount of deposition measured to give the operator an idea of the expected rate of sediment and oil deposition. After this initial period, systems should be inspected every six months to verify the appropriate level of maintenance. During these inspections, the floating debris and any floating oils should normally be removed. This may be done using a van-mounted system, without the need for a large tanker.

Silt should be removed when it reaches 75% of the capacity of the sump. In most situations, the units should be fully cleaned out at least annually. If there is a significant spill of oil (or other pollutant) the system should be cleaned immediately.

Proper disposal of oil, solids and floating debris removed from components must be ensured, and the environmental regulator should be approached for advice where there are any doubts concerning disposal options. A small portion of water will be removed along with the pollutants during the clean-out process, which should be considered when costing sediment disposal processes.

Harmful vapours may develop in subsurface filtration or hydrodynamic separation units, as hydrocarbons may remain there for extended periods of time. Appropriate testing for harmful vapours and venting should be undertaken whenever access for maintenance is required. Removal of oil, silt and other pollutants must be in accordance with the appropriate waste management legislation.

Table 14.2 of The CIRIA SuDS Manual provides guidance on the type of operation and maintenance schedule that may be appropriate for a proprietary treatment system. The list of actions is not exhaustive and some actions may not always be required

CIRIA SuDS Manual Table 14.2 - An Example of Operation and Maintenance Requirements for a Proprietary Treatment System

Maintenance Schedule	Required Action	Typical Frequency
Routine Maintenance	Remove litter and debris and inspect for sediment, oil and grease accumulation	Six monthly
	Change the filter media	As recommended by manufacturer
	Remove sediment, oil, grease and floatables	As necessary – indicated by system inspections o immediately following significant spill
Remedial Actions	Replace malfunctioning parts or structures	As required
Monitoring	Inspect for evidence of poor operation	Six monthly
	Inspect filter media and establish appropriate replacement frequencies	Six monthly
	Inspect sediment accumulation rates and establish appropriate removal frequencies	Monthly during first half year of operation, then every six months

2.1 Filter Strips

The responsibility for this maintenance will be placed with Aldi Stores Ltd.

Filter strips will require regular maintenance to ensure continuing operation to design performance standards.

The treatment performance of filter strips is dependent on maintenance, and robust management plans will be required to ensure that maintenance is carried out in the long term.

Maintenance of filter strips is relatively straightforward for landscape contractors and typically there should only be a small amount of extra work (if any) required for a filter strip over and above what is necessary for standard public open space. Providing landscape management is already required at site, filter strip maintenance should therefore have marginal cost implications. However, regular inspection and maintenance is important for the effective operation of filter strips as designed. Maintenance responsibility for a filter strip should always be placed with an appropriate organisation. If filter strips are implemented within private property, owners should be educated on their routine maintenance needs, and should understand the long-term Maintenance Plan and any legally binding maintenance agreement.

Access for maintenance vehicles should always be available. However, this is not usually a constraint due to the likely location of the filter strip adjacent to impermeable areas. Litter and debris removal should be undertaken as part of general landscape maintenance for the site and before any other SuDS management task. All litter should be removed from site.

The major maintenance requirement for filter strips is mowing. This should ideally retain grass lengths of 75-150mm across the main “treatment” surface to assist in filtering pollutants and retaining sediments and to reduce the risk of flattening during runoff events. However, longer vegetation lengths, where appropriate, are not considered to pose a significant risk to functionality.

Grass clippings should be disposed of either off site or outside the area of the filter strip to remove nutrients and pollutants. All vegetation management activities should take account of the need to maximise biosecurity and prevent the spread of invasive species.

Occasionally, sediment will need to be removed (e.g. once deposits exceed 25mm in depth), although this can be minimised by ensuring that upstream areas are fully stabilised in advance. Sediments excavated from a filter strip that receives runoff from residential or standard road and roof areas are generally not of toxic or hazardous material and can therefore be safely disposed of by either land application or landfilling. However, consultation should take place with the environmental regulator to confirm appropriate protocols. Sediment testing may be required before sediment excavation to determine its classification and appropriate disposal methods.)or runoff from streets with high vehicle traffic, sediment testing will be essential. In the majority of cases, it will be acceptable to distribute the sediment on site if there is an appropriate safe and acceptable location to do so.

Any damage due to sediment removal or erosion should be repaired and immediately reseeded or planted.

Table 15.1 of The CIRIA SuDS Manual provides guidance on the type of operational and maintenance requirements that may be appropriate. The list of actions is not exhaustive and some actions may not always be required.

CIRIA SuDS Manual Table 15.1 - Operation and Maintenance Requirements for Filter Strips

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter and debris	Monthly (or as required)
	Cut the grass – to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly (at start, the as required)
	Inspect filter strip surface to identify evidence of erosion, poor vegetation growth, compaction, ponding, sedimentation and contamination (e.g. oils)	Monthly (at start, then half yearly)
	Check flow spreader and filter strip surface for even gradients	Monthly (at start, then half yearly)
	Inspect gravel flow spreader upstream of filter strip for clogging	Monthly (at start, then half yearly)
	Inspect silt accumulation rates and establish appropriate removal frequencies	Monthly (at start, then half yearly)
Occasional Maintenance	Reseed areas of poor vegetation growth; alter plant types to better suit conditions, if required	As required or if bare soil is exposed over > 10% of the filter strip area
Remedial Actions	Repair erosion or other damage by re-turfing or reseeding	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oils or petrol residues using safe standard practice	As required

2.2 Filter Drains

The responsibility for this maintenance will be placed with Aldi Stores Ltd.

Filter drains will require regular maintenance to ensure continuing operation to design performance standards. The treatment performance of filter drains is dependent on maintenance, and robust management plans will be required to ensure that maintenance is carried out in the long term.

Regular inspection and maintenance is important for the effective operation of filter drains as designed. Maintenance responsibility for a filter drain should always be placed with an appropriate organisation. Adequate access should always be provided to the filter drain for inspection and maintenance. If filter drains are implemented within private property, owners should be educated on their routine maintenance needs, and should understand the long-term Maintenance Plan and any legally binding maintenance agreement.

Litter (including leaf litter) and debris removal should be undertaken as part of general landscape maintenance for the site and before any other 6u'6 management task. All litter should be removed from site.

Table 16.1 of The CIRIA SuDS Manual provides guidance on the type of operational and maintenance requirements that may be appropriate. The list of actions is not exhaustive and some actions may not always be required.

Sediments excavated from upstream pre-treatment devices that receive runoff from residential or standard road and roof areas are generally not toxic or hazardous material and can therefore be safely disposed of by either land application or landfilling. However, consultation should take place with the environmental regulator to confirm appropriate waste management protocols and compliance with legislation. Sediment testing may be required before sediment excavation to determine its classification and appropriate disposal methods. For industrial site runoff, sediment testing will be essential. In the majority of cases, it will be acceptable to distribute the sediment on site, if there is an appropriate safe and acceptable location to do so. Any damage due to sediment removal or erosion should be repaired and immediately reseeded or planted.

CIRIA SuDS Manual Table 16.1 - Operation and Maintenance Requirements for Filter Drains

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly (or as required)
	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
	Remove sediment from pre-treatment devices	Six monthly, or as required
Occasional Maintenance	Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (e.g. NJUG, 2007 or BS 3998:2010)	As required
	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	Five yearly, or as required
	Clear perforated pipework of blockages	As required