BETTS HYDRO
CONSULTING ENGINEERS

LAND OFF WHITEHAVEN ROAD
CLEATOR MOOR

FLOOD RISK ASSESSMENT AND
DRAINAGE MANAGEMENT STRATEGY

For

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SNG
Architecture & Design

AUGUST 2022

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EXECUTIVE SUMMARY

This Flood Risk Assessment and Drainage Management Strategy has been prepared to support a planning application for residential development on the former St. Bega Chapel site off Whitehaven Road in Cleator Moor.

Flood Risk

The site lies within Flood Zone 1, 2 and 3 based on the Environment Agency Flood Map for Planning and approximately covers 0.54ha. In accordance with planning policy, residential development proposed within Flood Zone 3, needs to be supported by the Exception Test. This is a planning test to be carried out by an appropriately qualified consultant, part of the Exception Test is satisfied by the provision of a site-specific Flood Risk Assessment.

Consultations with the Environment Agency, Cumbria County Council, Copeland Borough Council, and United Utilities have been undertaken and have identified historical flooding of the site and neighbouring areas in 1999, 2005 and 2017, due to the natural topography of the site and the proximity to Nor Beck (Main River) located adjacent to the western boundary.

Given the location of this Main River, consultations with the Environment Agency were undertaken to obtain the most up-to-date information. It was identified that due to the scale of the existing hydraulic model, some refinement was required. A hydraulic modelling exercise was therefore undertaken to support this assessment using the Environment Agency's existing modelling to assess in more detail the potential fluvial flood risks to the site.

The modelling undertaken identified that the development site is at risk of fluvial flooding during the 1% AEP, 1% AEP plus 30% Climate Change, and the 0.1% AEP events from the River Ehen and its tributaries (River Keekle, and Nor Beck which is located onsite). As the site is at risk in the fluvial events mitigation measures will be incorporated onsite to ensure the development is safe over its lifetime. The primary mitigation is typically setting the finished floor levels above the predicted top water level in the design event (fluvial defended 1 in 100 year plus 30% climate change event), which ranges between 71.71mAOD and 73.13mAOD. The finished floor levels for the residential dwellings vary across the site, however, a minimum freeboard of 300mm above the predicted flood water level in the design event will be achieved.

The additional modelling has also shown that in the 1% AEP, 1% AEP plus climate change, and the 0.1% AEP fluvial event, no increased flood risk to other properties will occur as a result of the proposals, and a net reduction in flood extent to land outside the site will be provided.

This assessment has therefore considered the potential flood resistance and resilience measures that should be incorporated to safeguards the proposed development not only from residual fluvial flood risks but also other sources of flooding. The key mitigation measures include appropriate levels design within the site, ensuring natural conveyance routes through the site are maintained and incorporation of a sustainable surface water management regime.

Drainage Strategy

A key focus of this assessment is on the sustainable management of surface water run-off to ensure no increased flood risk results from the development proposals. The surface water run-off management options have been assessed in accordance with the sustainable drainage

hierarchy, which is discharge to ground, followed by a waterbody or finally the public sewer system.

It is understood that based on the sites historical use there may be an existing connection from site into either Nor Beck. It is recommended that further onsite investigation of any existing drainage infrastructure is undertaken at an early stage to confirm the exact location, routing and condition of these existing drainage systems onsite, should they be re-used to serve for the new development proposals.

The proposed surface water management regime for the new development will therefore be to mimic the existing regime and discharge to Nor Beck, utilising the existing drainage infrastructure where at all practical. Should further investigation conclude the existing infrastructure is not suitable then a full new outfall to the River will be required subject to relevant consents and agreements.

In accordance with the SuDS Manual (CIRIA 753) and the Non-Statutory Technical Standards for Sustainable Drainage Systems, all sites should endeavour to achieve as close to pre-development greenfield rates as is viable, when discharging from site. Given the lack of information available to evidence the current condition, capacity and outfall location(s) of any formal drainage infrastructure severing the site, this assessment has therefore considered the site to be 100% permeable to calculate existing run-off rates.

Based on the site area, the pre-development greenfield rate (QBar) is calculated to be 6.0l/s. Restricting the rate of discharge will generate a requirement to provide onsite stormwater storage for the extreme rainfall events. The surface water scheme for the development will be designed to cater for the surface water run-off generated in the events up to and including the 1 in 100yr return period event with allowance for climate change.

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

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Figures & Tables

Specialist Software

- MicroDrainage WinDES (v.14.1) – Calculation of Greenfield run-off rates IH124/ICP-SUDS, Greenfield run-off volumes, rates of rainfall and stormwater storage estimates.
- Flood Estimation Handbook FEH CD-ROM (v.3.0) – Determination of Catchment Descriptors and depths of rainfall.

Abbreviations & Acronyms

AEP	Annual Exceedance Probability
BGS	British Geological Survey
CBC	Copeland Borough Council
CC	Climate Change
CCC	Cumbria County Council
EA	Environment Agency
FEH	Flood Estimation Handbook
FRA	Flood Risk Assessment
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
mAOD	Metres Above Ordnance Datum
NPPF	National Planning Policy Framework
NSRI	National Soil Resources Institute
PFRA	Preliminary Flood Risk Assessment
PPG	Planning Practice Guidance
QSE	Quick Storage Estimate
QBAR	Mean Annual Flood
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
TWL	Top Water Level
UU	United Utilities

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1.0 INTRODUCTION

1.1 Planning Policy Context

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

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

1.1.3 The proposals are solely 'residential' in nature and are classified as 'more vulnerable' in Table 2 (Flood Risk Vulnerability Classification) within the Planning Practice Guidance. The PPG identifies those certain types of development are not acceptable if located within high flood risk areas. Policy also notes that justification for locating certain development within these high-risk areas is required. The proposals should be supported by the Sequential Test, and the Exception Tests based on the site's location within Flood Zones 2 and 3, to conform with planning policy.

1.2 Site Context

1.2.1 This FRA&DMS has been prepared to support a planning application for residential development on the former St. Bega Chapel site off Whitehaven Road in Cleator Moor. The total site covers 0.54ha and the proposals will be complete with access, car parking, external works, landscaping, boundary walls/fencing, external services and drainage.

1.3 Consultation

1.3.1 The NPPF advises that the LPA (Copeland Borough Council) should consult with the Environment Agency who will provide advice and guidance on flood issues at a strategic level and in relation to planning applications. Consultations with the Environment Agency (EA), Cumbria County Council (CCC), Copeland Borough Council (CBC), and United Utilities (UU) have been carried out. These consultation responses have been used to support this assessment and can be seen in **Appendix B, C** and **D**.

2.0 EXISTING SITE LOCATION

2.1 Location

2.1.1 The site is accessed from Crossings Close (from Whitehaven Road) in Cleator Moor. The former St Bega Chapel building in currently located on the site, and will be demolished as part of the proposals. The nearest Ordnance Survey National Grid Reference is E: 385718, N: 363308 and the nearest postcode is CA25 5PY (see location plan in **Appendix E**). The total site area covers 0.54ha and is edged in red in **Figure 1**.

2.1.2 In terms of the surrounding land-use, the site is bounded to the north, east, south-east, and west by residential development. Located directly north of the site is Whitehaven Road, and to the east is Crossings Close. Finally, a tributary of Nor Beck is shown to flow through the development site parallel to the western boundary, before flowing south as illustrated in **Figure 1**.

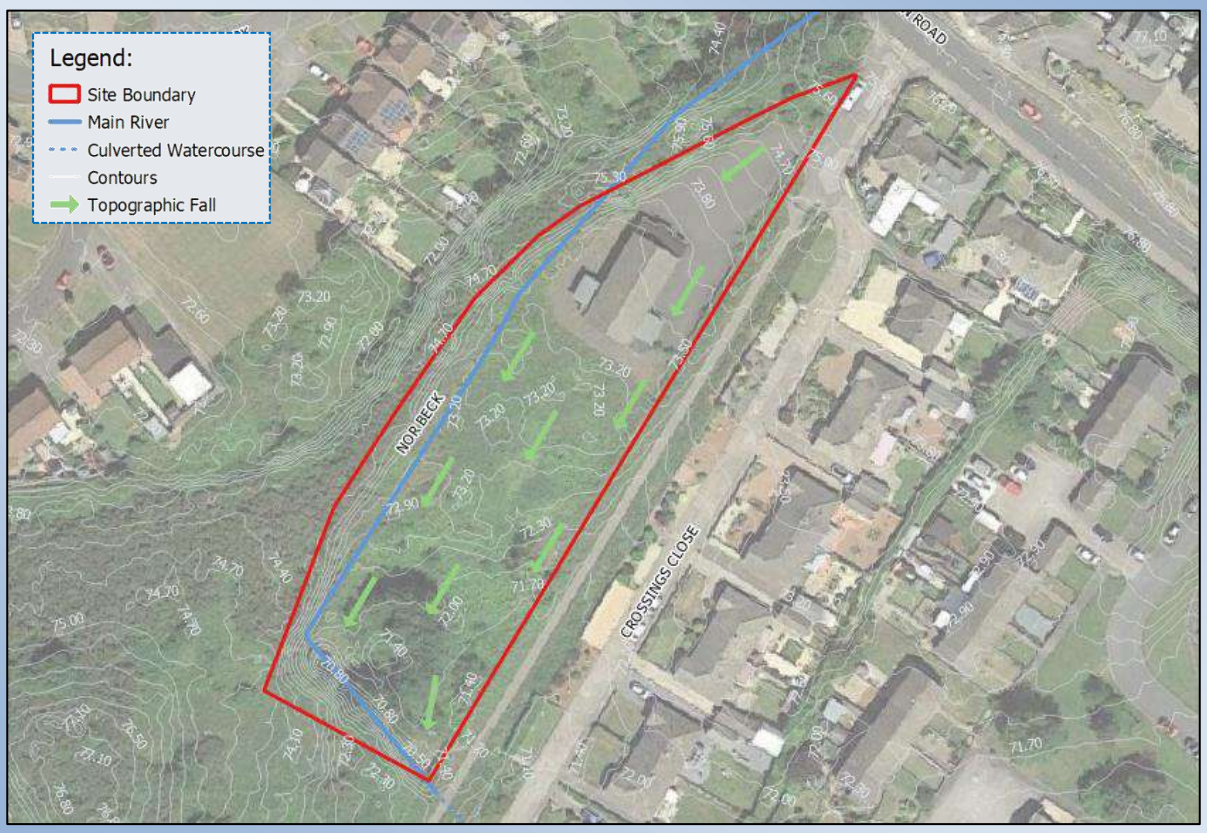

Figure 1: Existing Features Plan (Google Maps, 2022)

2.2 Existing and Historical Land Use

2.2.1 The development site is mostly undeveloped, although the former St Bega Chapel and associated hardstanding is present in the northern portion of the site, as illustrated above. No other historical uses have been determined during the preparation of this report.

2.3 Topography

2.3.1 A topographic survey has been undertaken and included within **Appendix F**. The topographic survey has identified that the site falls from 75.92mAOD in the northern corner of the site, down toward the onsite Main River (Nor Beck) to a level of 70.85mAOD. The arrows shown on **Figure 1** give a general indication of the fall across the site.

3.0 DEVELOPMENT PROPOSALS

3.1 Nature of the development

3.1.1 This assessment supports a planning application for 11no. residential properties and the proposals will be complete with access from Crossings Close in the north-eastern corner. Footpaths, car parking, external works lighting, landscaping, boundary walls/fencing, external services and drainage will also be included as shown within **Figure 2** (full layout included within **Appendix G**).

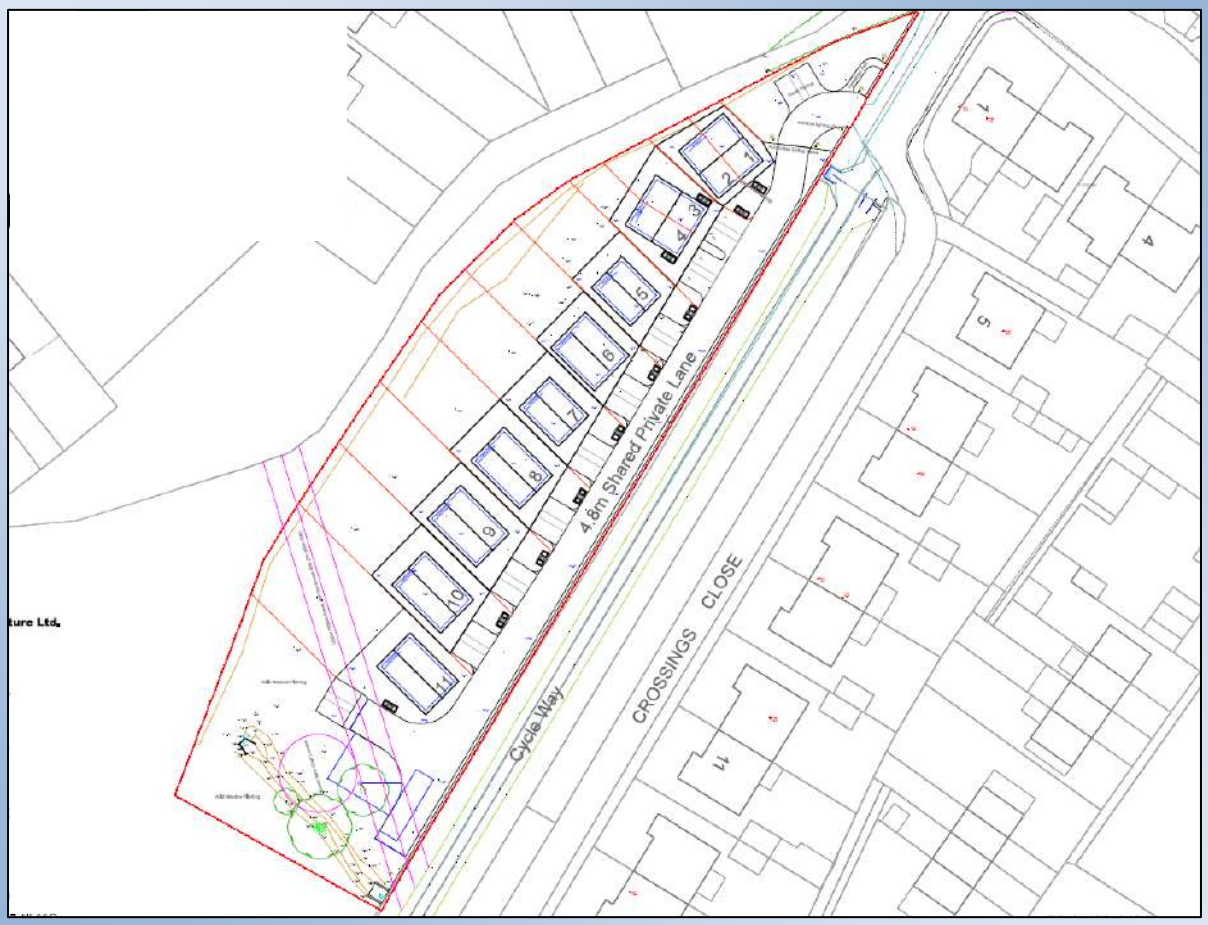

Figure 2: Proposed Planning Layout (SNG Architecture Ltd, 2022)

3.1.2 Review of the mapping has identified that a culverted Main River known as Nor Beck is located onsite adjacent to the western boundary. This Main River enters site from the north and flows in a southerly direction, becoming open channel adjacent to the southern boundary of site, before being culverted once again under Crossings Close.

3.1.3 The EA will require an 8m offset to be maintained from the top of the bank. This offset should provide clear and unimpeded access for future maintenance purposes. An Environmental Permit will also be required from the EA for any works being undertaken within 16m of a Main River, this permit is a standard requirement for any new development taking place within proximity to a Main River.

3.1.4 National and local policy identifies that Sustainable Drainage Systems (SuDS) should be incorporated into new development where at all feasible. SuDS should also be considered in proposed public open space areas to assist with providing attenuation and conveyance benefits.

4.0 SOURCES OF FLOOD RISK

4.1 Fluvial Flood Risk

4.1.1 Information relating to flood risk at the site has been obtained from the EA and the long-term government mapping. An extract of the EA's Flood Zone Map for Planning is show in **Figure 3**, which illustrates that the site is located within Flood Zones 1, 2 and 3.

4.1.2 Flood Zone 1 is an area not considered to be at risk of flooding. Flood Zone 2 is an area at 'low' to 'medium' risk of flooding (so an area at risk in the undefended 1 in 1000yr return period fluvial event). Flood Zone 3 is an area at medium to high risk, and an area at risk in the undefended 1 in 100yr return period fluvial event or the tidal 1 in 200yr return period event. In this case the primary source of flooding is fluvial given the sites proximity from the nearest tidal flood sources.

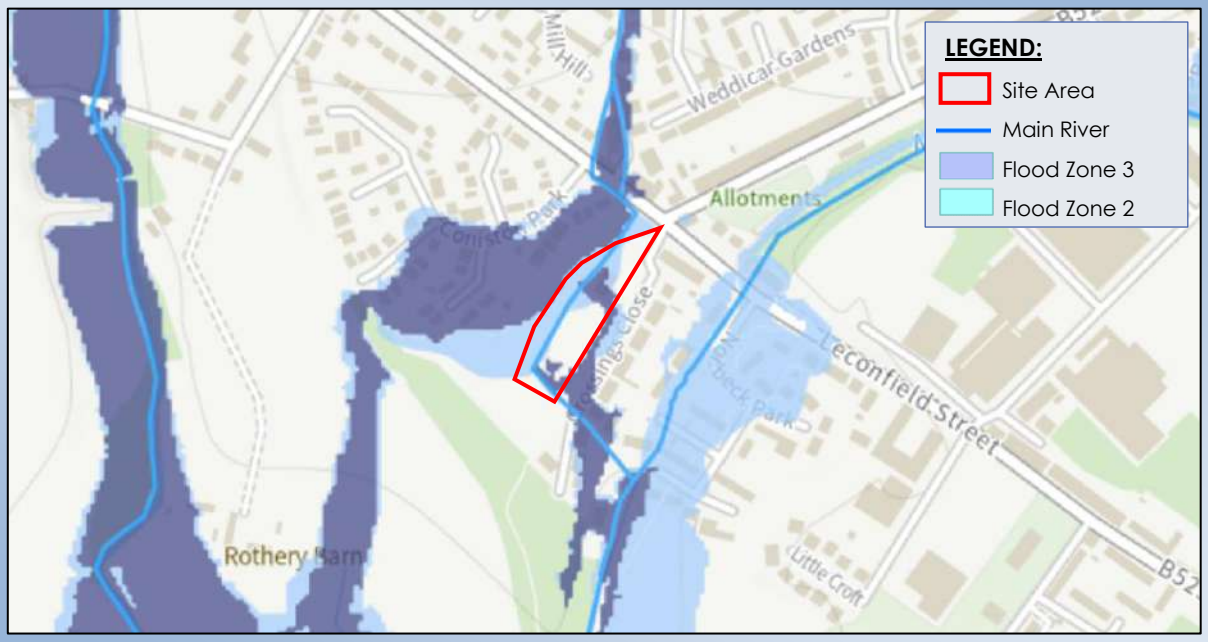

Figure 3: Flood Zone Map for Planning Extract with EA Node Locations (GOV.UK 2022)

4.1.3 The nearest Main River is the culverted watercourse which crosses the site, this is referred to as Nor Beck Tributary. This Main River enters site from the north and flows in a southerly direction, becoming open channel adjacent to the southern boundary of site, before being culverted once again under Crossings Close. This flows south into the Nor Beck Extension, and ultimately into River Keekle which is located less than 500m to the west of the site. The risk to the site from fluvial sources is identified to be low to high based on the long-term government flood maps, this is due to the site's proximity from these key watercourses (see full mapping in **Appendix B**).

Environment Agency Data Review

4.1.4 Given the primary flood risk source is from fluvial sources, consultations have been undertaken with the Environment Agency to obtain the most up-to-date information, to allow a better understanding to be gained of the potential flood risks at the site. The EA have provided predicted in-channel top water levels (TWLs) from the fluvial Ehen 2015 study. Updated climate change data, including a 30%, 35% and 70% increase in

river flows, were also provided from the Ehen Study 2020 climate change update. The model considers the key events including the 1 in 100yr and 1 in 1000yr return period events, along with the 1 in 100yr plus climate change scenarios, as noted in **Table 1**.

LOCATION ONSITE:		FLUVIAL TOP WATER LEVELS ONSITE IN THE KEY RETURN PERIOD EVENTS (mAOD)				
		1 in 100yr	1 in 100yr + 30% CC	1 in 100yr + 35% CC	1 in 100yr + 70% CC	1 in 1000yr
DEFENDED	Existing Building	73.13	73.15	73.17	73.18	73.16
	Southern Boundary	71.79	71.81	71.81	71.82	71.82
UNDEFENDED	Existing Building	73.15	73.16	73.17	73.19	73.17
	Southern Boundary	71.79	71.81	71.81	71.82	71.82

Table 1: Predicted Fluvial Modelled onsite Top Water Levels to mAOD (EA, 2022)

4.1.5 Although the EA have onsite top water levels, their existing hydraulic model is a large model extending from the River Keekle at Whitehaven, down to the River Ehen at Sellafield. Such a large model lacks the appropriate level of detail required to support a site specific Flood Risk Assessment; therefore, some refinement was required. The model was therefore refined by the adding a site specific topographical survey and reducing its computation grid size to improve its accuracy.

4.1.6 A hydraulic modelling exercise was therefore undertaken to support this assessment using the EA's existing modelling to assess in more detail the potential fluvial flood risks to the site from the River Ehen, but also the other neighbouring watercourses including the River Keekle, Nor Beck and the River Erewash.

Hydraulic Modelling

4.1.7 Betts Hydro obtained the EA's River Ehen model (and its tributaries, including the River Keekle, and Nor Beck), the model was refined by added site specific topographical survey and reducing its computation grid size to improve its accuracy. The full Hydraulic Assessment report (HYD662_WHITEHAVENRD_CLEATORMOOR_HYDRAULICASSESSMENT_01) details the improvements made to the model, including topographical data used. Various return period events were then re-run including the design event (1 in 100yr plus climate change) which will be used to determine any required flood mitigation measures. The hydraulic modelling outputs have been included within **Appendix H** for completeness.

4.1.8 The full hydraulic modelling report has also considered both the defended and the undefended events. The undefended scenarios define the Flood Zones 2 and 3, however, the defended scenarios represent the actual flood risk to the site. For full details regarding both the undefended and defended scenarios please see the full hydraulic modelling report included within **Appendix H**.

Existing Scenario

4.1.9 In the baseline scenarios were run using the EA's hydraulic Model with the topographic survey modifications. The model was run for both the undefended and defended

scenarios for the 1 in 100yr and 1 in 1000yr events. The model was also run for the defended 1 in 100yr plus CC event. A climate change factor of 30% increase in flow given that this is the latest standard requirement.

4.1.10 In terms of the proposals, this assessment has focused on the defended model results as these represent a real-world situation. The key modelled scenarios to be considered are the fluvial 1 in 100 year, 1 in 100 year plus 30% climate change, and the 1 in 1000 year events. For full flood depth and flood level plans, refer to **Appendix H**.

4.1.11 In the fluvial defended 1 in 100 year event, it is noted that the flood extent is nearly identical to the undefended 1 in 100 year extent, and it is therefore understood that the site does not benefit from any formal flood defences. The peak flood depth onsite was identified to be 0.31m, however, the majority of flooding onsite is identified to be 10mm or less. The flood level onsite ranges between approximately 71.70mAOD and 73.11mAOD.

4.1.12 In the fluvial 1 in 100 year event plus 30% climate change event, the peak flood depth onsite was identified to be approximately 0.32m in the southern part of site, close to Nor Beck. A flood depth of 0.20m was also identified near to the church, which is a slight increase when compared to the 1 in 100 year event flood depth. The remainder of flooding on site is mostly around 10mm or less, as illustrated in **Figure 4**. The peak flood level on site ranges between 71.71mAOD and 73.13maOD.

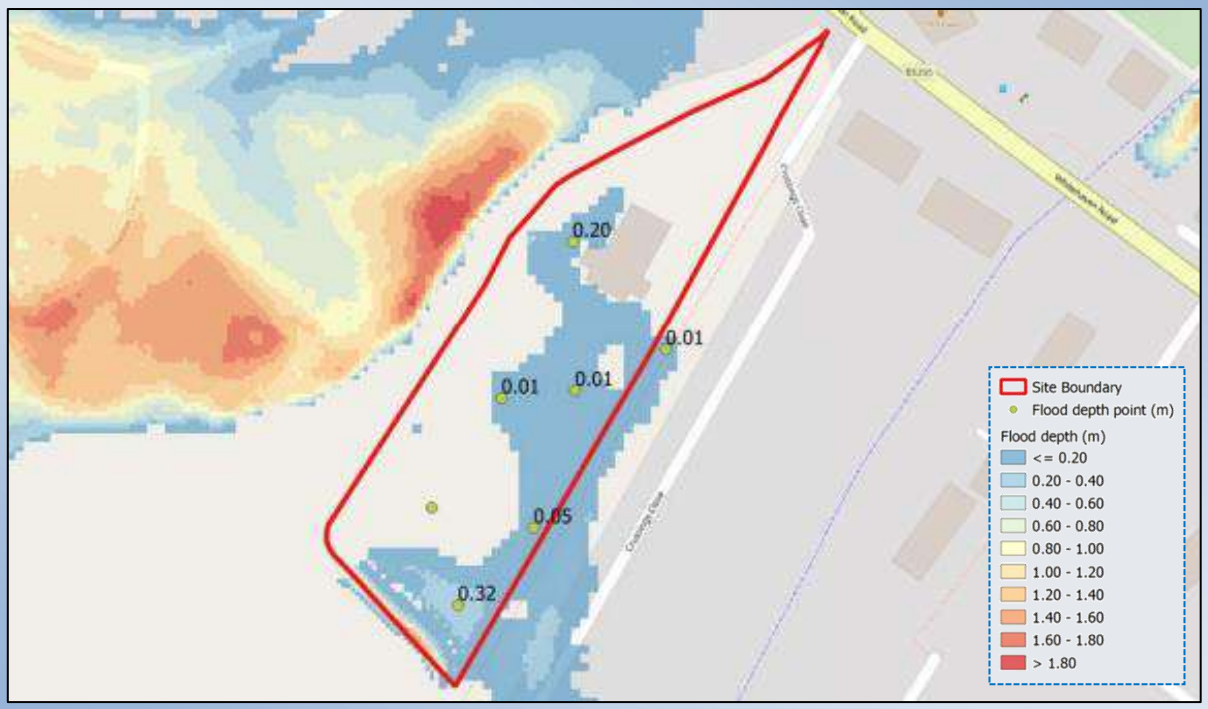

Figure 4: Defended 1 in 100 Year plus 30% CC Flood Depth Extract (Betts Hydro, 2022)

4.1.13 In the defended 1 in 1000 year event, the flood extent is also nearly identical to the undefended 1 in 1000 year extent. The peak flood depth with the site is approximately 0.33m, which is a slight increase when compared to the 1 in 100 year climate change event flood depth. The majority of the flooding on site is around 10mm or less although

there is a flood depth of approximately 0.21m adjacent to the church. The flood level ranges between approximately 71.72mAOD up to 73.14mAOD, which is a slight increase on the 1 in 100 year climate change event.

4.1.14 In summary, based on the modelling undertaken the development site is at risk of fluvial flooding during the 1% AEP, 1% AEP plus 30% Climate Change, and the 0.1% AEP events from the River Ehen and its tributaries (River Keekle, and Nor Beck which is located onsite).

Proposed Scenario

4.1.15 The hydraulic modelling exercise also considered the proposed scenario by incorporating proposed changes in levels, the full details and plans can be found in the Hydraulic Assessment report in **Appendix H**.

4.1.16 In the proposed 1 in 100 year scenario, the flood level ranges from 71.70mAOD to 73.37mAOD, with flood depths of up to 0.44m identified onsite. Review of the flood level plan for the 1 in 100 year plus 30% climate change event has identified that levels range from 71.71mAOD to 73.39mAOD, resulting in flood depths of up to 0.46m onsite (as shown in **Figure 5**. Furthermore, in the more extreme proposed 1 in 1000 year event the flood level ranges from 71.71mAOD to 73.41mAOD onsite. It should also be noted that no flooding was identified to the residential dwellings in the proposed scenario 1 in 100 year, 1 in 100 year plus climate change, and 1 in 1000 year events.

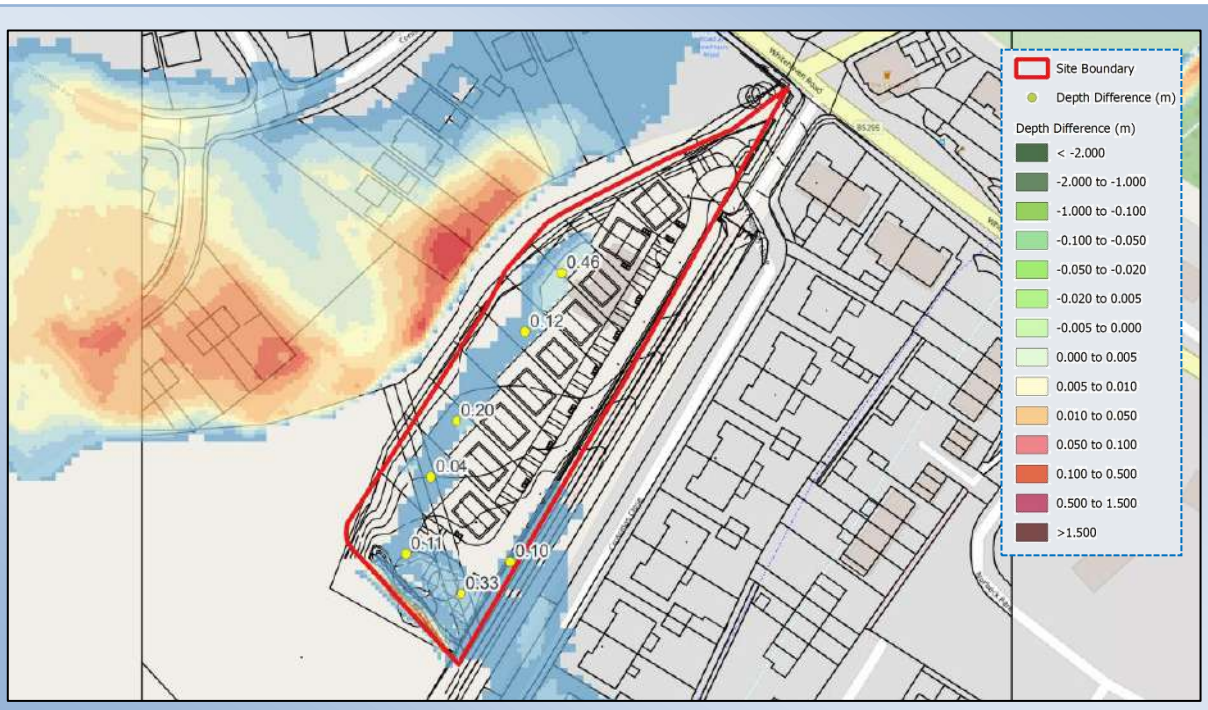

Figure 5: Proposed 1 in 100 Year plus 30% CC Flood Depth Extract (Betts Hydro, 2022)

4.1.17 It is therefore proposed that the FFL of the residential units will be raised 300mm above the predicted top water levels in the 1 in 100yr plus 30% climate change event (design event) to ensure the development remains dry, safe, and flood-free for its lifetime. Modelling of the proposed development scenario has shown that the flood risk can be mitigated in events up to and including the 0.1% AEP fluvial event.

4.1.18 The additional modelling has also shown that in the 1% AEP, 1% AEP plus climate change, and the 0.1% AEP fluvial event, no increased flood risk to other properties will occur as a result of the proposals, and a net reduction in flood extent to land outside the site will be provided as shown in **Figure 6**. To review the full Hydraulic Modelling Assessment, see **Appendix H**.

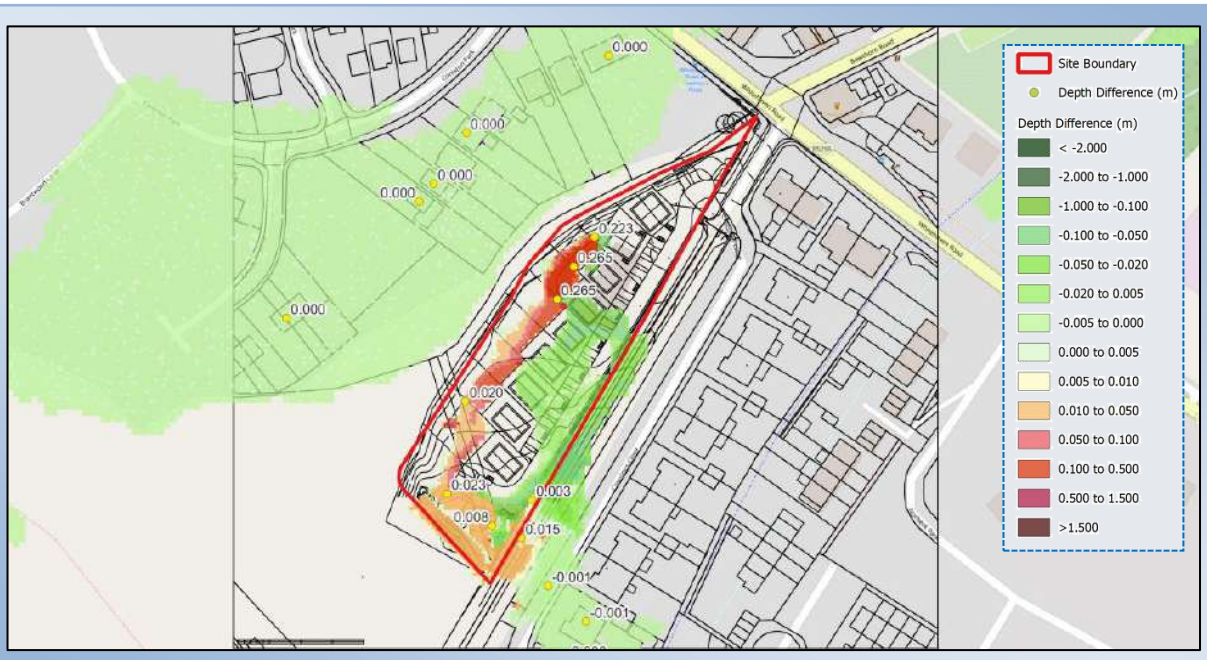

Figure 6: Defended 1 in 100 Year plus 30% CC Depth Difference Extract (Betts Hydro, 2022)

Safe Access and Egress

4.1.19 As the site is located within Flood Zones 1, 2 and 3, consideration for safe access and egress has been provided. The site is located within an EA Flood Alert Area, this means Nor Beck and the River Keekle are monitored at their locations in close proximity to the site, and that early warning would be provided in the event of a potential future flood event. This will provide future occupants of the properties with an early warning of future flood events and give them time to implement any emergency plans or procedures.

4.1.20 It is recommended that future occupiers of the dwellings look to prepare their own household Flood Plans based on their proximity to an area which is potential at high flood risk. These are documents which identify procedures to be carried out in the event of future flooding (IE. moving valuables upstairs, implementing temporary flood resistance measures and reviewing local media to determine whether evacuation is recommended). Flood Plans are not specific to a single type of flood source and can be used for a variety of flood sources such surface water and reservoir flooding. A flood plan would note the actions for the household to take before, during and after a flood event and there are multiple guidance documents available to assist in the preparation of these plans.

4.1.21 Although the proposals are to raise the residential dwellings above the TWL in the design event (fluvial 1 in 100 year plus 30% climate change), safe access and egress has still been considered. If evacuation from the site is advised, then occupants would

need to evacuate towards an area of safety located outside of the predicted floodplain extents, which can be achieved via Bowthorn Road located north of the site.

4.2 Tidal Flood Risk

4.2.1 The coastline is located over 5km west of the site. Due to the distance from the coast, the associated tidal flood risk to site is 'very low'.

4.3 Flood Risk Vulnerability Classification and Flood Zone Compatibility

4.3.1 The site lies within Flood Zones 1, 2 and 3 based on the Environment Agency Flood Map for Planning. Residential development is classified as 'more vulnerable' within the Planning Practice Guidance which supports the National Planning Policy Framework. The PPG notes that certain development types are only suitable for locating within Flood Zones 2 and 3, if the development can be justified and safeguarded for its design life.

4.3.2 As residential development is proposed within Flood Zones 2 and 3, the planning application for residential development will also need to be supported by the Sequential and Exception Tests. This is a planning test which should be carried out by an appropriately qualified professional. This site-specific Flood Risk Assessment will satisfy part of the exception test.

4.4 Surface Water Flood Risk

4.4.1 Surface water flooding occurs when rainwater is unable to drain away through the normal drainage systems or soak into the ground but lies on or flows over the ground instead. The risk associated with surface water run-off is indicated by the long-term flood risk mapping (extract shown in **Figure 7**).

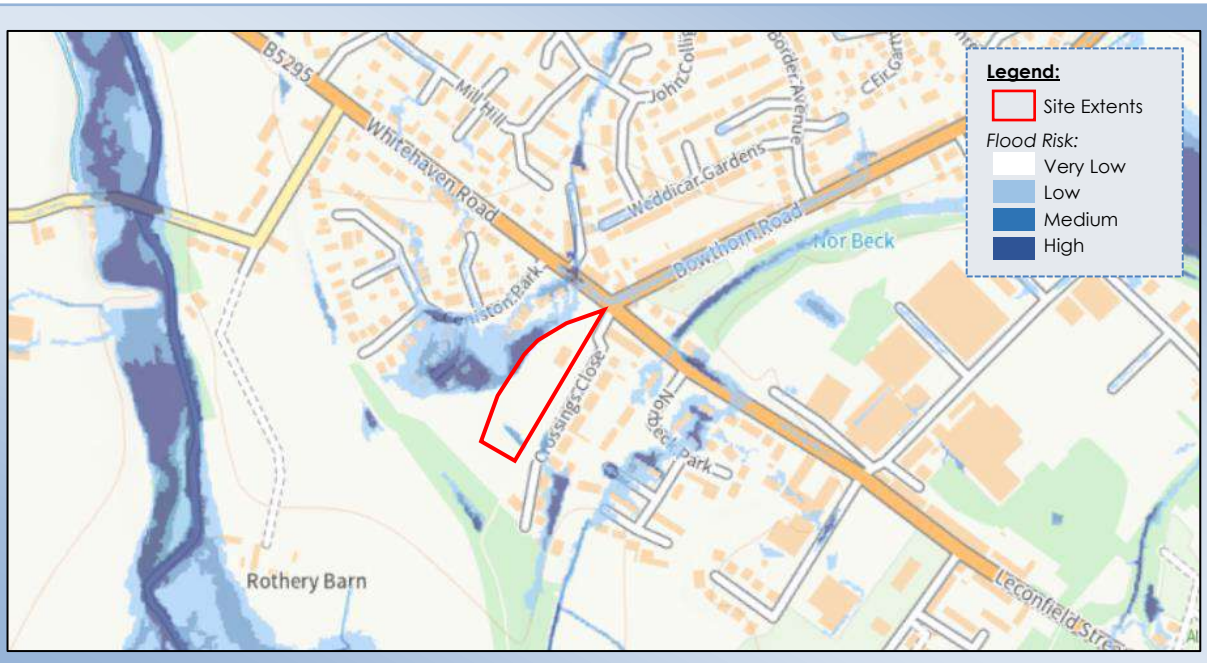

Figure 7: Surface Water Flood Map Extract (GOV.UK, 2022)

4.4.2 As indicated in **Figure 7**, the site is predominantly at very low risk from surface water flooding. There is an isolated area shown to be at low risk form surface water flooding although this isolated area is understood to be associated with the open channel section of the onsite Main River.

4.4.3 The potential depths and velocities of surface water flooding can be identified on the long-term national flood mapping datasets. This mapping notes the potential depths of flooding in those low risk areas onsite to be between 300mm and 900mm. The potential volumes are anticipated to be less than 0.25m/s in those areas at low risk.

4.4.4 Risk to the proposals from surface water flooding will be managed and reduced, post-development through appropriate levels design and incorporation of a sustainable drainage management system. Natural flow routes will where practical be maintained, and a formal sustainable surface water drainage regime will be implemented to manage existing and proposed surface water run-off.

Pluvial (Overland run-off) Flood Risk

4.4.5 The topography of the development and surrounding area means there is little likelihood of significant flows impacting on the proposed development or on adjacent land/property as a result of the development proposals. Any overland flows generated by the proposed development must be carefully controlled; safe avenues directing overland flow away from the proposed or existing adjacent buildings are advised.

Sewer Flood Risk

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

4.4.7 UU sewer records have identified there to be a public foul water sewer (225mm dia.) located onsite, and a public combined sewer within the access track between the eastern boundary of the site and Crossings Close (see sewer records in **Appendix C**). Consultation with United Utilities has been undertaken and has not identified any historical sewer flooding issues on or near to the proposed development site (see **Appendix C** for correspondence).

4.4.8 It should be noted that there will be a requirement to provide a maintenance offset from the onsite public combined sewer. The specific offset needs to be discussed with UU, as they vary depending on the size of the infrastructure and the depth at which it is laid. Where any required offset cannot be achieved then diversion works may be required and early discussion with UU is advised for any proposed works. A 6m offset (3m each side) has however been included within the proposed site plan (see layout in **Appendix G**).

4.5 Groundwater Flood Risk

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

than days meaning the result to property is often more severe. In general terms groundwater flooding can occur from three main sources:

- If groundwater levels are naturally close to the surface, then this can present a flood risk during times of intense rainfall.
- Seepage and percolation occur where embankments above ground level hold water. In these cases, water travels through the embankment material and emerges on the opposite side of the embankment.
- Groundwater recovery/rebound occurs where the water table has been artificially depressed by abstraction. When the abstraction stops the water, table makes a recovery to its original level. There is the potential for groundwater flooding in low lying areas where groundwater levels have been depressed below their pre-pumping conditions, where these were at or close to ground level.

4.5.2 The mapping data for groundwater shows that the site is underlain by a Secondary A Bedrock Aquifer with Secondary (undifferentiated) Deposits. The site has been identified to be in a Medium – Low Groundwater Vulnerability Zone with no historical groundwater flooding identified by the EA.

4.5.3 No groundwater flood risk has been identified during consultation with the other stakeholders. Irrespective, it is advised that the Finished Floor Levels of the units be raised sufficiently above the external levels to safeguard them. The external levels should fall away from the proposed development to provide safe avenues for overland flows around/away from any proposed more vulnerable development.

4.6 Artificial Sources of Flood Risk

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

Reservoirs

4.6.2 The EA recognises reservoirs as bodies of water over 25,000cu.m and the long-term flood mapping is included in **Appendix B**. The mapping shows that the site is not at risk of flooding should a breach or overtopping in the nearest reservoir(s) occur.

Canals

4.6.3 There are no canals in proximity of the site and there is therefore no flood risk to the site associated with canals. Irrespective, it is advised that external levels fall away from the proposed buildings, to minimise the flood risk from a variety of sources. By keeping the finished floor levels elevated relative to the externals, this should help create an overland flood flow route in the event of a breach or any other source of flooding that could lead to overland flows including reservoir or canal flooding.

4.7 Historical and Anecdotal Flooding Information

4.7.1 Review of the Copeland Borough Council Strategic Flood Risk Assessment (see mapping extracts in **Appendix I**) has identified that in 1999, a prolonged and intense storm caused significant flooding in the wider Cleator Moor area. Further historic flooding was identified also in October 2005 (surface water flooding), and most recently in 2017 due to surface water flooding and surcharging of local drainage systems.

4.7.2 Consultation with the EA also identified historic flooding in close proximity to the site, occurring in 1999, 2005, and 2017 as previously discussed. The flood outlines for each event are shown in **Figure 8**, provided by the EA as part of Product 4. It is noted that of the three events, the 1999 flood event was the only event shown to directly impact the site (see correspondence in **Appendix B**).

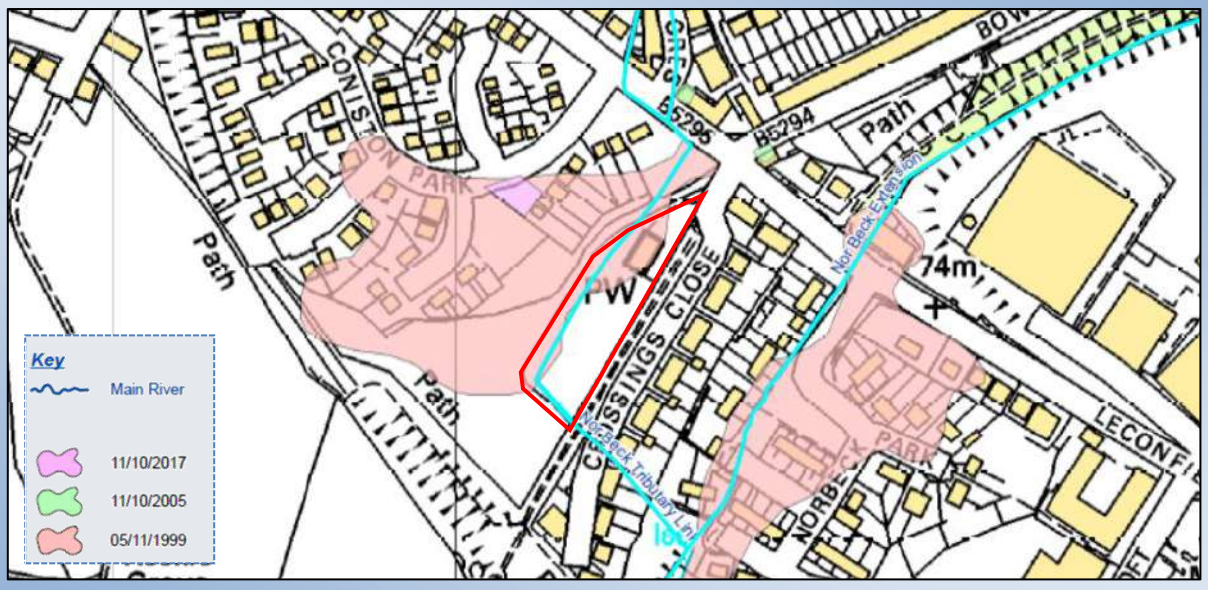

Figure 8: Recorded Flood Outlines (EA, 2022)

4.7.3 Furthermore, consultation with Copeland Borough Council also identified historic flooding associated with Nor Beck specifically. In 1999, a blockage of the culvert upstream of the site caused severe flooding to the Coniston Park estate located north-west of the site. Several incidents of localised flooding along Crossings Close were also identified, resulting from blockages of the trash screen to the south-east of the site. It was also noted that in 2011, the culverts within proximity to the site were not up to standard and were therefore improved. There are however still some outstanding concerns that the Nor Beck culverts are undersized and/or susceptible to blockages (see correspondence in **Appendix D**).

4.8 Flood Risk Mitigation Measures & Residual Risks

4.8.1 The site is located within Flood Zones 1, 2 and 3 and considered to be at medium to high risk of fluvial/tidal flooding. To observe a conservative approach, mitigation measures have been proposed below to safeguard the development and to consider the future uncertainties of climate change in accordance with the NPPF and PPG.

Mitigation Measures

4.8.2 As the site is at risk in the fluvial events mitigation measures will need to be incorporated onsite to ensure the development is safe over its lifetime. To ensure residential development remains safe, the primary mitigation is typically setting the finished floor levels (FFL) above the predicted top water level in the design event (fluvial defended 1 in 100 year plus 30% climate change event), which ranges between 71.71mAOD and 73.13mAOD. The FFLs for the residential dwellings vary across the site, however, a

minimum freeboard of 300mm above the predicted flood water level in the design event will be achieved.

4.8.3 It is also recommended where feasible that internal flood resilience measures are incorporated internally given the sites location in close proximity to flooding during key flood risk events. In terms of internal flood resilience measures, the following flood resilience measures are recommended:

- Fitting electric, gas and phone circuits above expected flood levels.
- Using solid rather than suspended floors
- Flood resilient skirting boards and walls up to 1.2m
- Using water-resistant alternatives to traditional plaster or plaster-boarding for internal wall finishes.
- Avoiding the use of chip board or MDF
- Avoiding fitted carpets and using treated timber to resist waterlogging.
- Appropriate flooring material (e.g., tiles or concrete)
- Fitting one-way auto-seal valves on WCs

4.8.4 The additional modelling has also shown that in the 1% AEP, 1% AEP plus climate change, and the 0.1% AEP fluvial event, no increased flood risk to other properties will occur as a result of the proposals, and a net reduction in flood extent to land outside the site will be provided.

4.8.5 Although the proposals are to raise the residential dwellings above the TWL in the design event (fluvial 1 in 100 year plus 30% climate change), safe access and egress has still been considered. If evacuation from the site is advised, then occupants would need to evacuate towards an area of safety located outside of the predicted floodplain extents, which can be achieved via Bowthorn Road located north of the site.

4.8.6 Due to the site's location within Flood Zone 2 and 3, it is however recommended that future occupiers of the dwellings look to prepare their own household Flood Plans based on their proximity to an area which is potential at high flood risk. A flood plan would note the actions for the household to take before, during and after a flood event and there are multiple guidance documents available to assist in the preparation of these plans.

4.8.7 Review of the mapping has identified that a culverted Main River known as Nor Beck is located onsite adjacent to the western boundary. The EA will require an 8m offset to be maintained from the top of the bank. This offset should provide clear and unimpeded access for future maintenance purposes. An Environmental Permit will also be required from the EA for any works being undertaken within 16m of a Main River, this permit is a standard requirement for any new development taking place within proximity to a Main River.

4.8.8 It should also be noted that there will be a requirement to provide a maintenance offset from the onsite public foul water sewer. The specific offset needs to be discussed with UU, as they vary depending on the size of the infrastructure and the depth at which it is laid. Where any required offset cannot be achieved then diversion works may be

required and early discussion with UU is advised for any proposed works. A 6m offset (3m each side) has however been included within the proposed site plan

4.8.9 Any overland flows generated by the development must be carefully controlled. Safe avenues directing overland flow way from any existing and proposed buildings are advised. Any natural conveyance routes through the site will be maintained, where this is not practical then provision should be made to intercept and convey flows through the proposals to safely outfall as they would naturally.

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

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

Residual Risks

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

5.0 SURFACE WATER MANAGEMENT

5.1 Pre-Development Surface Water Run-off

5.1.1 The total site area covers 0.54ha and is understood to be 20% impermeable at present due to the former St Bega Chapel and associated hardstanding present in the northern portion of the site.

5.1.2 It is understood that based on the sites historical use there may be an existing connection from site into Nor Beck. It is recommended that further onsite investigation of any existing drainage infrastructure is undertaken at an early stage to confirm the exact location, routing and condition of these existing drainage systems onsite, should they be re-used to serve for the new development proposals.

5.1.3 This assessment has therefore considered the site to be 100% permeable to calculate existing run-off, given the lack of information available to evidence the current condition, capacity and outfall location(s) of any formal drainage infrastructure serving the site.

5.1.4 The peak rates and volumes of run-off have been calculated for the development area only in the key storm events using the FEH Statistical Method. Details of the pre-development rates and volumes are included in **Table 1** (full details can be found in **Appendix J**).

Development Area	Run-Off Rates				Run-Off Volumes	
	1 In 1 Year	1 In 30 Year	1 In 100 Year	QBar	1 In 1 Year	1 In 100 Year
0.54ha	5.2l/s	10.2l/s	12.5l/s	6.0l/s	38.0cu.m	102.3cu.m

Table 2: Pre-Development Surface Water Run-Off Rates (Betts Hydro, 2022)

5.2 Post Development Surface Water Run-Off

5.2.1 The impermeable areas onsite will increase because of the proposals. Based on the current planning proposals, it is anticipated that the impermeable areas of site will increase to 52% of the development area, equating to 0.28ha. The unrestricted post-development run-off rates and volumes generated by this impermeable area have been detailed in **Table 3**.

Impermeable Areas	Run-Off Rates		
	1 In 1 Yr	1 In 30 Yr	1 In 100 Yr + CC
0.28ha	15.5l/s	26.7l/s	47.7l/s

Table 3: Post-Development Un-Restricted Run-Off Rates (Betts Hydro, 2022)

5.2.2 In accordance with national and local planning policy it is necessary to restrict surface water run-off rates, to mimic a pre-development situation with betterment where at all practical. This assessment has however considered the site to be 100% permeable to calculate existing run-off, due to the lack of information surrounding the existing drainage systems onsite.

5.3 Sustainable Drainage Systems (SuDS)

5.3.1 In accordance with national and local planning policy, including the Non-Statutory Technical Standards for Sustainable Drainage Systems (March 2015) and the SuDS Manual (CIRIA 753), peak surface water discharge rates from new development should be appropriately managed and where possible reduced.

5.3.2 To manage surface water run-off policy shows that preference should always be given to Sustainable Drainage Systems (SuDS) over the traditional methods of buried sewers wherever possible and practical. SuDS can (if designed and situated appropriately) address the four key sustainability objectives embedded in planning policy including providing space for water (water quantity), improving water quality and biodiversity, along with providing valuable amenity/recreational space within new development sites. These benefits depend on the type of SuDS features being proposed.

5.3.3 Opportunities should also be taken to provide soft landscaping where at all possible on site to assist in minimising surface water run-off. It would also be recommended that permeable surfacing and bio-filtration (tree pits) be considered in non-adopted areas where at all feasible. By including measures such as these the surface water run-off is being dealt with at source and this will assist locally with surface water management (subject to optimum ground conditions).

Figure 9: SuDS Photographs (SusDrain, 2012)

5.3.4 It would also be recommended that permeable paving and bio-filtration (tree pits) be considered in non-adopted areas where at all feasible. By including measures such as these the surface water run-off is being dealt with at source and this will assist locally with surface water management (subject to optimum ground conditions). If infiltration is not feasible then a connection into the main drainage systems is needed, but the presence of the permeable surfaces will still allow the first 5mm of rainfall to be dealt with at source as identified in the SuDS Manual (CIRIA 753).

5.3.5 Promoting SuDS to deal with surface water at the source, will limit the required attenuation and in turn reduce the volume of surface water in the nearby watercourse and sewer infrastructure. There may be the potential to utilise some small-scale SuDS features, however the surface water attenuation required will likely be dealt with using

more traditional below ground infrastructure (cellular storage) given the sites location within Flood Zone 3. Detailed design should confirm whether this site would be suitable for incorporation of SuDS following more detailed analysis of levels, ground conditions and attenuation requirements.

5.4 Methods of Surface Water Management

5.4.1 The focus of this assessment is to identify the appropriate means of managing surface water run-off generated by the newly proposed buildings and associated areas of hardstanding. There are three methods that have been reviewed for the management and discharge of surface water. These may be applied individually or collectively to form a complete strategy and should be applied in the order of priority listed below:

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

5.5 Discharge via Infiltration

5.5.1 Any impermeable areas that can drain to a soakaway or an alternative method of infiltration would significantly improve the sustainability of any surface water systems. The published online datasets have initially been reviewed to consider how favourable the underlying strata is to support a potential infiltration-based solution at the site.

5.5.2 The Cranfield Soil and AgriFood Institute (CSAI), Soilscapes viewer identifies the soils to be loamy and clayey floodplain soils with naturally high groundwater. The British Geology Survey (BGS) mapping data indicates that the underlying strata consists of Pennine Middle Coal Measures Formation (Mudstone, Siltstone and Sandstone) at bedrock level with Devensian Till superficial deposits.

5.5.3 Based on the ground conditions identified by the published online datasets, it can be considered that infiltration would not likely provide a viable drainage solution for all the development site due to the cohesive nature of the underlying ground strata. This is supported by the soil classification being 0.47, which indicates low permeability based on the FEH catchment characteristics (0.1 is very high permeability and 0.5 is very low).

5.5.4 The mapping reviewed is generalised only and of large scale in nature. As infiltration rates can vary on a site by site basis, it would be recommended further investigation in the form of Soakaway Testing to BRE365, takes place. Soakaway Testing will confirm whether the site will be suitable for any infiltration-based solutions, to assist with reducing the run-off discharging from the site to the nearby watercourse network. As Soakaway Testing at the site has not at this stage been carried out, this assessment has also considered the alternatives for manging surface water run-off should future testing be unsupportive of a full infiltration-based solution in due course.

5.6 Discharge to Watercourse

5.6.1 Should onsite soakaway tests show that rates onsite are not favourable to an infiltration-based surface water solution at the site, then the next approach in the sustainable drainage hierarchy is to discharge to the nearest watercourse or waterbody. As

previously discussed, the nearest waterbody is Nor Beck which is located onsite adjacent to the western boundary.

5.6.2 It is understood that based on the sites historical use there may be an existing connection from site into either Nor Beck. It is recommended that further onsite investigation of any existing drainage infrastructure is undertaken at an early stage to confirm the exact location, routing and condition of these existing drainage systems onsite, should they be re-used to serve for the new development proposals.

5.6.3 The proposals are to therefore mimic the existing regime and discharge to Nor Beck, as illustrated in **Figure 10** subject to design and consent. There may be scope to utilise the former surface water drainage infrastructure in part to deal with run-off, providing the condition and outfall to the Main River are still functioning. Where further investigation identifies the existing drainage infrastructure is not suitable, then a new formal outfall will need to be constructed on the bank of Nor Beck. Detailed design would be required to confirm whether a gravity system can be achieved, although given the existing falls, this is anticipated to be viable.

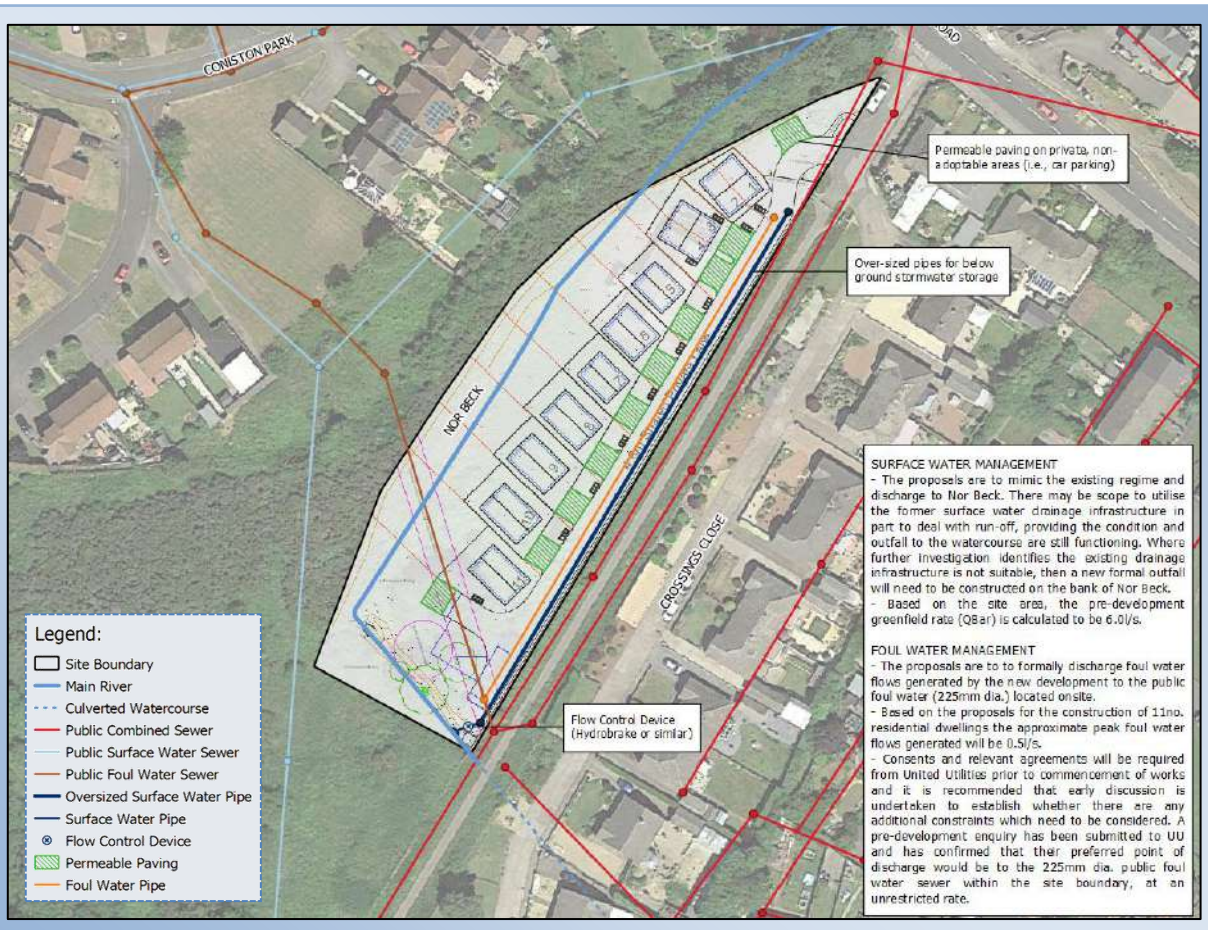

Figure 10: Preliminary Drainage Strategy Extract (Betts Hydro, 2022)
This drawing is not a drainage 'design' it is a preliminary drainage strategy. The location and sizes of proposed assets are not to scale or in fixed locations.

5.6.4 Consent and relevant agreements for works to the Main River will be required from the EA and the Lead Local Flood Authority (LLFA). Consent will also be required from the LLFA (Cumbria County Council), who will also need to agree to any proposed

discharge rates. Early discussion is advised with all parties, to ensure there are no other constraints in terms of points of connection or rates of discharge.

Proposed Discharge Rates

5.6.5 In accordance with the SuDS Manual (CIRIA) and the Non-Technical Standards for SuDS (March 2015) all sites should endeavour to achieve as close to pre-development greenfield rates as is viable. The guidance however acknowledges that it is not always feasible to restrict a brownfield site to the greenfield equivalent. In these cases, it is usually acceptable to offer betterment on the pre-development brownfield rates as an alternative proposal, however, given the lack of information available to evidence the current condition, capacity and outfall location(s) of any formal drainage infrastructure severing the site, this assessment has therefore considered the site to be 100% permeable to calculate existing run-off rates.

5.6.6 Based on the site area, the pre-development greenfield rate (QBar) is calculated to be 6.0l/s. Restricting the rate of discharge will generate a requirement to provide onsite stormwater storage for the extreme rainfall events. The stormwater storage figures quoted in **Table 3** (**Appendix L**) are estimates only. Detailed design will determine with accuracy the attenuation requirements.

IMPERMEABLE AREA (0.28HA)	1 IN 1 YEAR	1 IN 30 YEAR	1 IN 100 YEAR + 40% CC
Restricted Run-Off Rate	6.0l/s	6.0l/s	6.0l/s
Estimated Stormwater Storage Volume	15cu.m-38cu.m	48cu.m-86cu.m	118cu.m-193cu.m

Table 4: Estimated Stormwater Storage Requirements (Betts Hydro, 2022)

5.6.7 As discussed previously, restricting the rate of discharge will generate a requirement to provide onsite stormwater storage for the extreme rainfall events. Given the scale and nature of the development this will be provided via underground storage. The surface water scheme for the development will be designed to cater for the surface water run-off generated in the events up to and including the 1 in 100yr return period event with allowance for climate change.

5.7 Discharge to Public Sewer Network

5.7.1 United Utilities sewer records have identified there to be a public combined sewer located onsite adjacent to the western boundary, however, given the proximity of the Main River, there are no proposals at this time to outfall surface water run-off generated by the development to the public sewer network.

5.8 Climate Change

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

sea levels will rise gradually. An increase in flood water levels means that future flooding events will occur more frequently and will have a greater impact.

5.8.2 In light of the future uncertainties Climate Change should be accounted for within the design of all new developments. Climate change factors have been considered and any increase in the level of flood risk (to the site) from climate change is likely to be related to the increase in rainfall intensity and duration and its impact upon the surface water drainage system.

5.8.3 In accordance with the updated Climate Change projections provides estimated changes to rainfall intensity (**Table 5**) and based on the design life of the development (100yrs) the "total potential change figures for the 2080's has been utilised.

PROJECTIONS	TOTAL POTENTIAL CHANGE ANTICIPATED FOR THE 2080'S
Upper End Estimate	40%
Central Change Factor	20%

Table 5: Change to Extreme Rainfall Intensity Compared to 1961-1990 Baseline (Environment Agency, 2016)

6.0 FOUL WATER MANAGEMENT

6.1 Consultation with United Utilities has been carried out to obtain the sewer records, which show there to be public foul water sewer (225mm dia.) located onsite, and a public combined sewer within the access track between the eastern boundary of the site and Crossings Close (refer to sewer records within **Appendix C**).

6.2 As the site was formerly developed it is likely that there would have been foul water flows generated by the former land-use and therefore formal foul water drainage infrastructure in place to cater for such flows. There is no information available to determine the routing or outfall of any former foul water flows generated by the development. It is however assumed that the foul water flows previously generated by the development onsite would have discharged to the public foul water sewer network located onsite.

6.3 The proposals are to formally discharge foul water flows generated by the new development to the public foul water (225mm dia.) located onsite. There may be scope to use some of the former foul water drainage infrastructure to convey flows to the public sewer, but where this is not possible there may be a requirement to form a new foul water connection to serve the new development. Detailed drainage design will be required to confirm this strategy and identify whether a site wide gravity connection is feasible.

6.4 Based on the proposals for the construction of 11no. residential dwellings the approximate peak foul water flows generated will be 0.5l/s. This has been calculated based on 4000 litres per dwelling per 24 hours; the guidance contained within Sewers for Adoption (SfA).

6.5 Consents and relevant agreements will be required from United Utilities prior to commencement of works, and it is recommended that early discussion is undertaken to establish whether there are any additional constraints which need to be considered. A pre-development enquiry has been submitted to UU and has confirmed that their preferred point of discharge would be to the 225mm dia. public foul water sewer within the site boundary, at an unrestricted rate (see correspondence in **Appendix C**).

7.0 SUMMARY AND CONCLUSIONS

7.1 This Flood Risk Assessment and Drainage Management Strategy has been prepared to support a planning application for residential development on the former St. Bega Chapel site off Whitehaven Road in Cleator Moor.

Flood Risk

7.2 The site lies within Flood Zone 1, 2 and 3 based on the Environment Agency Flood Map for Planning and approximately covers 0.54ha. In accordance with Planning policy, residential development proposed within Flood Zone 3, needs to be supported by the Exception Test. This is a planning test to be carried out by an appropriately qualified consultant, part of the Exception Test is satisfied by the provision of a site-specific Flood Risk Assessment.

7.3 Consultations with the Environment Agency, Cumbria County Council, Copeland Borough Council, and United Utilities have been undertaken and have identified historical flooding of the site and neighbouring areas in 1999, 2005 and 2017, due to the natural topography of the site and the proximity to Nor Beck (Main River) located adjacent to the western boundary.

7.4 Given the location of this Main River, consultations with the Environment Agency were undertaken to obtain the most up-to-date information. It was identified that due to the scale of the existing hydraulic model, some refinement was required. A hydraulic modelling exercise was therefore undertaken to support this assessment using the Environment Agency's existing modelling to assess in more detail the potential fluvial flood risks to the site.

7.5 The modelling undertaken identified that the development site is at risk of fluvial flooding during the 1% AEP, 1% AEP plus 30% Climate Change, and the 0.1% AEP events from the River Ehen and its tributaries (River Keekle, and Nor Beck which is located onsite). As the site is at risk in the fluvial events mitigation measures will be incorporated onsite to ensure the development is safe over its lifetime. The primary mitigation is typically setting the finished floor levels above the predicted top water level in the design event (fluvial defended 1 in 100 year plus 30% climate change event), which ranges between 71.71mAOD and 73.13mAOD. The finished floor levels for the residential dwellings vary across the site, however, a minimum freeboard of 300mm above the predicted flood water level in the design event will be achieved.

7.6 The additional modelling has also shown that in the 1% AEP, 1% AEP plus climate change, and the 0.1% AEP fluvial event, no increased flood risk to other properties will occur as a result of the proposals, and a net reduction in flood extent to land outside the site will be provided.

7.7 This assessment has therefore considered the potential flood resistance and resilience measures that should be incorporated to safeguards the proposed development not only from residual fluvial flood risks but also other sources of flooding. The key mitigation measures include appropriate levels design within the site, ensuring natural conveyance routes through the site are maintained and incorporation of a sustainable surface water management regime.

Drainage Strategy

7.8 A key focus of this assessment is on the sustainable management of surface water run-off to ensure no increased flood risk results from the development proposals. The surface water run-off management options have been assessed in accordance with the sustainable drainage hierarchy, which is discharge to ground, followed by a waterbody or finally the public sewer system.

7.9 It is understood that based on the sites historical use there may be an existing connection from site into either Nor Beck. It is recommended that further onsite investigation of any existing drainage infrastructure is undertaken at an early stage to confirm the exact location, routing and condition of these existing drainage systems onsite, should they be re-used to serve for the new development proposals.

7.10 The proposed surface water management regime for the new development will therefore be to mimic the existing regime and discharge to Nor Beck, utilising the existing drainage infrastructure where at all practical. Should further investigation conclude the existing infrastructure is not suitable then a full new outfall to the River will be required subject to relevant consents and agreements.

7.11 In accordance with the SuDS Manual (CIRIA 753) and the Non-Statutory Technical Standards for Sustainable Drainage Systems, all sites should endeavour to achieve as close to pre-development greenfield rates as is viable, when discharging from site. Given the lack of information available to evidence the current condition, capacity and outfall location(s) of any formal drainage infrastructure severing the site, this assessment has therefore considered the site to be 100% permeable to calculate existing run-off rates.

7.12 Based on the site area, the pre-development greenfield rate (QBar) is calculated to be 6.0l/s. Restricting the rate of discharge will generate a requirement to provide onsite stormwater storage for the extreme rainfall events. The surface water scheme for the development will be designed to cater for the surface water run-off generated in the events up to and including the 1 in 100yr return period event with allowance for climate change.

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

8.0 RECOMMENDATIONS

8.1 As the site is at risk in the fluvial events mitigation measures will need to be incorporated onsite to ensure the development is safe over its lifetime. To ensure residential development remains safe, the primary mitigation is typically setting the finished floor levels (FFL) above the predicted top water level in the design event (fluvial defended 1 in 100 year plus 30% climate change event), which ranges between 71.71mAOD and 73.13mAOD. The FFLs for the residential dwellings vary across the site, however, a minimum freeboard of 300mm above the predicted flood water level in the design event will be achieved.

8.2 It is also recommended where feasible that internal flood resilience measures are incorporated internally given the sites location in close proximity to flooding during key flood risk events. In terms of internal flood resilience measures, the following flood resilience measures are recommended:

- Fitting electric, gas and phone circuits above expected flood levels.
- Using solid rather than suspended floors
- Flood resilient skirting boards and walls up to 1.2m
- Using water-resistant alternatives to traditional plaster or plaster-boarding for internal wall finishes.
- Avoiding the use of chip board or MDF
- Avoiding fitted carpets and using treated timber to resist waterlogging.
- Appropriate flooring material (e.g., tiles or concrete)
- Fitting one-way auto-seal valves on WCs

8.3 The additional modelling has also shown that in the 1% AEP, 1% AEP plus climate change, and the 0.1% AEP fluvial event, no increased flood risk to other properties will occur as a result of the proposals, and a net reduction in flood extent to land outside the site will be provided.

8.4 Although the proposals are to raise the residential dwellings above the TWL in the design event (fluvial 1 in 100 year plus 30% climate change), safe access and egress has still been considered. If evacuation from the site is advised, then occupants would need to evacuate towards an area of safety located outside of the predicted floodplain extents, which can be achieved via Bowthorn Road located north of the site.

8.5 Due to the site's location within Flood Zone 2 and 3, it is however recommended that future occupiers of the dwellings look to prepare their own household Flood Plans based on their proximity to an area which is potential at high flood risk. A flood plan would note the actions for the household to take before, during and after a flood event and there are multiple guidance documents available to assist in the preparation of these plans.

8.6 Review of the mapping has identified that a culverted Main River known as Nor Beck is located onsite adjacent to the western boundary. The EA will require an 8m offset to be maintained from the top of the bank. This offset should provide clear and unimpeded access for future maintenance purposes. An Environmental Permit will also be required from the EA for any works being undertaken within 16m of a Main River,

this permit is a standard requirement for any new development taking place within proximity to a Main River.

8.7 It should also be noted that there will be a requirement to provide a maintenance offset from the onsite public foul water sewer. The specific offset needs to be discussed with UU, as they vary depending on the size of the infrastructure and the depth at which it is laid. Where any required offset cannot be achieved then diversion works may be required and early discussion with UU is advised for any proposed works. A 6m offset (3m each side) has however been included within the proposed site plan

8.8 Any overland flows generated by the development must be carefully controlled. Safe avenues directing overland flow way from any existing and proposed buildings are advised. Any natural conveyance routes through the site will be maintained, where this is not practical then provision should be made to intercept and convey flows through the proposals to safely outfall as they would naturally.

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

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

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United Utilities - https://www.unitedutilities.com/

APPENDIX A: NPPF & PPG EXTRACTS

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

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

Planning for climate change

153. Plans should take a proactive approach to mitigating and adapting to climate change, taking into account the long-term implications for flood risk, coastal change, water supply, biodiversity and landscapes, and the risk of overheating from rising temperatures[53]. Policies should support appropriate measures to ensure the future resilience of communities and infrastructure to climate change impacts, such as providing space for physical protection measures, or making provision for the possible future relocation of vulnerable development and infrastructure.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

b) approve the application if its impacts are (or can be made) acceptable[54]. Once suitable areas for renewable and low carbon energy have been identified in plans, local planning authorities should expect subsequent applications for commercial scale projects outside these areas to demonstrate that the proposed location meets the criteria used in identifying suitable areas.

Planning and flood risk

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

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

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

161. All plans should apply a sequential, risk-based approach to the location of development – taking into account all sources of flood risk and the current and future impacts of climate change – so as to avoid, where possible, flood risk to people and property. They should do this, and manage any residual risk, by:

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

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

c) using opportunities provided by new development and improvements in green and other infrastructure to reduce the causes and impacts of flooding, (making as much use as possible of natural flood management techniques as part of an integrated approach to flood risk management); and

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

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

163. If it is not possible for development to be located in areas with a lower risk of flooding (taking into account wider sustainable development objectives), the exception test may have to be applied. The need for the exception test will depend on the potential vulnerability of the site and of the development proposed, in line with the Flood Risk Vulnerability Classification set out in Annex 3.

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

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

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

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

166. Where planning applications come forward on sites allocated in the development plan through the sequential test, applicants need not apply the sequential test again. However, the exception test may need to be reapplied if relevant aspects of the proposal had not been considered when the test was applied at the plan-

making stage, or if more recent information about existing or potential flood risk should be taken into account.

167. When determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment[55]. Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

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

b) the development is appropriately flood resistant and resilient such that, in the event of a flood, it could be quickly brought back into use without significant refurbishment;

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

d) any residual risk can be safely managed; and

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

168. Applications for some minor development and changes of use[56] should not be subject to the sequential or exception tests but should still meet the requirements for site-specific flood risk assessments set out in footnote 55.

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

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

b) have appropriate proposed minimum operational standards;

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

d) where possible, provide multifunctional benefits.

Coastal change

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

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

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

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

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

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

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

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

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

c) the development provides wider sustainability benefits; and

d) the development does not hinder the creation and maintenance of a continuous signed and managed route around the coast[57].

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

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

Revision date: 06 03 2014

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

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

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

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

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

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

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

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

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

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

Paragraph: 064 Reference ID: 7-064-20140306

Revision date: 06 03 2014

Flood Zone and flood risk tables

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

Table 1: Flood Zones

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

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

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

Paragraph: 065 Reference ID: 7-065-20140306

Revision date: 06 03 2014

Table 2: Flood risk vulnerability classification

Essential infrastructure

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

Highly vulnerable

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

More vulnerable

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

Less vulnerable

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

Water-compatible development

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

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

Paragraph: 066 Reference ID: 7-066-20140306

Revision date: 06 03 2014

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

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

Key:

✓ Development is appropriate

✗ Development should not be permitted.

Notes to table 3:

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

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

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

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

Paragraph: 067 Reference ID: 7-067-20140306

Revision date: 06 03 2014

Site-specific flood risk assessment: Checklist

1 - Development site and location

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

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

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

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

2 - Development proposals

APPENDIX B: EA INFORMATION & CORRESPONDENCE

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Megan Berry

From: Hannah Buchanan
Sent: 06 October 2021 09:28
To: Megan Berry; Richard Nicholas
Subject: FW: CL232400KR : Products 4, 5, 6 and 7
Attachments: CL232400 - Whitehaven Rd Product 4.pdf

From: CMBLNC Info Requests
Sent: 06 October 2021 08:24:11 (UTC) Coordinated Universal Time
To: Hannah Buchanan
Subject: CL232400KR : Products 4, 5, 6 and 7

Dear Hannah

Enquiry regarding product data

Thank you for your enquiry which was received on 6 September 2021. Apologies for the delay.

We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004.

Please see the Product 4 attached and response below for: Cleator Moor.

- The fluvial data has been taken from the Ehen 2015 study. Updated climate change data, including a 30%, 35% and 70% increase in river flows, have been provided from the Ehen Study 2020 climate change update. New climate change allowances can be checked on the following website: www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances. **Please note this guidance was updated on 20th July 2021.** **Please note** that the Node point IDs within the Fluvial levels and flows table (pages 4-9) are filtered in alphabetical/numerical order and **are not** in order of how the node point IDs feature on the fluvial levels and flows map on page 3, i.e. upstream to downstream.

- For all queries relating to flooding from surface water, ordinary watercourses and groundwater flooding, please contact the Lead Local Flood Authority Cumbria County Council.

- Surface Water Maps can be viewed online at https://flood-warning-information.service.gov.uk/long-term-flood-risk/map.

- Please find the Products 5, 6 & 7 at this link: https://ea.sharefile.com/d-s705021584ac94176b47cc0e52bbb0866

  (Please download on receipt as the link will expire on 15th October 2021). This data is being supplied under the terms of our Conditional Licence.

There are no flood defences at this location although there is a culvert which runs underneath the site boundary. The information for the culvert is available if required.

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

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

Thanks

Karen

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

inforequests.cmblnc@environment-agency.gov.uk

From: Hannah Buchanan [mailto:hannahbuchanan@betts-associates.co.uk]
Sent: 06 September 2021 16:13
To: CMBLNC Info Requests <Inforequests.cmblnc@environment-agency.gov.uk>
Subject: Products 4, 5, 6 and 7

To whom it may concern,

Whitehaven Road, Cleator Moor, CA25 5PY

Please could you confirm whether you have any information (Products 4, 5, 6 and 7) that you feel would be valuable to a Flood Risk Assessment and Drainage Management Strategy for the above site (location plan attached), including details of historical flooding and any predicted flood water levels; this would be greatly appreciated. If there are any specific requirements that you require in a scope of works for this site, please can you advise at this stage so that it can be fully incorporated into the proposals at an early stage.

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

Kind Regards,

Hannah Buchanan *BSc (Hons)*
Graduate Flood Risk Analyst

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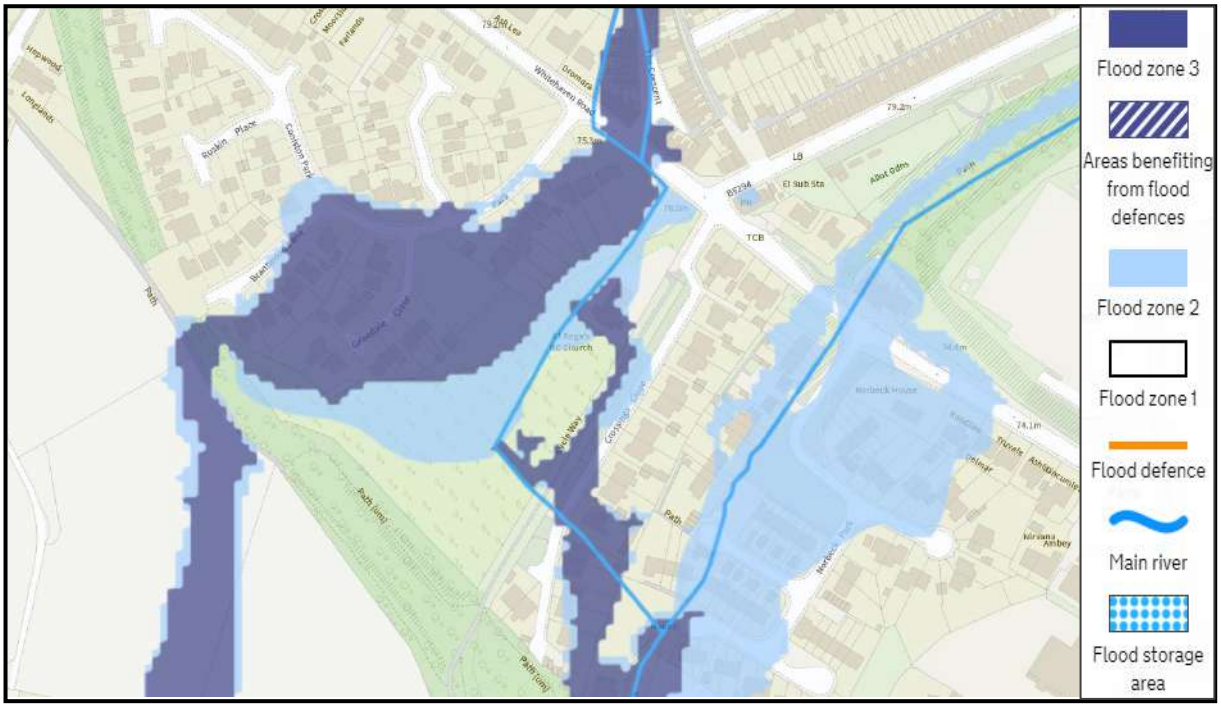
www.betts-associates.co.uk

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

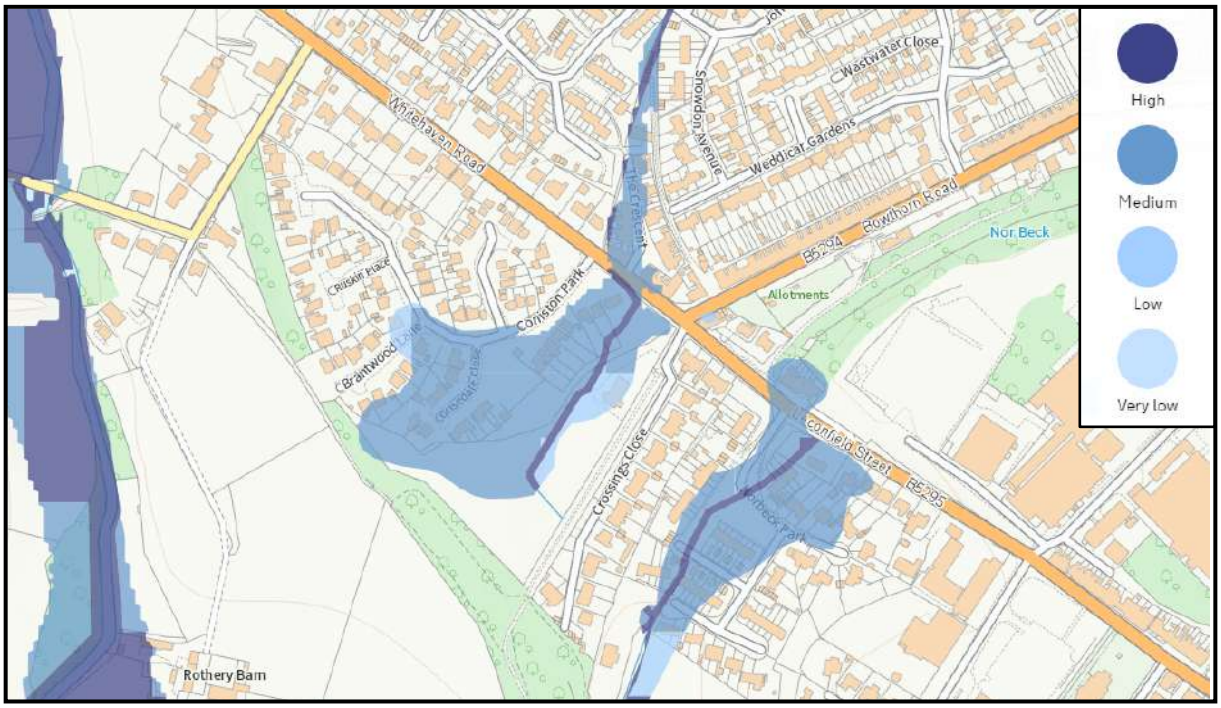
NATIONAL FLOOD MAPPING

BETTS HYDRO
CONSULTING ENGINEERS

Flood Map for Planning



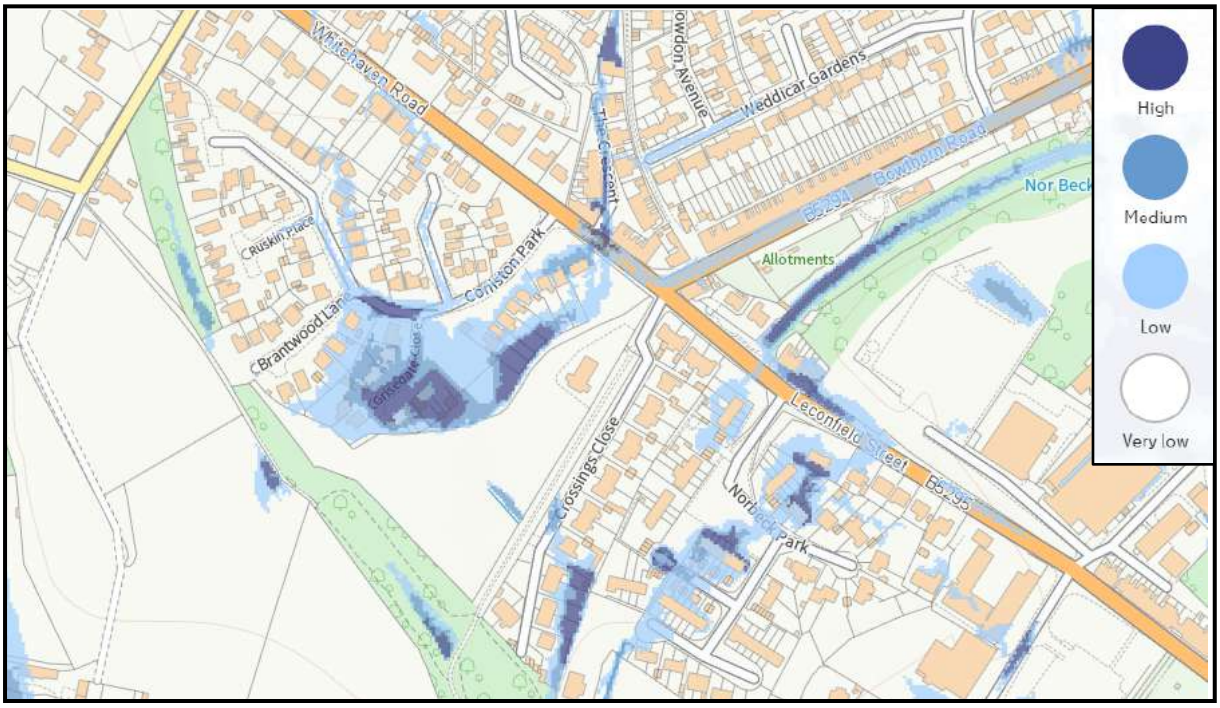
Long Term Flood Risk – Rivers or Sea



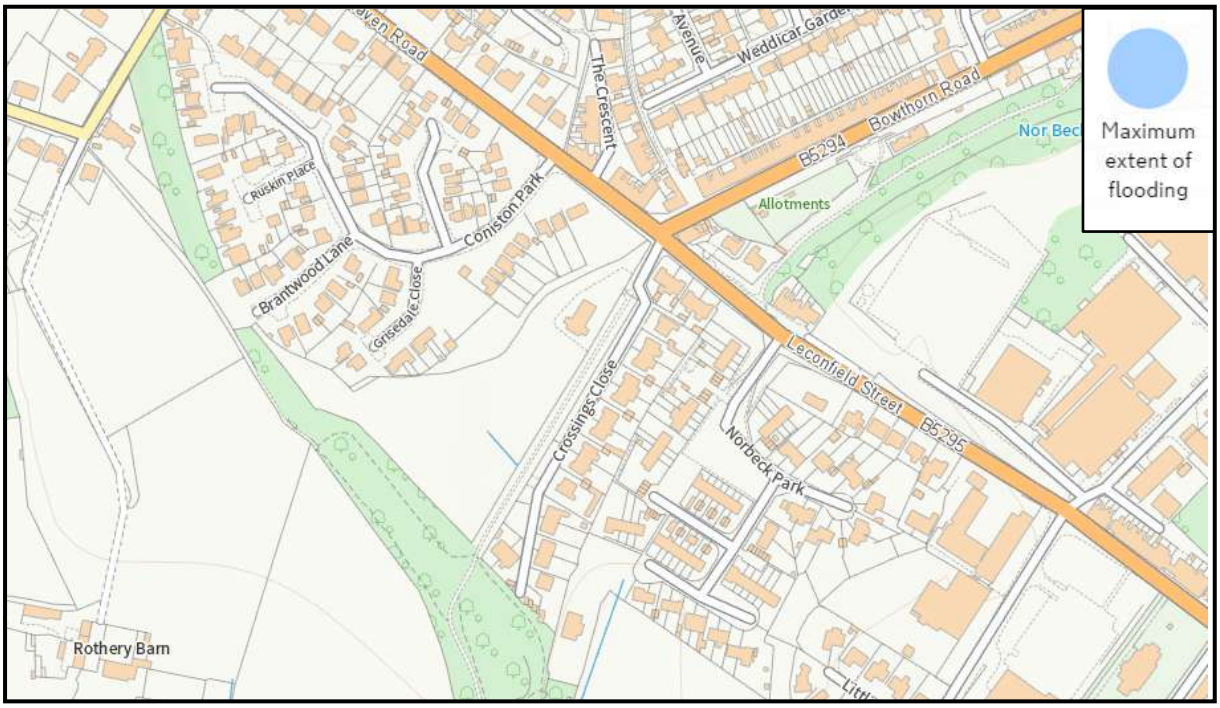
NATIONAL FLOOD MAPPING

BETTS HYDRO
CONSULTING ENGINEERS

Long Term Flood Risk – Surface Water

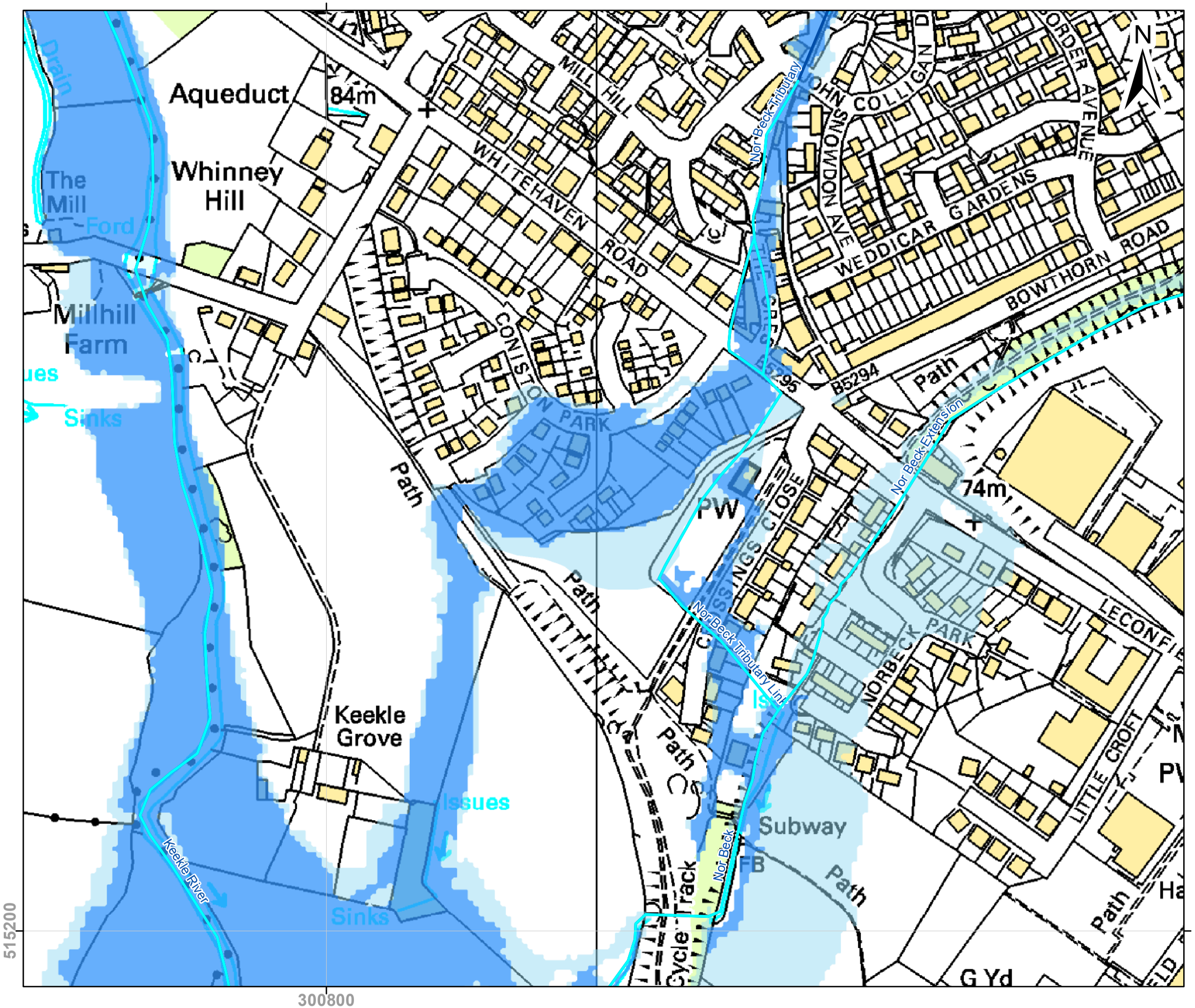


Long Term Flood Risk - Reservoirs



Flood Zones Map: Whitehaven Road, Cleator Moor, CA25 5PY

Produced: 14 September 2021
Our Ref: CL232400
NGR: NY0111215532



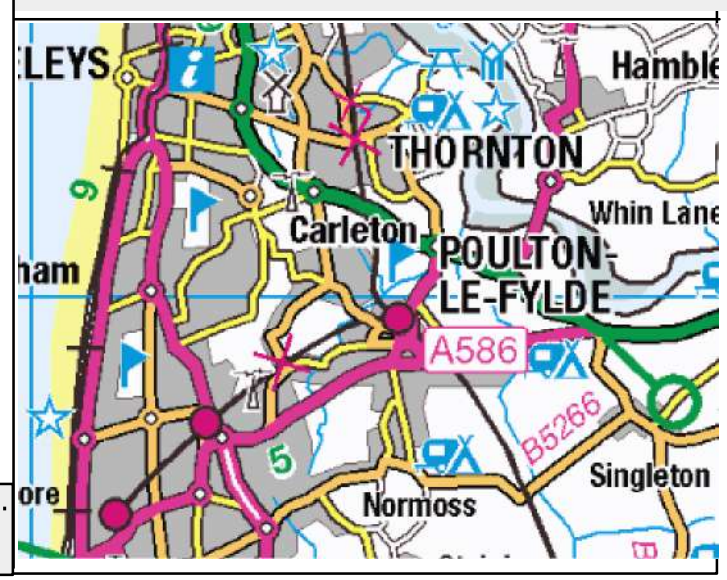
Key

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

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

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to 0.1% chance of occurring each year.

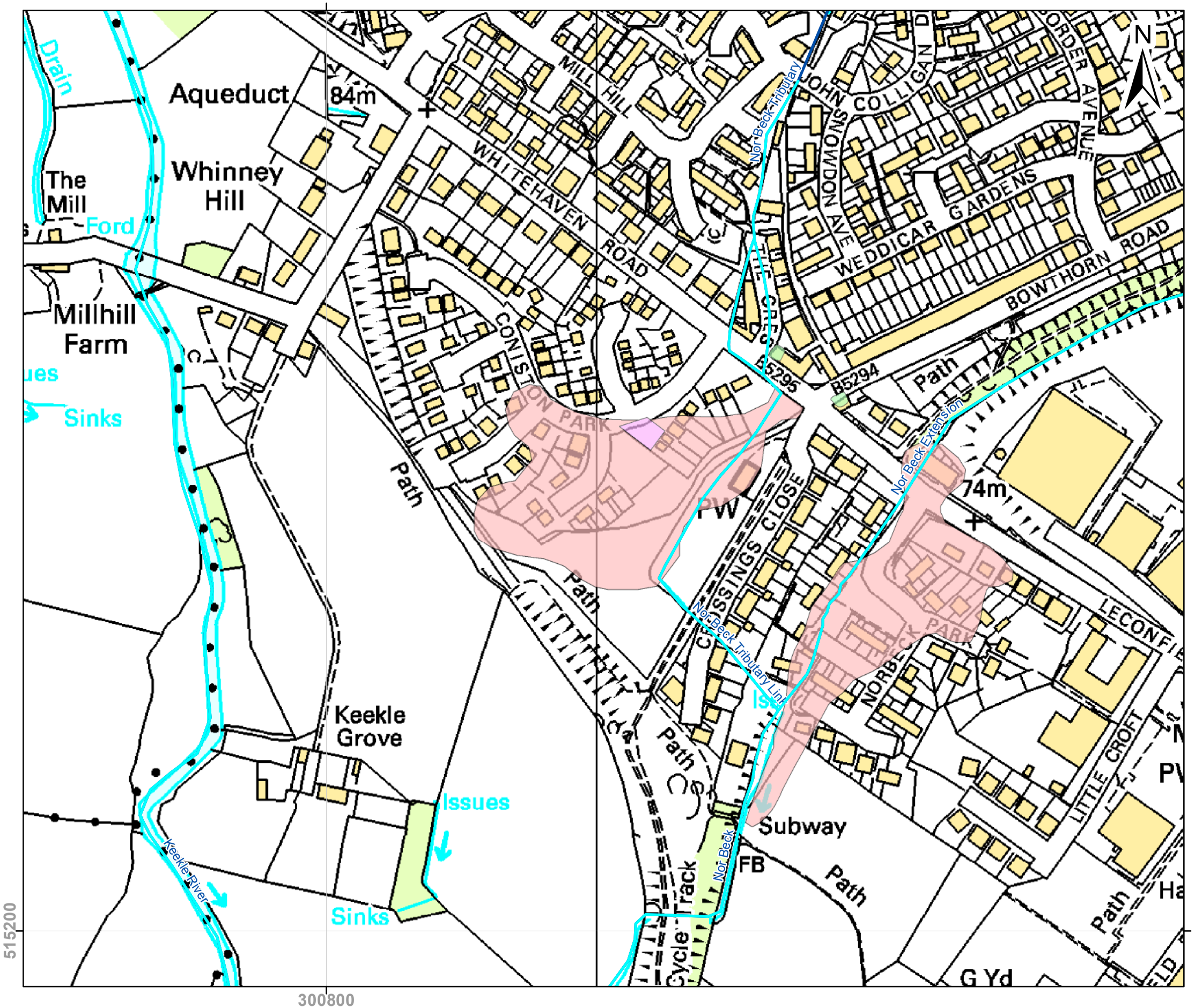
ABDs (Areas Benefiting from Defences) show the area benefiting from defences during a 0.5% tidal, or 1.0% fluvial flood event.



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

Flood History Map: Whitehaven Road, Cleator Moor, CA25 5PY

Produced: 14 September 2021
Our Ref: CL232400
NGR: NY0111215532



Key

Main River

11/10/2017

11/10/2005

05/11/1999

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

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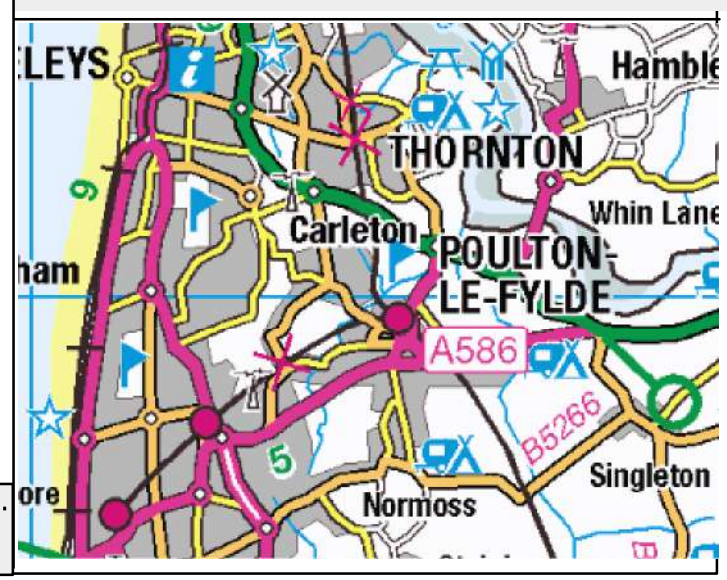
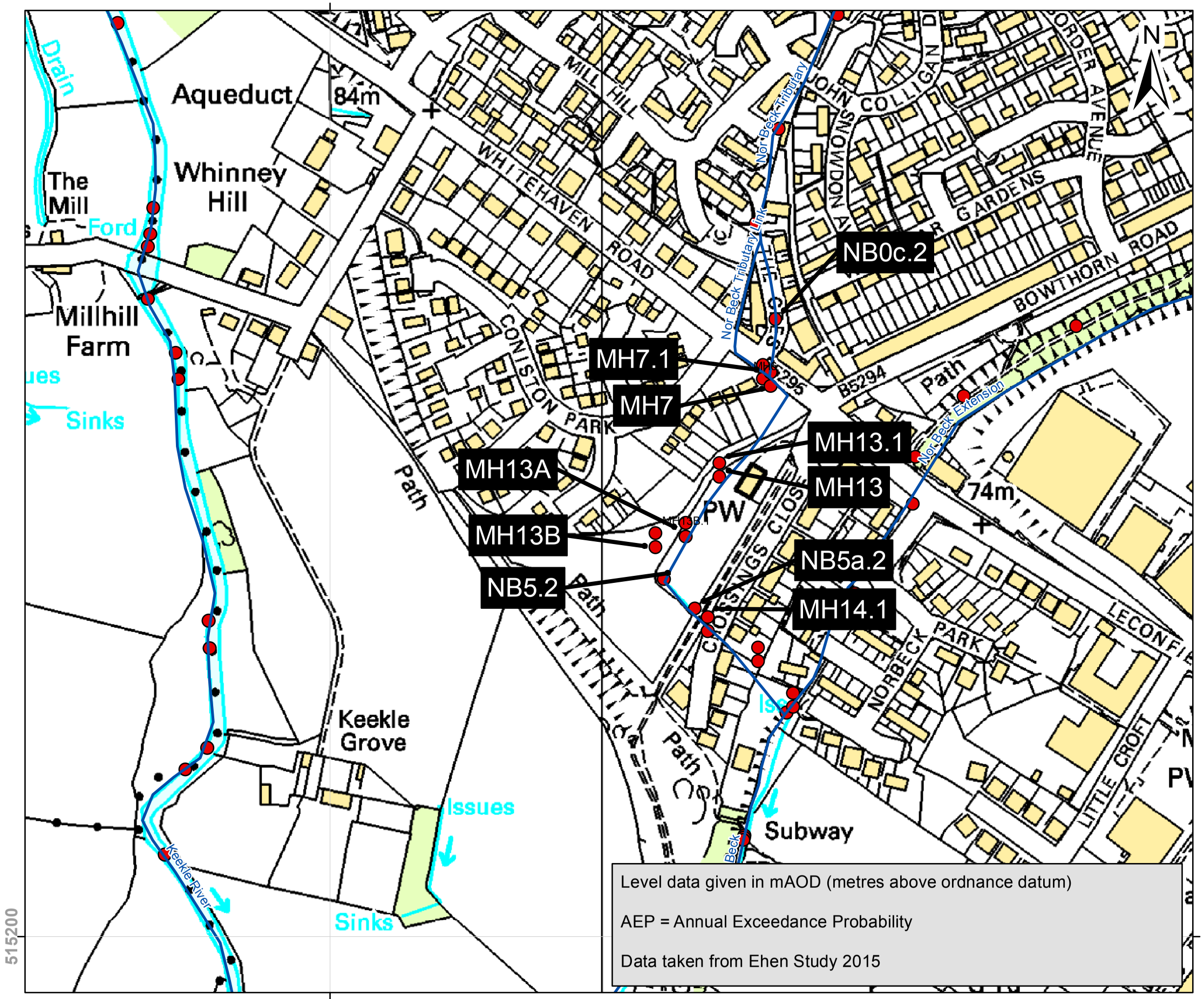
ABDs (Areas Benefiting from Defences) show the area benefiting from defences during a 0.5% tidal, or 1.0% fluvial flood event.



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

Fluvial Levels and Flows Map: Whitehaven Road, Cleator Moor, CA25 5PY

Produced: 14 September 2021
Our Ref: CL232400
NGR: NY0111215532



Level data given in mAOD (metres above ordnance datum)

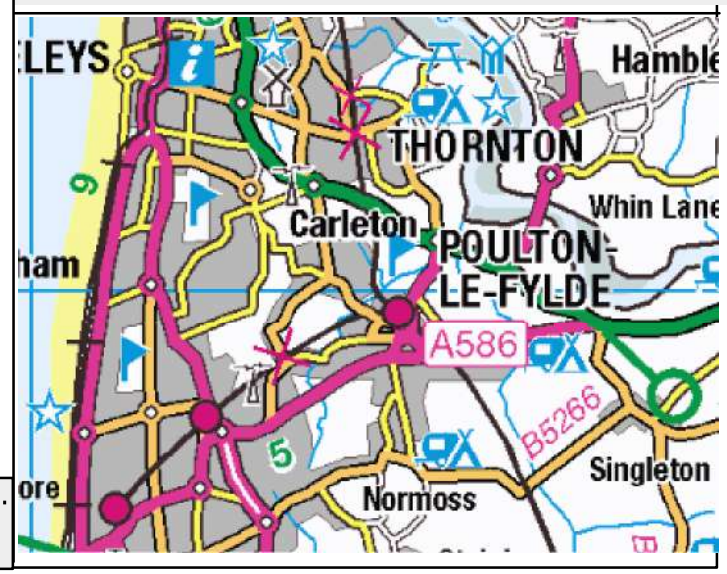
AEP = Annual Exceedance Probability

Data taken from Ehen Study 2015

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

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to 0.1% chance of occurring each year.

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



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

Node Point ID	Defended (D), Undefended (UD), Climate Change (CC)	Return Period (years)	Water Level (mAOD)	Flow (Cumecs)
MH13	Ehen2015_U	5	73.30	0.48
MH13	Ehen2015_D	5	73.30	0.48
MH13	Ehen2015_D	10	73.32	0.48
MH13	Ehen2015_U	10	73.32	0.48
MH13	Ehen2015_D	15	73.32	0.48
MH13	Ehen2015_U	20	73.33	0.48
MH13	Ehen2015_D	20	73.33	0.48
MH13	Ehen2015_U	25	73.33	0.48
MH13	Ehen2015_D	25	73.33	0.48
MH13	Ehen2015_D	30	73.33	0.48
MH13	Ehen2015_U	30	73.33	0.48
MH13	Ehen2015_D	40	73.34	0.48
MH13	Ehen2015_D	50	73.35	0.48
MH13	Ehen2015_U	50	73.35	0.48
MH13	Ehen2015_D	75	73.35	0.48
MH13	Ehen2015_U	75	73.35	0.48
MH13	Ehen2015_U	100	73.36	0.48
MH13	Ehen2015_D	100	73.36	0.48
MH13	Ehen2015_U_35%CC	100	73.39	0.47
MH13	Ehen2015_U_30%CC	100	73.39	0.47
MH13	Ehen2015_U_70%CC	100	73.42	0.47
MH13	Ehen2015_D_35%CC	100	73.39	0.47
MH13	Ehen2015_D_30%CC	100	73.39	0.47
MH13	Ehen2015_D_70%CC	100	73.42	0.47
MH13	Ehen2015_U	200	73.38	0.48
MH13	Ehen2015_D	200	73.38	0.48
MH13	Ehen2015_D	500	73.40	0.48
MH13	Ehen2015_D	1000	73.42	0.48
MH13	Ehen2015_U	1000	73.42	0.48
MH13.1	Ehen2015_U	5	73.14	0.00
MH13.1	Ehen2015_D	5	73.14	0.00
MH13.1	Ehen2015_D	10	73.14	0.00
MH13.1	Ehen2015_U	10	73.14	0.00
MH13.1	Ehen2015_D	15	73.15	0.00
MH13.1	Ehen2015_U	20	73.15	0.00
MH13.1	Ehen2015_D	20	73.15	0.00
MH13.1	Ehen2015_U	25	73.15	0.00
MH13.1	Ehen2015_D	25	73.15	0.00
MH13.1	Ehen2015_D	30	73.15	0.00
MH13.1	Ehen2015_U	30	73.15	0.00
MH13.1	Ehen2015_D	40	73.15	0.00
MH13.1	Ehen2015_D	50	73.16	0.00
MH13.1	Ehen2015_U	50	73.16	0.00
MH13.1	Ehen2015_D	75	73.16	0.00
MH13.1	Ehen2015_U	75	73.16	0.00
MH13.1	Ehen2015_U	100	73.16	0.00

MH13.1	Ehen2015_D	100	73.16	0.00
MH13.1	Ehen2015_U_35%CC	100	73.18	0.00
MH13.1	Ehen2015_U_30%CC	100	73.17	0.00
MH13.1	Ehen2015_U_70%CC	100	73.19	0.00
MH13.1	Ehen2015_D_35%CC	100	73.18	0.00
MH13.1	Ehen2015_D_30%CC	100	73.17	0.00
MH13.1	Ehen2015_D_70%CC	100	73.19	0.00
MH13.1	Ehen2015_U	200	73.17	0.00
MH13.1	Ehen2015_D	200	73.17	0.00
MH13.1	Ehen2015_D	500	73.18	0.00
MH13.1	Ehen2015_D	1000	73.19	0.00
MH13.1	Ehen2015_U	1000	73.19	0.00
MH13A	Ehen2015_U	5	72.65	0.50
MH13A	Ehen2015_D	5	72.65	0.50
MH13A	Ehen2015_D	10	72.67	0.50
MH13A	Ehen2015_U	10	72.67	0.50
MH13A	Ehen2015_D	15	72.68	0.50
MH13A	Ehen2015_U	20	72.69	0.50
MH13A	Ehen2015_D	20	72.69	0.50
MH13A	Ehen2015_U	25	72.70	0.50
MH13A	Ehen2015_D	25	72.70	0.50
MH13A	Ehen2015_D	30	72.71	0.50
MH13A	Ehen2015_U	30	72.71	0.50
MH13A	Ehen2015_D	40	72.72	0.50
MH13A	Ehen2015_D	50	72.73	0.50
MH13A	Ehen2015_U	50	72.73	0.50
MH13A	Ehen2015_D	75	72.75	0.50
MH13A	Ehen2015_U	75	72.75	0.50
MH13A	Ehen2015_U	100	72.76	0.50
MH13A	Ehen2015_D	100	72.76	0.50
MH13A	Ehen2015_U_35%CC	100	72.83	0.49
MH13A	Ehen2015_U_30%CC	100	72.82	0.49
MH13A	Ehen2015_U_70%CC	100	72.91	0.49
MH13A	Ehen2015_D_35%CC	100	72.83	0.49
MH13A	Ehen2015_D_30%CC	100	72.82	0.49
MH13A	Ehen2015_D_70%CC	100	72.91	0.49
MH13A	Ehen2015_U	200	72.79	0.50
MH13A	Ehen2015_D	200	72.79	0.50
MH13A	Ehen2015_D	500	72.85	0.50
MH13A	Ehen2015_D	1000	72.90	0.50
MH13A	Ehen2015_U	1000	72.90	0.50
MH13B	Ehen2015_U	5	72.23	0.52
MH13B	Ehen2015_D	5	72.23	0.52
MH13B	Ehen2015_D	10	72.26	0.52
MH13B	Ehen2015_U	10	72.26	0.52
MH13B	Ehen2015_D	15	72.27	0.52
MH13B	Ehen2015_U	20	72.28	0.52
MH13B	Ehen2015_D	20	72.28	0.52
MH13B	Ehen2015_U	25	72.29	0.52

MH13B	Ehen2015_D	25	72.29	0.52
MH13B	Ehen2015_D	30	72.29	0.52
MH13B	Ehen2015_U	30	72.29	0.52
MH13B	Ehen2015_D	40	72.30	0.52
MH13B	Ehen2015_D	50	72.31	0.52
MH13B	Ehen2015_U	50	72.31	0.52
MH13B	Ehen2015_D	75	72.32	0.52
MH13B	Ehen2015_U	75	72.32	0.52
MH13B	Ehen2015_U	100	72.34	0.52
MH13B	Ehen2015_D	100	72.34	0.52
MH13B	Ehen2015_U_35%CC	100	72.40	0.54
MH13B	Ehen2015_U_30%CC	100	72.39	0.53
MH13B	Ehen2015_U_70%CC	100	72.47	0.56
MH13B	Ehen2015_D_35%CC	100	72.40	0.54
MH13B	Ehen2015_D_30%CC	100	72.39	0.53
MH13B	Ehen2015_D_70%CC	100	72.47	0.56
MH13B	Ehen2015_U	200	72.37	0.52
MH13B	Ehen2015_D	200	72.37	0.52
MH13B	Ehen2015_D	500	72.42	0.54
MH13B	Ehen2015_D	1000	72.46	0.56
MH13B	Ehen2015_U	1000	72.46	0.56
MH14.1	Ehen2015_U	5	71.44	0.00
MH14.1	Ehen2015_D	5	71.44	0.00
MH14.1	Ehen2015_D	10	71.44	0.00
MH14.1	Ehen2015_U	10	71.44	0.00
MH14.1	Ehen2015_D	15	71.44	0.00
MH14.1	Ehen2015_U	20	71.44	0.00
MH14.1	Ehen2015_D	20	71.44	0.00
MH14.1	Ehen2015_U	25	71.44	0.00
MH14.1	Ehen2015_D	25	71.44	0.00
MH14.1	Ehen2015_D	30	71.44	0.00
MH14.1	Ehen2015_U	30	71.44	0.00
MH14.1	Ehen2015_D	40	71.44	0.00
MH14.1	Ehen2015_D	50	71.44	0.00
MH14.1	Ehen2015_U	50	71.44	0.00
MH14.1	Ehen2015_D	75	71.44	0.00
MH14.1	Ehen2015_U	75	71.44	0.00
MH14.1	Ehen2015_U	100	71.44	0.00
MH14.1	Ehen2015_D	100	71.44	0.00
MH14.1	Ehen2015_U_35%CC	100	71.44	0.00
MH14.1	Ehen2015_U_30%CC	100	71.44	0.00
MH14.1	Ehen2015_U_70%CC	100	71.44	0.00
MH14.1	Ehen2015_D_35%CC	100	71.44	0.00
MH14.1	Ehen2015_D_30%CC	100	71.44	0.00
MH14.1	Ehen2015_D_70%CC	100	71.44	0.00
MH14.1	Ehen2015_U	200	71.44	0.00
MH14.1	Ehen2015_D	200	71.44	0.00
MH14.1	Ehen2015_D	500	71.44	0.00
MH14.1	Ehen2015_D	1000	71.44	0.00

MH14.1	Ehen2015_U	1000	71.44	0.00
MH7	Ehen2015_U	5	74.69	0.49
MH7	Ehen2015_D	5	74.69	0.49
MH7	Ehen2015_D	10	74.71	0.49
MH7	Ehen2015_U	10	74.71	0.49
MH7	Ehen2015_D	15	74.73	0.49
MH7	Ehen2015_U	20	74.74	0.50
MH7	Ehen2015_D	20	74.74	0.50
MH7	Ehen2015_U	25	74.75	0.50
MH7	Ehen2015_D	25	74.75	0.50
MH7	Ehen2015_D	30	74.75	0.50
MH7	Ehen2015_U	30	74.75	0.50
MH7	Ehen2015_D	40	74.77	0.50
MH7	Ehen2015_D	50	74.78	0.50
MH7	Ehen2015_U	50	74.78	0.50
MH7	Ehen2015_D	75	74.79	0.50
MH7	Ehen2015_U	75	74.79	0.50
MH7	Ehen2015_U	100	74.81	0.50
MH7	Ehen2015_D	100	74.81	0.50
MH7	Ehen2015_U_35%CC	100	74.88	0.51
MH7	Ehen2015_U_30%CC	100	74.87	0.51
MH7	Ehen2015_U_70%CC	100	74.93	0.52
MH7	Ehen2015_D_35%CC	100	74.88	0.51
MH7	Ehen2015_D_30%CC	100	74.87	0.51
MH7	Ehen2015_D_70%CC	100	74.93	0.52
MH7	Ehen2015_U	200	74.84	0.51
MH7	Ehen2015_D	200	74.84	0.51
MH7	Ehen2015_D	500	74.90	0.51
MH7	Ehen2015_D	1000	74.93	0.52
MH7	Ehen2015_U	1000	74.93	0.52
MH7.1	Ehen2015_U	5	74.88	0.00
MH7.1	Ehen2015_D	5	74.88	0.00
MH7.1	Ehen2015_D	10	74.88	0.00
MH7.1	Ehen2015_U	10	74.88	0.00
MH7.1	Ehen2015_D	15	74.88	0.00
MH7.1	Ehen2015_U	20	74.88	0.00
MH7.1	Ehen2015_D	20	74.88	0.00
MH7.1	Ehen2015_U	25	74.88	0.00
MH7.1	Ehen2015_D	25	74.88	0.00
MH7.1	Ehen2015_D	30	74.88	0.00
MH7.1	Ehen2015_U	30	74.88	0.00
MH7.1	Ehen2015_D	40	74.88	0.00
MH7.1	Ehen2015_D	50	74.88	0.00
MH7.1	Ehen2015_U	50	74.88	0.00
MH7.1	Ehen2015_D	75	74.88	0.00
MH7.1	Ehen2015_U	75	74.88	0.00
MH7.1	Ehen2015_U	100	74.88	0.00
MH7.1	Ehen2015_D	100	74.88	0.00
MH7.1	Ehen2015_U_35%CC	100	74.88	0.00

MH7.1	Ehen2015_U_30%CC	100	74.88	0.00
MH7.1	Ehen2015_U_70%CC	100	74.88	0.00
MH7.1	Ehen2015_D_35%CC	100	74.88	0.00
MH7.1	Ehen2015_D_30%CC	100	74.88	0.00
MH7.1	Ehen2015_D_70%CC	100	74.88	0.00
MH7.1	Ehen2015_U	200	74.88	0.00
MH7.1	Ehen2015_D	200	74.88	0.00
MH7.1	Ehen2015_D	500	74.88	0.00
MH7.1	Ehen2015_D	1000	74.88	0.00
MH7.1	Ehen2015_U	1000	74.88	0.00
NB0c.2	Ehen2015_U	5	76.32	0.47
NB0c.2	Ehen2015_D	5	76.32	0.47
NB0c.2	Ehen2015_D	10	76.39	0.48
NB0c.2	Ehen2015_U	10	76.39	0.48
NB0c.2	Ehen2015_D	15	76.42	0.48
NB0c.2	Ehen2015_U	20	76.46	0.49
NB0c.2	Ehen2015_D	20	76.46	0.49
NB0c.2	Ehen2015_U	25	76.49	0.49
NB0c.2	Ehen2015_D	25	76.49	0.49
NB0c.2	Ehen2015_D	30	76.50	0.49
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NB0c.2	Ehen2015_D	40	76.54	0.50
NB0c.2	Ehen2015_D	50	76.57	0.50
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NB0c.2	Ehen2015_D	75	76.61	0.51
NB0c.2	Ehen2015_U	75	76.61	0.51
NB0c.2	Ehen2015_U	100	76.65	0.51
NB0c.2	Ehen2015_D	100	76.65	0.51
NB0c.2	Ehen2015_U_35%CC	100	76.90	0.54
NB0c.2	Ehen2015_U_30%CC	100	76.86	0.54
NB0c.2	Ehen2015_U_70%CC	100	77.13	0.57
NB0c.2	Ehen2015_D_35%CC	100	76.90	0.54
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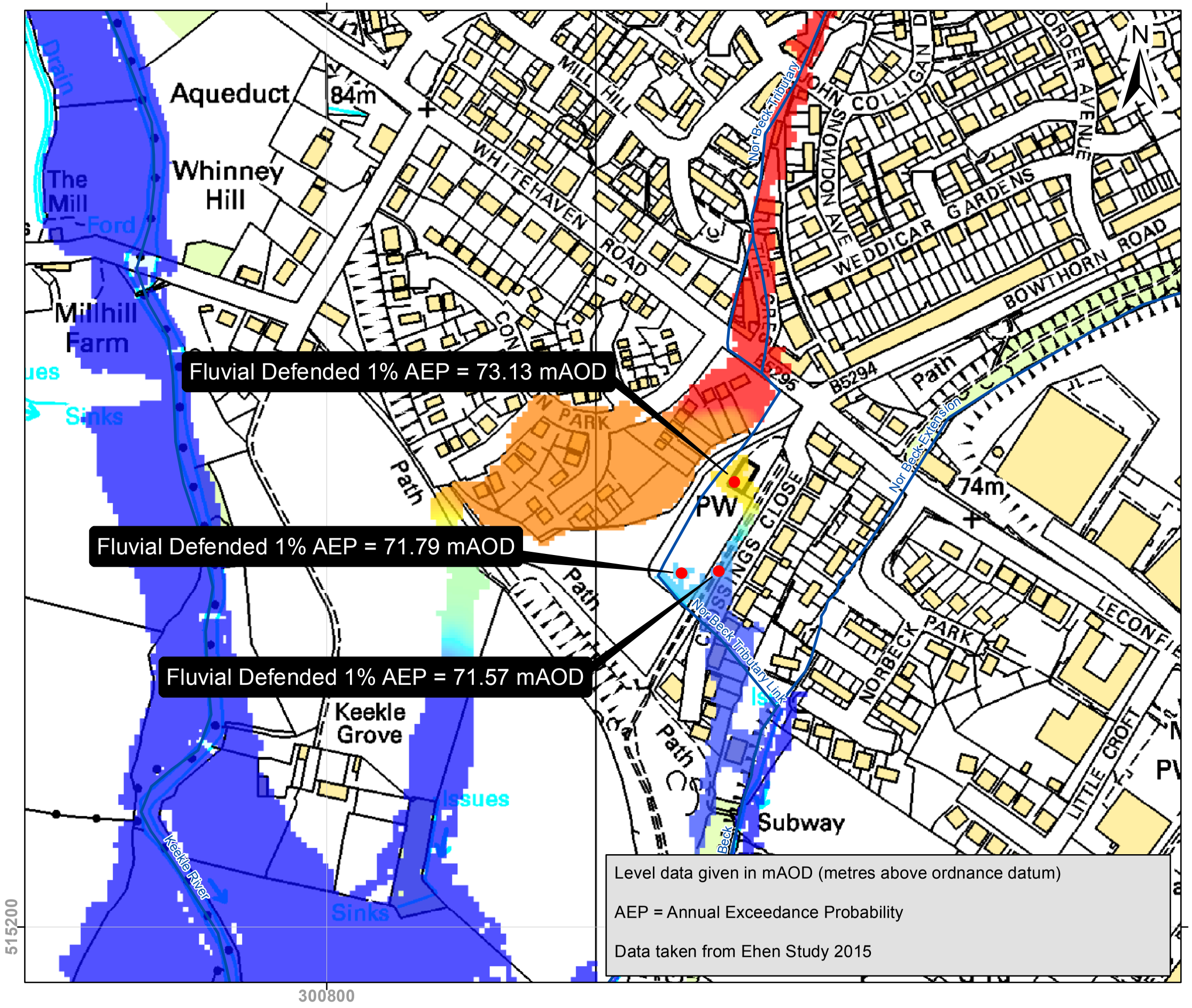
NB0c.2	Ehen2015_D_70%CC	100	77.13	0.57
NB0c.2	Ehen2015_U	200	76.76	0.53
NB0c.2	Ehen2015_D	200	76.76	0.53
NB0c.2	Ehen2015_D	500	76.96	0.55
NB0c.2	Ehen2015_D	1000	77.10	0.57
NB0c.2	Ehen2015_U	1000	77.10	0.57
NB5.2	Ehen2015_U	5	71.75	0.53
NB5.2	Ehen2015_D	5	71.75	0.53
NB5.2	Ehen2015_D	10	71.77	0.53
NB5.2	Ehen2015_U	10	71.77	0.53
NB5.2	Ehen2015_D	15	71.77	0.53
NB5.2	Ehen2015_U	20	71.78	0.53
NB5.2	Ehen2015_D	20	71.78	0.53
NB5.2	Ehen2015_U	25	71.78	0.54
NB5.2	Ehen2015_D	25	71.78	0.54
NB5.2	Ehen2015_D	30	71.78	0.54

NB5.2	Ehen2015_U	30	71.78	0.54
NB5.2	Ehen2015_D	40	71.78	0.55
NB5.2	Ehen2015_D	50	71.79	0.56
NB5.2	Ehen2015_U	50	71.79	0.56
NB5.2	Ehen2015_D	75	71.79	0.56
NB5.2	Ehen2015_U	75	71.79	0.56
NB5.2	Ehen2015_U	100	71.80	0.57
NB5.2	Ehen2015_D	100	71.80	0.57
NB5.2	Ehen2015_U_35%CC	100	71.81	0.61
NB5.2	Ehen2015_U_30%CC	100	71.81	0.60
NB5.2	Ehen2015_U_70%CC	100	71.82	0.65
NB5.2	Ehen2015_D_35%CC	100	71.81	0.61
NB5.2	Ehen2015_D_30%CC	100	71.81	0.60
NB5.2	Ehen2015_D_70%CC	100	71.82	0.65
NB5.2	Ehen2015_U	200	71.80	0.59
NB5.2	Ehen2015_D	200	71.80	0.59
NB5.2	Ehen2015_D	500	71.81	0.62
NB5.2	Ehen2015_D	1000	71.82	0.65
NB5.2	Ehen2015_U	1000	71.82	0.65
NB5a.2	Ehen2015_U	5	71.75	0.55
NB5a.2	Ehen2015_D	5	71.75	0.55
NB5a.2	Ehen2015_D	10	71.76	0.55
NB5a.2	Ehen2015_U	10	71.76	0.55
NB5a.2	Ehen2015_D	15	71.77	0.55
NB5a.2	Ehen2015_U	20	71.78	0.55
NB5a.2	Ehen2015_D	20	71.78	0.55
NB5a.2	Ehen2015_U	25	71.78	0.55
NB5a.2	Ehen2015_D	25	71.78	0.55
NB5a.2	Ehen2015_D	30	71.78	0.55
NB5a.2	Ehen2015_U	30	71.78	0.55
NB5a.2	Ehen2015_D	40	71.78	0.55
NB5a.2	Ehen2015_D	50	71.79	0.55
NB5a.2	Ehen2015_U	50	71.79	0.55
NB5a.2	Ehen2015_D	75	71.79	0.55
NB5a.2	Ehen2015_U	75	71.79	0.55
NB5a.2	Ehen2015_U	100	71.79	0.55
NB5a.2	Ehen2015_D	100	71.79	0.55
NB5a.2	Ehen2015_U_35%CC	100	71.81	0.55
NB5a.2	Ehen2015_U_30%CC	100	71.81	0.55
NB5a.2	Ehen2015_U_70%CC	100	71.82	0.54
NB5a.2	Ehen2015_D_35%CC	100	71.81	0.55
NB5a.2	Ehen2015_D_30%CC	100	71.81	0.55
NB5a.2	Ehen2015_D_70%CC	100	71.82	0.54
NB5a.2	Ehen2015_U	200	71.80	0.55
NB5a.2	Ehen2015_D	200	71.80	0.55
NB5a.2	Ehen2015_D	500	71.81	0.55
NB5a.2	Ehen2015_D	1000	71.82	0.55
NB5a.2	Ehen2015_U	1000	71.82	0.55



Level data given in mAOD (metres above ordnance datum)

AEP = Annual Exceedance Probability

Data taken from Ehen Study 2015

Environment Agency

Fluvial Flood Map: Whitehaven Road, Cleator Moor, CA25 5PY

Produced: 14 September 2021
Our Ref: CL232400
NGR: NY0111215532

Key

Main River

Fluvial Defended 1% annual probability of flooding scenario

mAOD

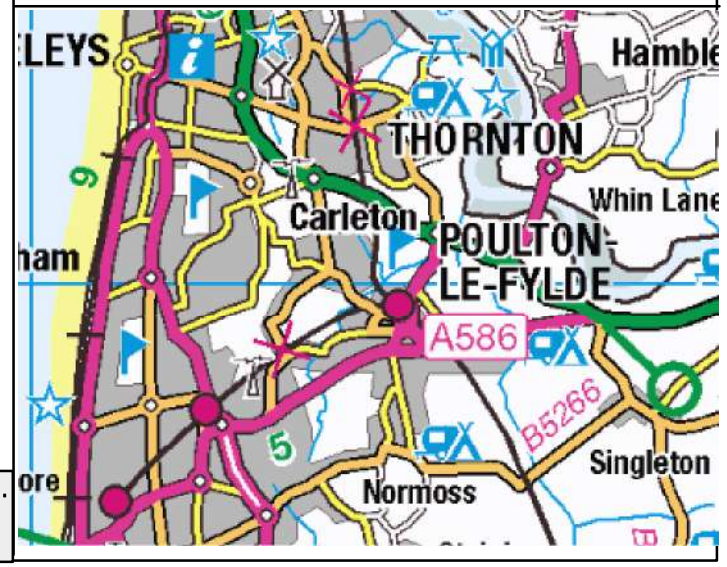
High : 74

Low : 71

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

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to 0.1% chance of occurring each year.

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



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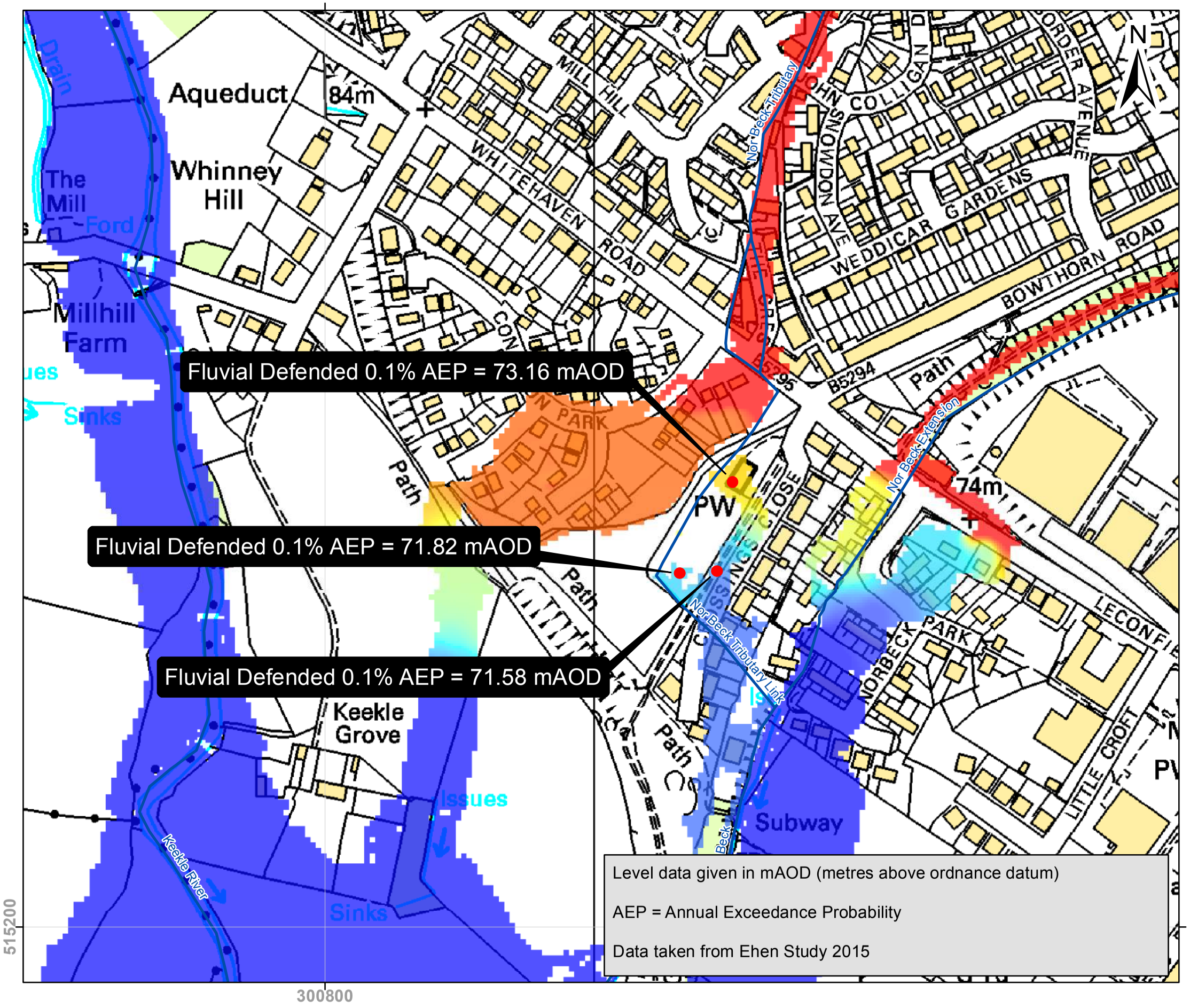


Level data given in mAOD (metres above ordnance datum)

AEP = Annual Exceedance Probability

Data taken from Ehen Study 2015

Environment Agency

Fluvial Flood Map: Whitehaven Road, Cleator Moor, CA25 5PY

Produced: 14 September 2021
Our Ref: CL232400
NGR:NY0111215532

Key

Main River

Fluvial Defended 0.1% annual probability of flooding scenario

mAOD

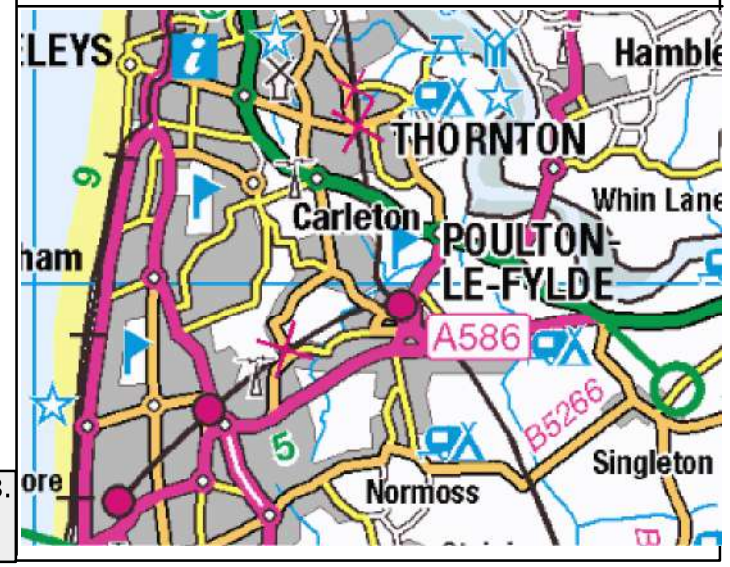
High : 74

Low : 71

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

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to 0.1% chance of occurring each year.

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



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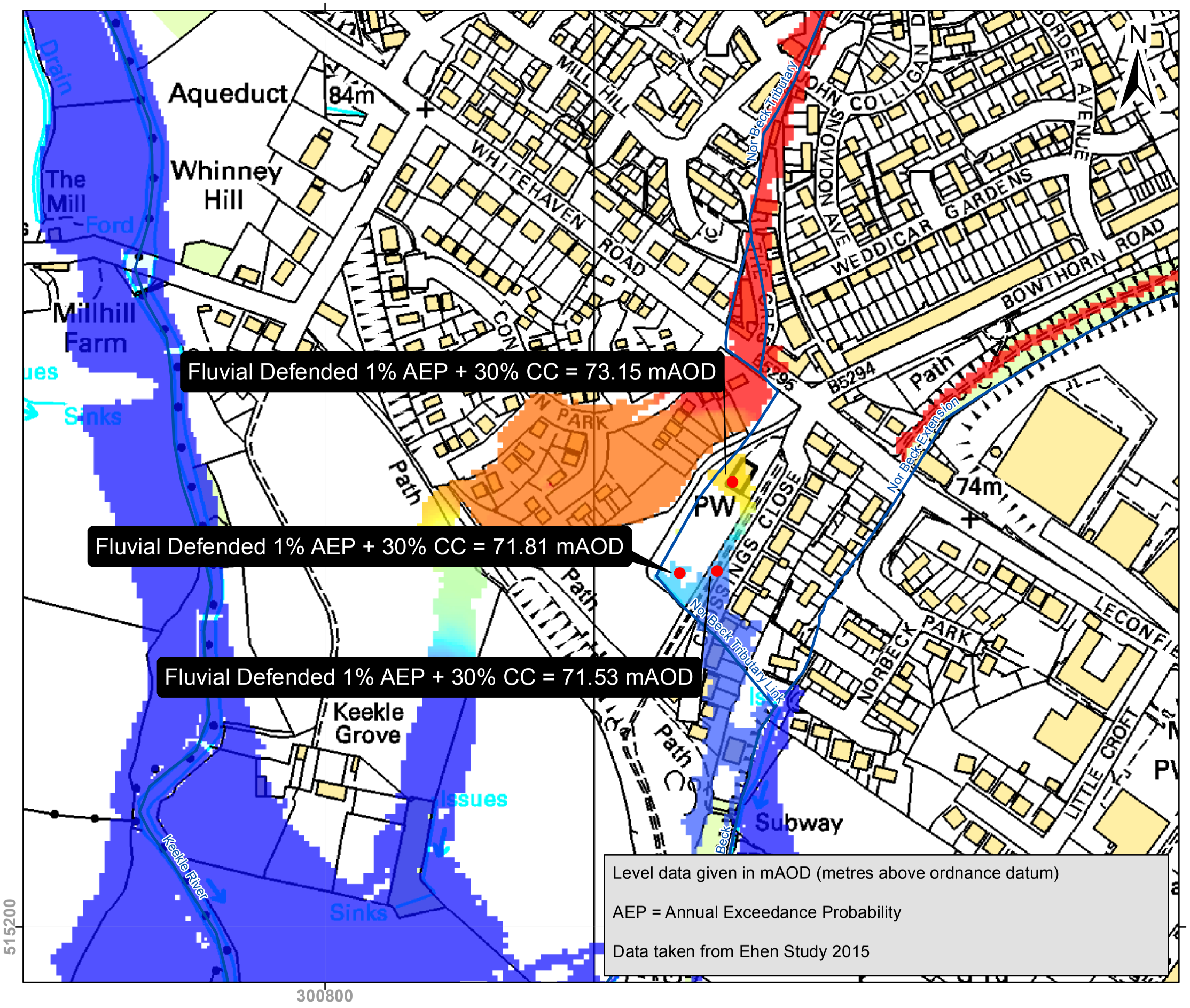


Level data given in mAOD (metres above ordnance datum)

AEP = Annual Exceedance Probability

Data taken from Ehen Study 2015

Environment Agency

Fluvial Flood Map: Whitehaven Road, Cleator Moor, CA25 5PY

Produced: 14 September 2021
Our Ref: CL232400
NGR: NY0111215532

Key

Main River

Fluvial Defended 1% annual probability of flooding scenario + 30% Climate change

mAOD

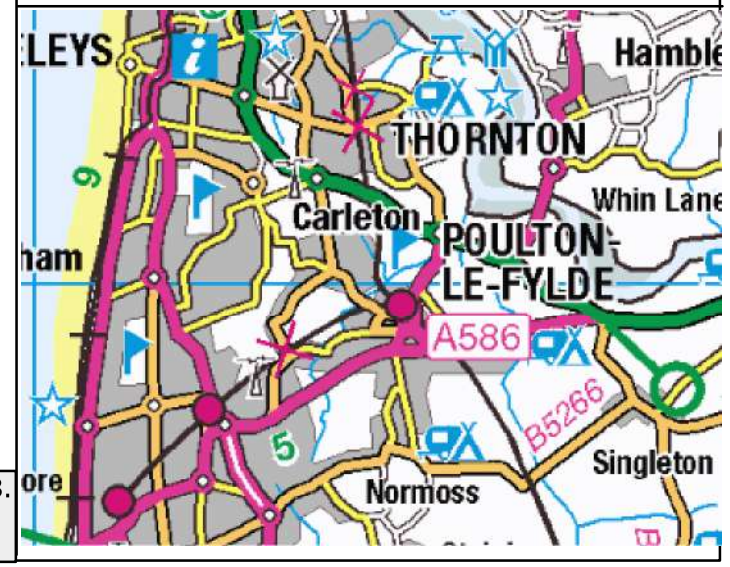
High : 74

Low : 71

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

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to 0.1% chance of occurring each year.

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



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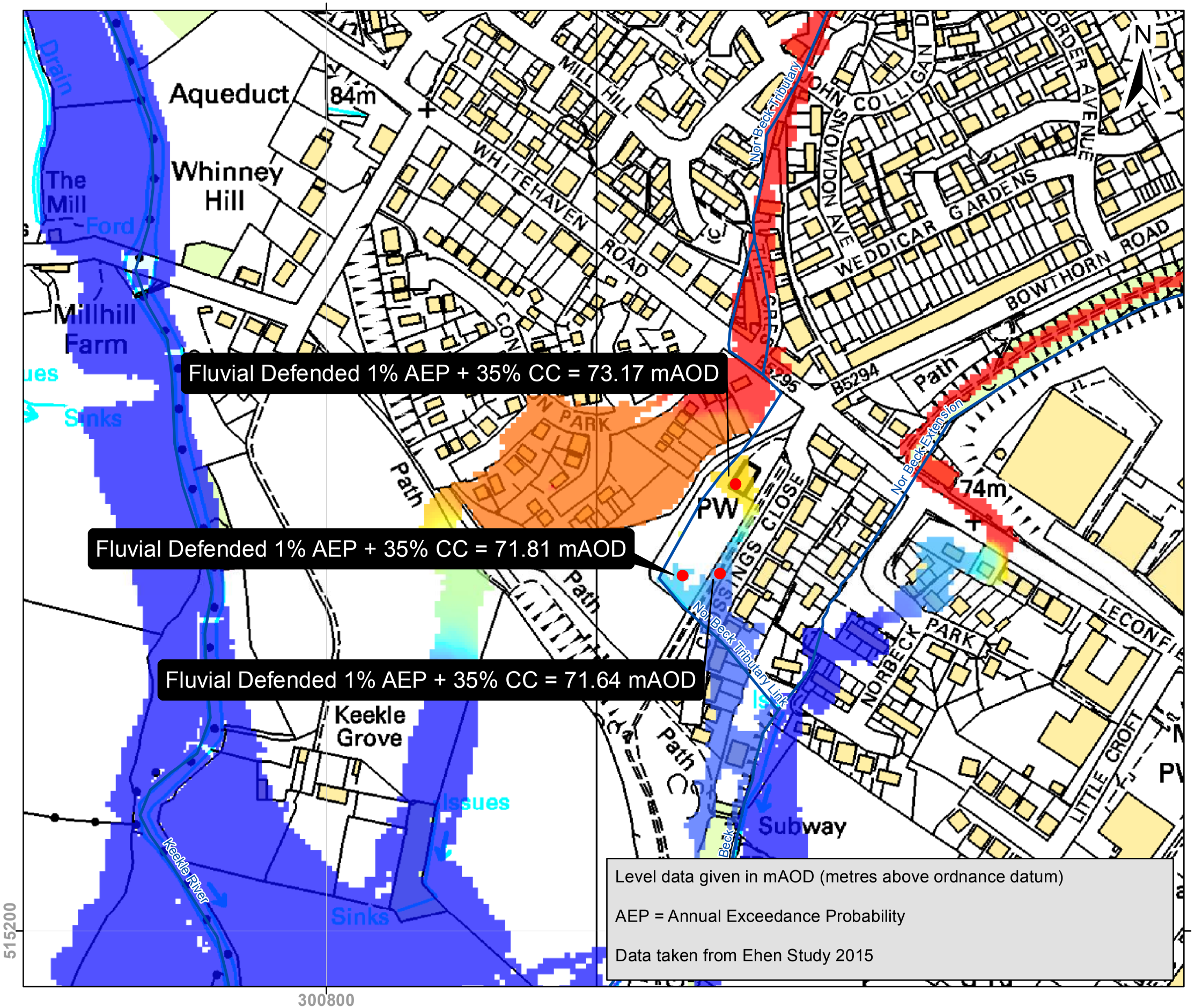
Fluvial Flood Map: Whitehaven Road, Cleator Moor, CA25 5PY

Produced: 14 September 2021
Our Ref: CL232400
NGR: NY0111215532



Level data given in mAOD (metres above ordnance datum)

AEP = Annual Exceedance Probability

Data taken from Ehen Study 2015

Key

Main River

Fluvial Defended 1% annual probability of flooding scenario + 35% Climate change

mAOD

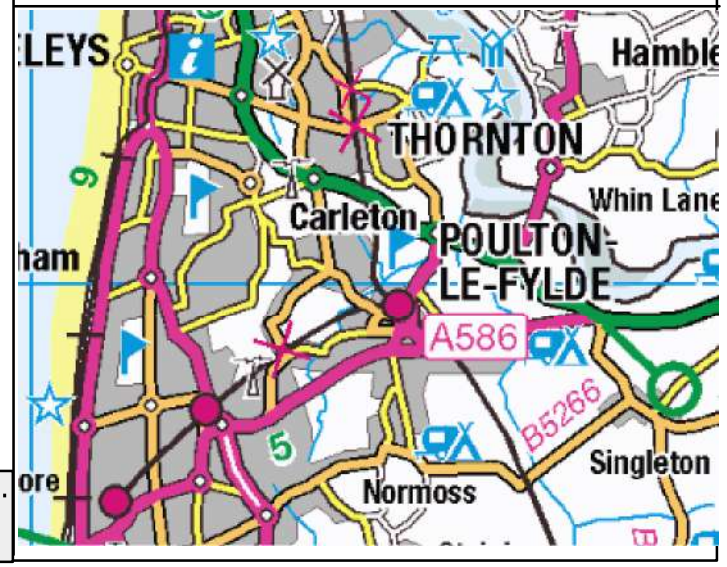
High : 74

Low : 71

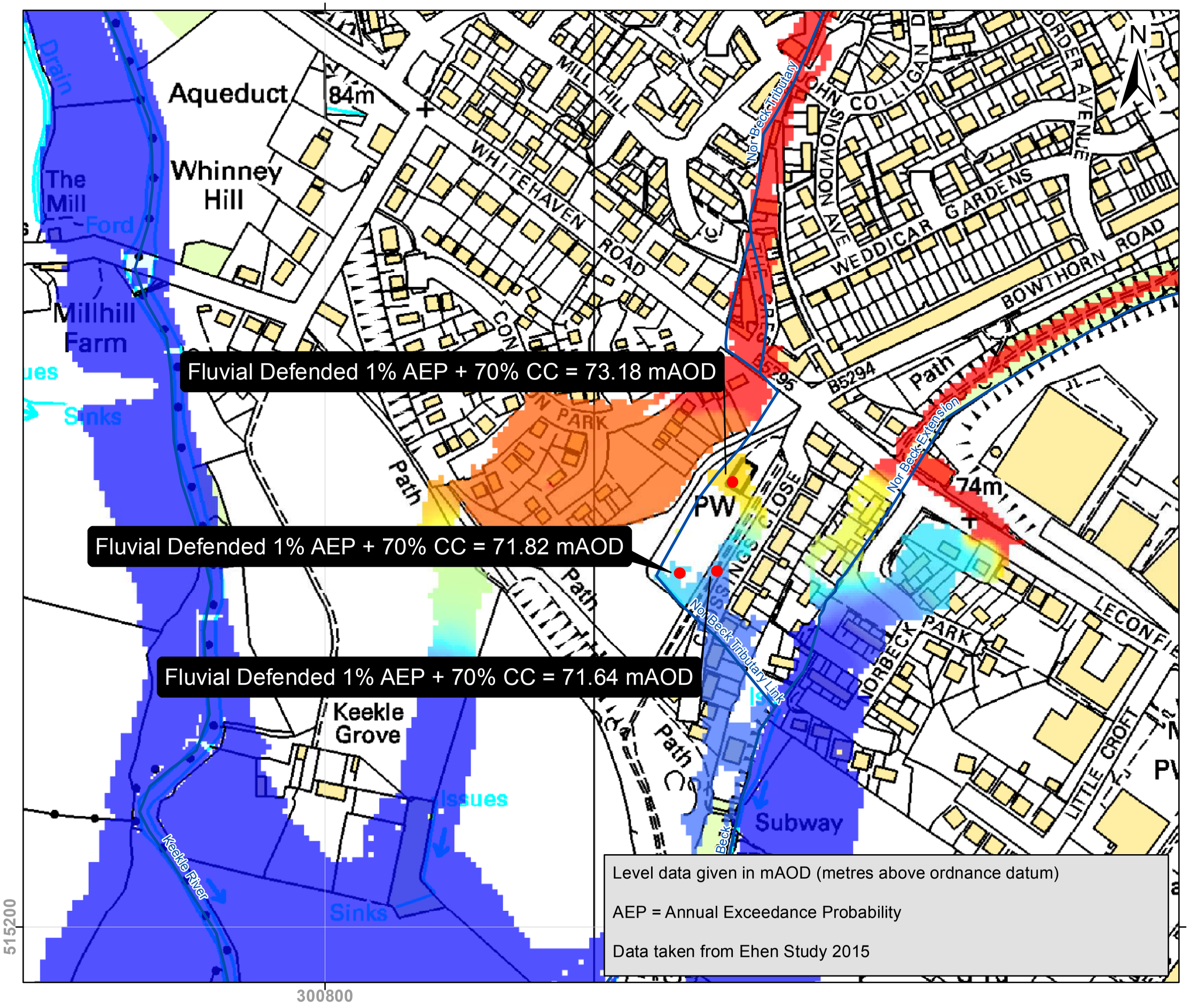
Flood Zone 3 shows the area that could be affected by flooding:
- from the sea with a 0.5% or greater chance of happening each year
- or from a river with a 1.0% or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to 0.1% chance of occurring each year.

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



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



Environment Agency

Fluvial Flood Map: Whitehaven Road, Cleator Moor, CA25 5PY

Produced: 14 September 2021
Our Ref: CL232400
NGR: NY0111215532

Key

Main River

Fluvial Defended 1% annual probability of flooding scenario + 70% Climate change

mAOD

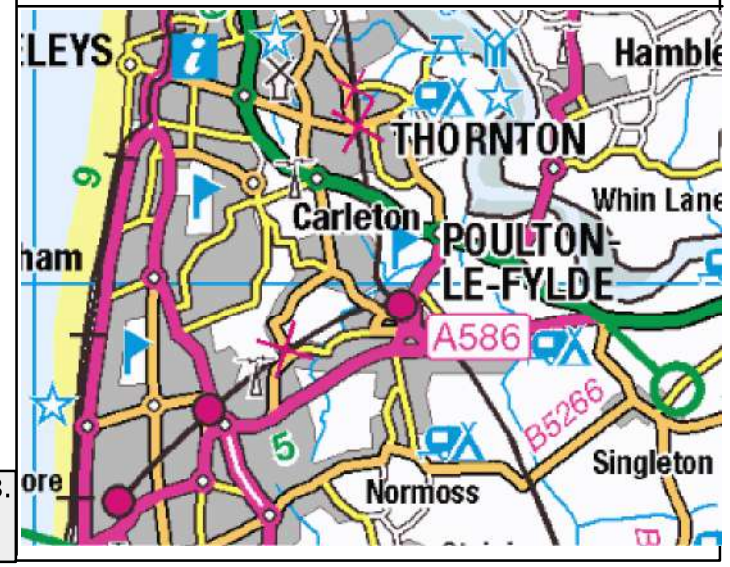
High : 74

Low : 71

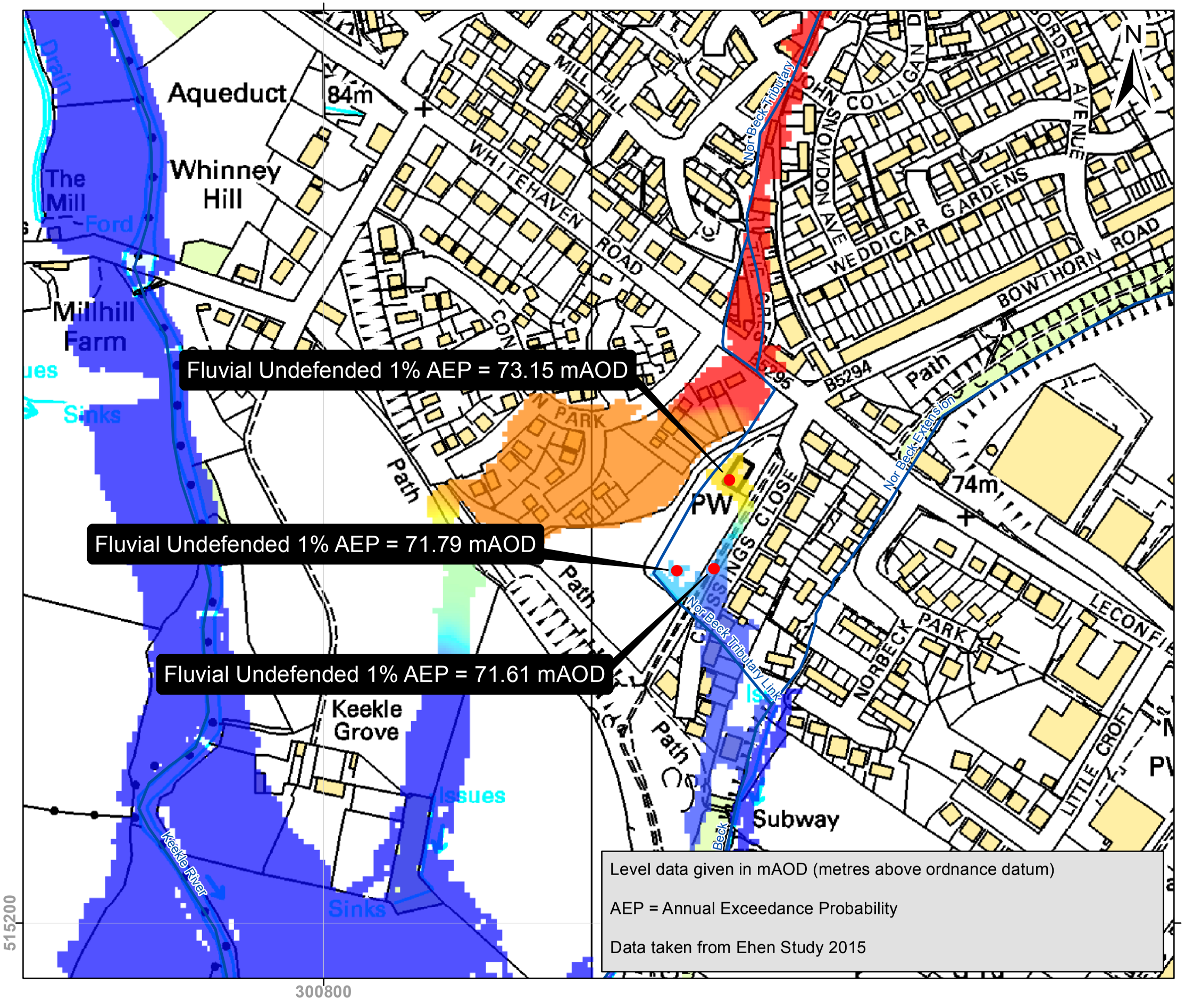
Flood Zone 3 shows the area that could be affected by flooding:
- from the sea with a 0.5% or greater chance of happening each year
- or from a river with a 1.0% or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to 0.1% chance of occurring each year.

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



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



Level data given in mAOD (metres above ordnance datum)

AEP = Annual Exceedance Probability

Data taken from Ehen Study 2015

Fluvial Flood Map: Whitehaven Road, Cleator Moor, CA25 5PY

Produced: 14 September 2021
Our Ref: CL232400
NGR: NY0111215532

Key

Main River

Fluvial Undefended 1% annual probability of flooding scenario

mAOD

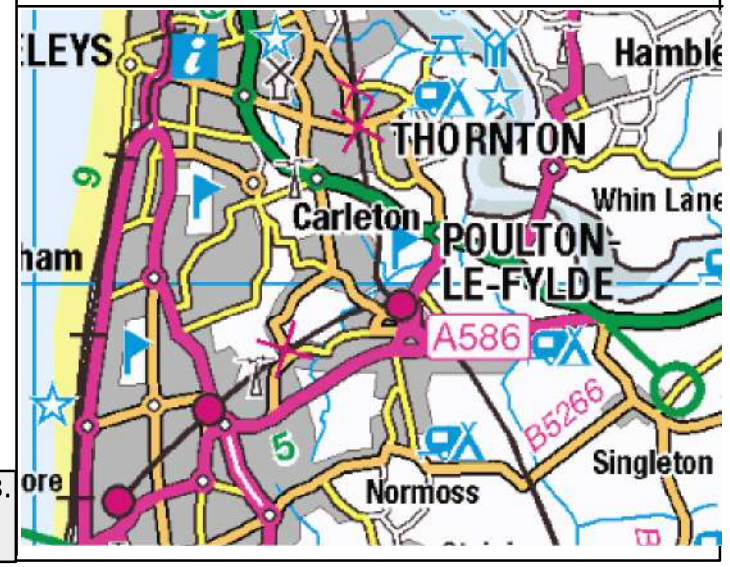
High : 74

Low : 71

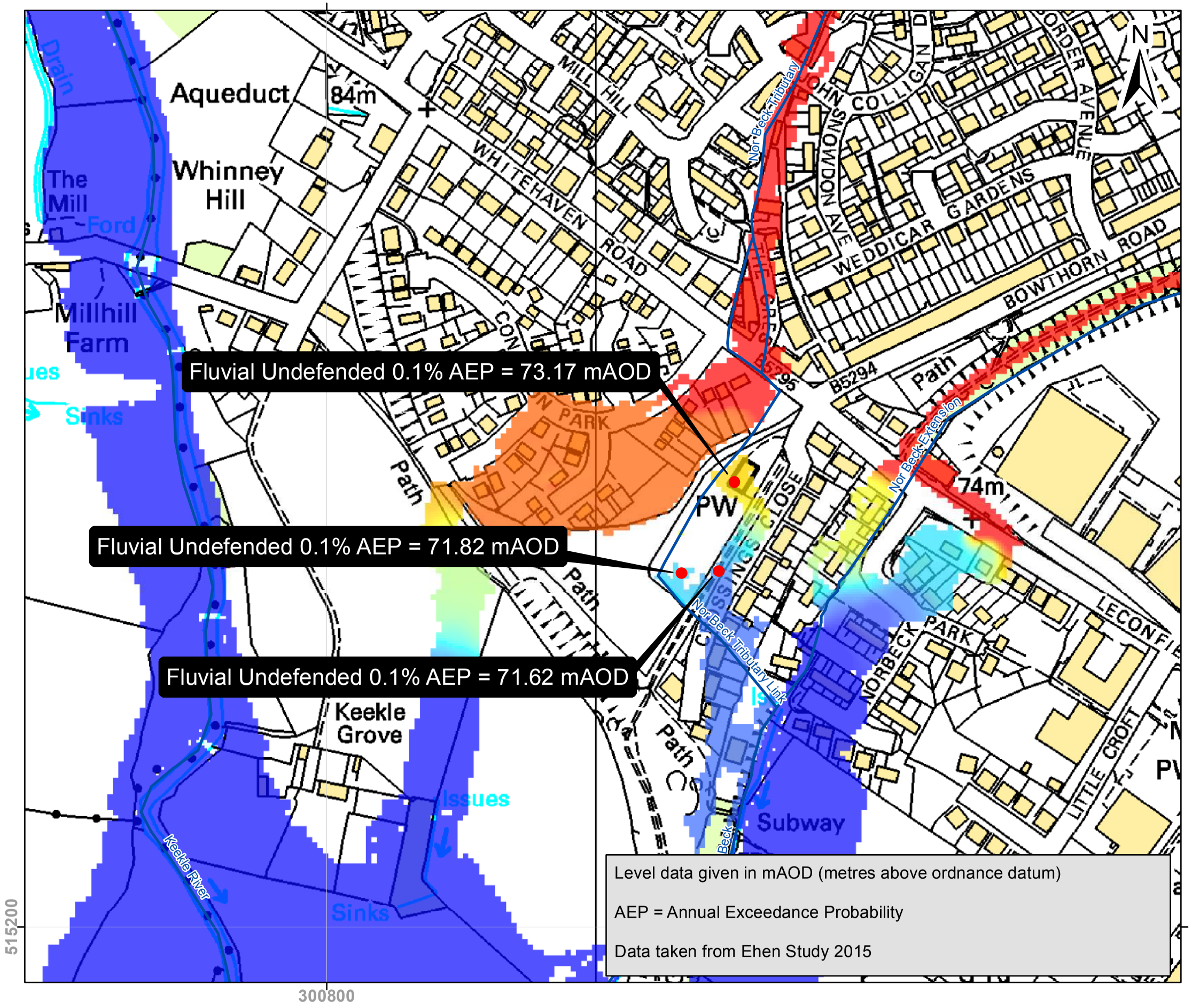
Flood Zone 3 shows the area that could be affected by flooding:
- from the sea with a 0.5% or greater chance of happening each year
- or from a river with a 1.0% or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to 0.1% chance of occurring each year.

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



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



Environment Agency

Fluvial Flood Map: Whitehaven Road, Cleator Moor, CA25 5PY

Produced: 14 September 2021
Our Ref: CL232400
NGR: NY0111215532

Key

Main River

Fluvial Undefended 0.1% annual probability of flooding scenario

mAOD

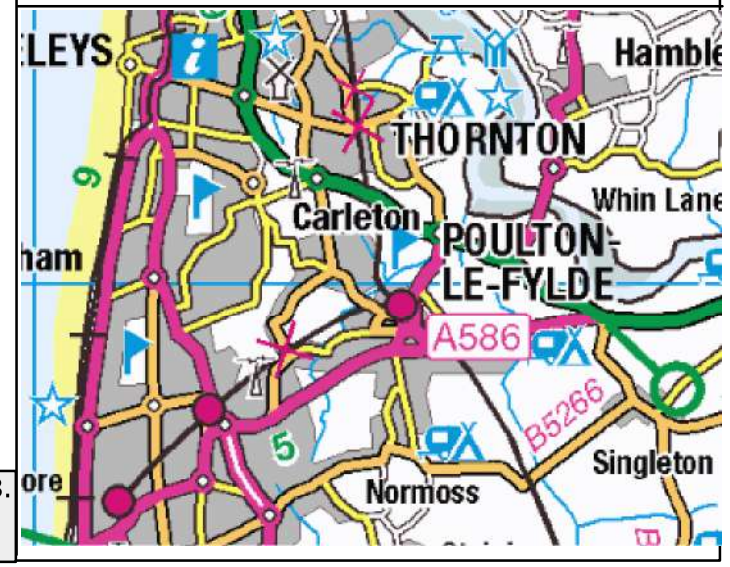
High : 74

Low : 71

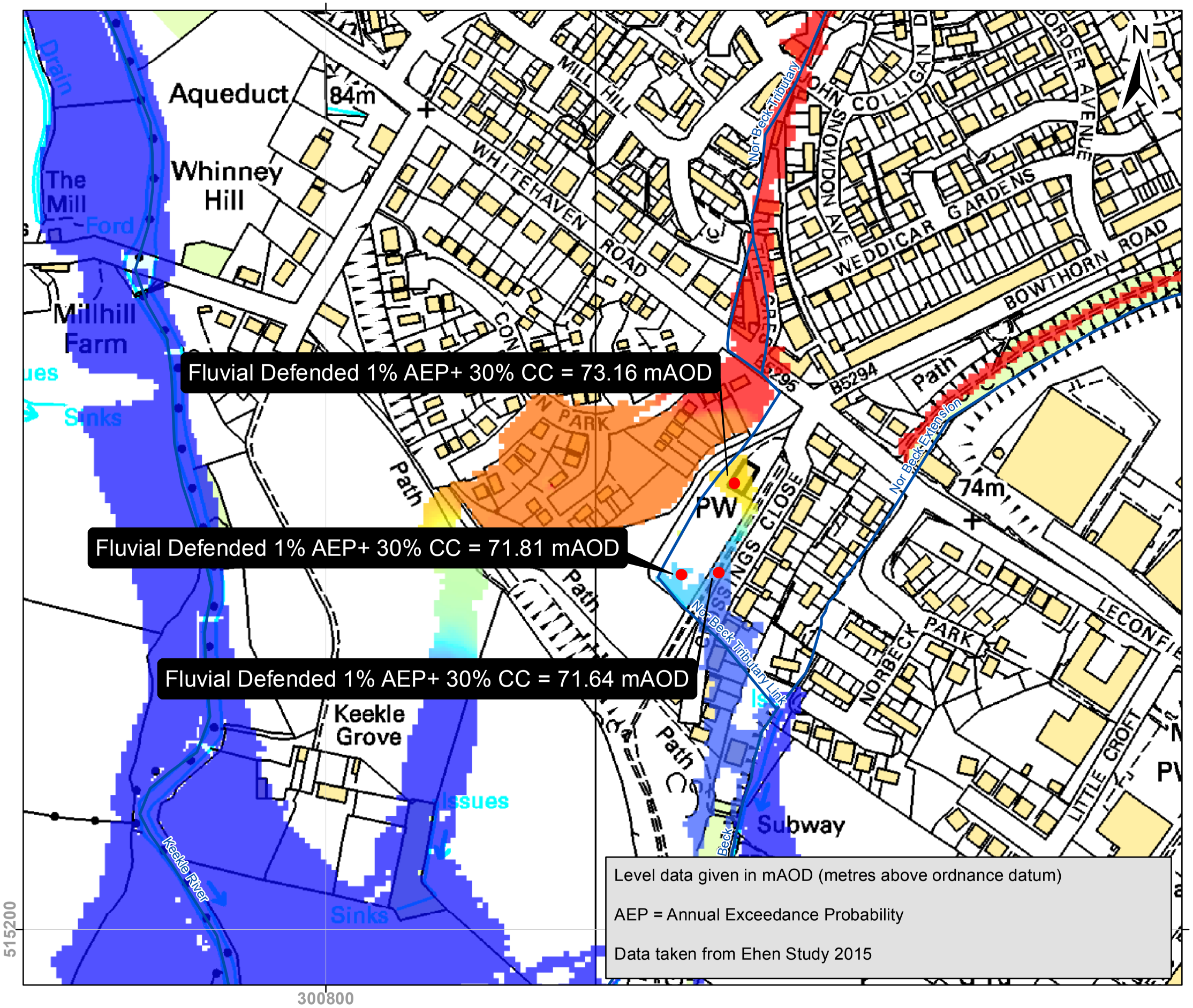
Flood Zone 3 shows the area that could be affected by flooding:
- from the sea with a 0.5% or greater chance of happening each year
- or from a river with a 1.0% or greater chance of happening each year.

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to 0.1% chance of occurring each year.

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



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



Level data given in mAOD (metres above ordnance datum)

AEP = Annual Exceedance Probability

Data taken from Ehen Study 2015

Environment Agency

Fluvial Flood Map: Whitehaven Road, Cleator Moor, CA25 5PY

Produced: 15 September 2021
Our Ref: CL232400
NGR: NY0111215532

Key

Main River

Fluvial Undefended 1% annual probability of flooding scenario + 30% Climate change

mAOD

High : 74

Low : 71

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

Flood Zone 2 shows the extent of an extreme flood from rivers or the sea with up to 0.1% chance of occurring each year.

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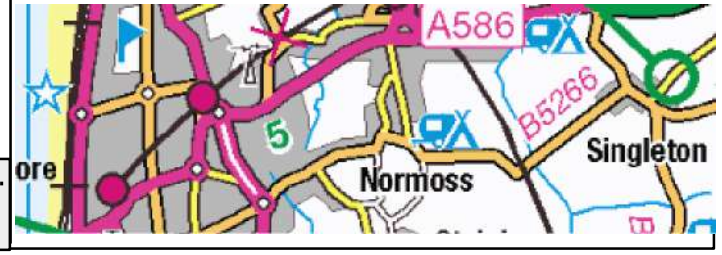
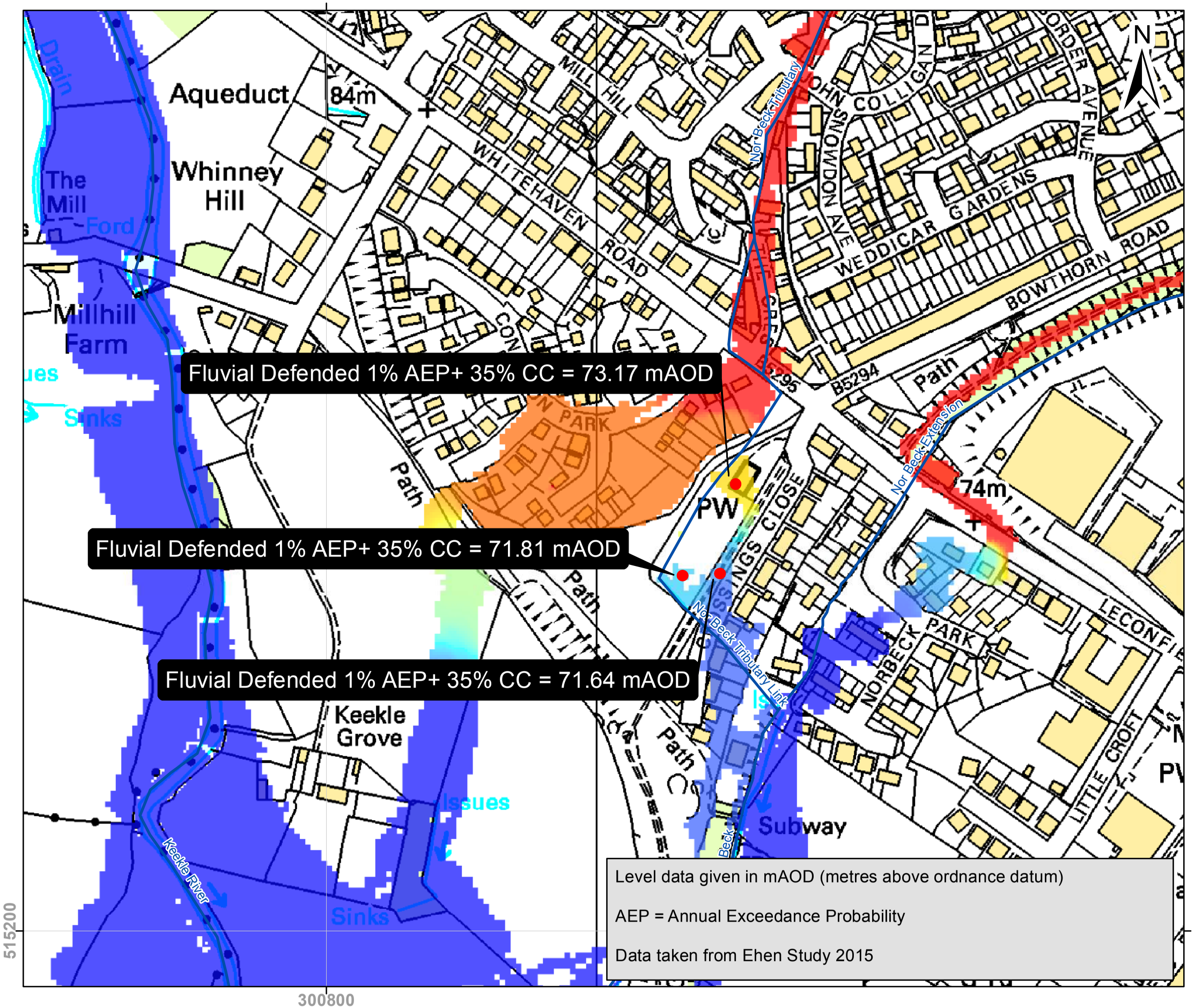


Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

Fluvial Flood Map: Whitehaven Road, Cleator Moor, CA25 5PY

Produced: 15 September 2021
Our Ref: CL232400
NGR: NY0111215532



Level data given in mAOD (metres above ordnance datum)

AEP = Annual Exceedance Probability

Data taken from Ehen Study 2015

Key

Main River

Fluvial Undefended 1% annual probability of flooding scenario + 35% Climate change

mAOD

High : 74

Low : 71

Flood Zone 3 shows the area that could be affected by flooding:
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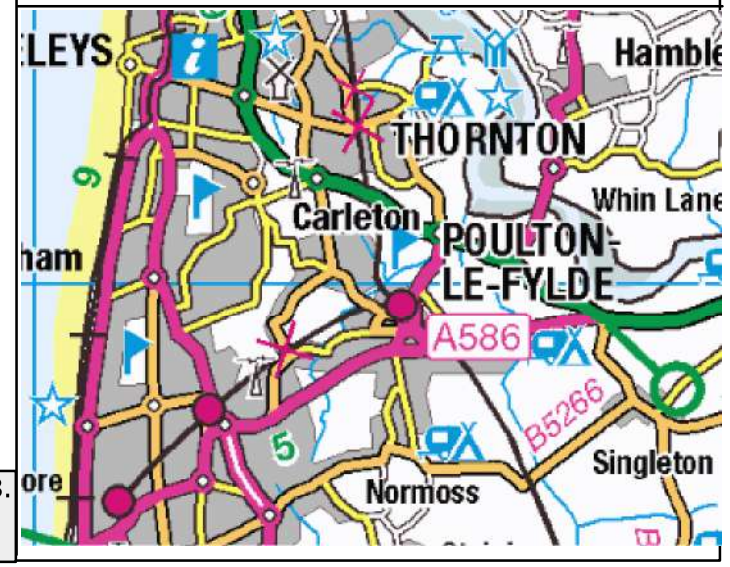
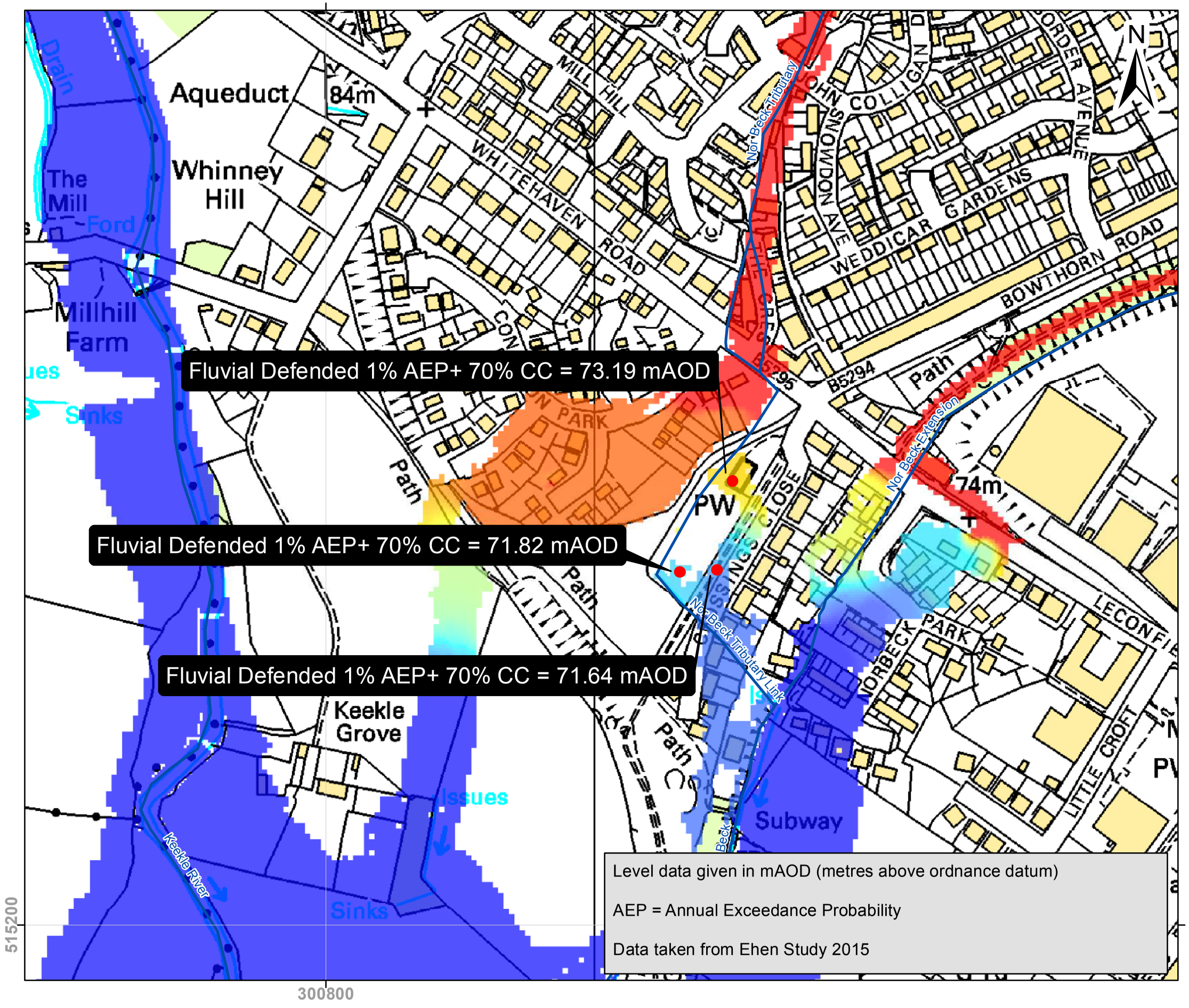


Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk



Environment Agency

Fluvial Flood Map: Whitehaven Road, Cleator Moor, CA25 5PY

Produced: 15 September 2021
Our Ref: CL232400
NGR: NY0111215532

Key

Main River

Fluvial Undefended 1% annual probability of flooding scenario + 70% Climate change

mAOD

High : 74

Low : 71

Flood Zone 3 shows the area that could be affected by flooding:
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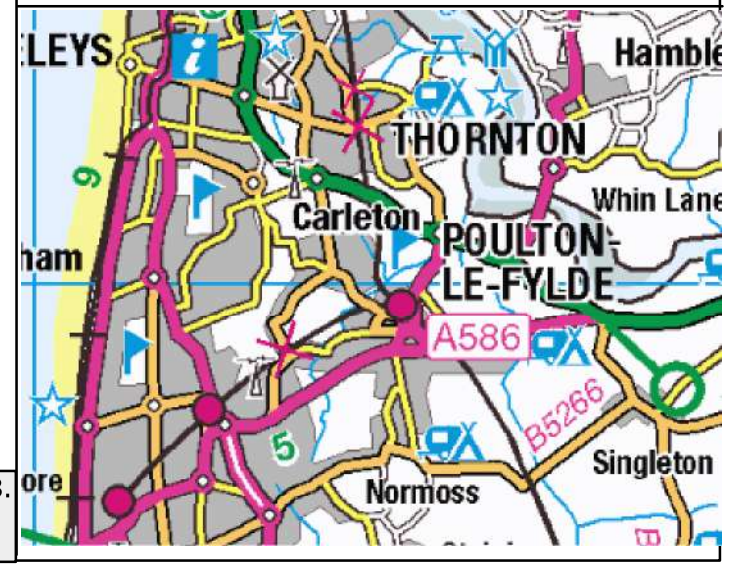

Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

APPENDIX C: UU CORRESPONDENCE

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Hannah Buchanan

From: seweradoptions@uuplc.co.uk
Sent: 26 August 2022 12:38
To: Hannah Buchanan
Subject: Pre Development Enquiry for: Land Off Whitehaven Road UU Reference Number : 02687482

Good afternoon Hannah,

Pre Development Enquiry for: Land Off Whitehaven Road UU Reference Number : 02687482

https://www.unitedutilities.com/builders-developers/larger-developments/pre-development/wastewater-pre-dev/

We have carried out an assessment of your application which is based on the information provided. This pre-development advice on your drainage strategy will be valid for 12 months. Your drainage strategy will need to be reviewed by other competent authorities as part of the planning process, and we advise that you carry out the necessary site investigations to confirm the viability of your proposals.

If your investigations require access to our public sewer network, we ask that you contact our network engineers with a request for an access certificate via our main contact telephone number 0345 6723 723 or refer to the link below:

https://www.unitedutilities.com/builders-developers/working-near-our-assets/

Foul Water

Foul flow from this site will be allowed to drain into the public foul water/combined sewer system.

Our preferred point of discharge would be to the 225mm diameter public foul water sewer within the site boundary of your proposed development at an unrestricted rate.

If you are able to identify an alternative, more suitable point of discharge, we request that you contact us at your earliest convenience so that we can assess suitability.

In accordance with our infrastructure plans we may ask you to change your point of connection. Therefore please contact us when you are ready to formalise your drainage proposals, we would suggest before you submit for Full Planning.

Surface Water

All surface water flow from the proposed development should drain in-line with the drainage hierarchy, as outlined in Paragraph 80, (Reference ID: 7-080-20150323), of the National Planning Practice Guidance. We also recommend you prioritise the use of multi-functional sustainable drainage systems for the management of surface water in accordance with national planning policy.

Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable.
This is outlined as follows, in order of priority:

1. **into the ground (infiltration);**

2. **to a surface waterbody;**
3. **to a surface water sewer or highway drain;**
4. **to a combined sewer.**

For guidance, The **North West SuDS Pro-Forma** provides information on the appropriate evidence required at each stage of the hierarchy, to demonstrate how each level has been discounted.

The Lead Local Flood Authority has responsibility for all surface water drainage concerns and their input to your proposal is critical. You should also consider whether it is necessary to discuss your proposal with the Environment Agency, or Internal Drainage Board (if operating in your area).

The Local Planning Authority are the determining authority for any application for planning permission and the appropriate authority for determining cost viability of a proposed drainage scheme, such assessments are outside of the jurisdiction of United Utilities.

Infiltration

Surface water runoff generated from this development should discharge to the ground via infiltration system where feasible.

A detailed evidence based feasibility assessment must be carried out in line with Chapter 25 of the CIRIA SuDS Manual 2015 to determine whether infiltration is a suitable method of surface water disposal.

Particular attention must be paid to Ground Water Source Protection Zones to ensure that the risk of pollution to these valuable resources is not compromised. Details can be obtained from the government website:

https://www.gov.uk/guidance/groundwater-source-protection-zones-spzs#find-groundwater-spzs

If your site is in a Groundwater Source Protection Zone, you should have regard to the Environment Agency's approach to Groundwater Protection. Information on this is available via the link below:

https://www.gov.uk/government/publications/groundwater-protection-position-statements

Please note that such a location could have implications for the principle of your development and the need for additional mitigating measures to protect the groundwater environment and public water supply in the detailed design of your site.

Waterbody

If an evidence based assessment has been carried out and confirms that infiltration is not feasible, we recommend that you contact the Lead Local Flood Authority and/or Environment Agency to discuss a point of discharge to the main river located West of the proposed site.

We would encourage you to identify and engage with any third party landowner and riparian owner to agree access and discharge rights to the water body if this is not in your ownership.

Highway Drainage

If an evidence based assessment has been carried out and confirms that infiltration is not feasible, we recommend that you investigate the possibility of draining surface water to the highway drain where this ultimately discharges to a watercourse, by contacting the relevant Highway Authority.

Public Sewer

In accordance with the hierarchy of drainage options within the National Planning Practice Guidance, both discharge to ground via infiltration and discharge to a waterbody should be discounted prior to consideration of discharging surface water to the public sewer system. Evidence should be provided to demonstrate how these have been discounted, as outlined in the North West SuDS pro-forma.

Once evidence is provided as outlined above, United Utilities will consider a connection to the 600mm diameter public surface water sewer within the site boundary at a pass forward flow to be agreed by the Lead Local Flood Authority. United Utilities request that any agreed rate does not exceed 6l/s.

As a Water Company, we have no obligation to accept highway drainage into our public sewer network. However, should your proposals include runoff from highways, we would request that consideration is given to SuDS components that deliver source control are incorporated within the design of the scheme to reduce the volume and frequency of discharges of these flows to the public sewer.

Levels

For low-lying sites, (where the ground level of the site or the level of a basement is below the ground level at the point where the drainage connects to the public sewer), care should be taken to ensure that the property is not at increased risk of flooding. If these circumstances exist, we recommend that you contact us to discuss further. It could affect the detailed design of your site and result in the need to incorporate appropriate mitigating measures in your drainage scheme.

Land drainage / Overland flows / track drainage

United Utilities have no obligation, and furthermore we do not accept land drainage, overland flows or track drainage into the pubic sewerage network under any circumstances

Existing Wastewater Assets Crossing the Site

According to our public sewer records there are public sewers located within your site boundary. We will require unrestricted access to the sewer for maintenance purposes, we would ask that you maintain a minimum clearance of 6m which is measured 3m from the centre line of the pipe unless there happens to be a formal easement agreement in place, in which case the specified easement width would apply. If you cannot achieve this then you may wish to consider diverting and or abandoning the public sewer.

Please be aware that any proposed diversion may require modelling. This process may take up to 6 months in order to reach an acceptable design.

Please refer to the link below to obtain full details of the processes involved with sewer diversions:

https://www.unitedutilities.com/builders-developers/larger-developments/wastewater/sewer-diversions/

Existing Water Assets Crossing the Site

It is the developer responsibility to identify utilities on-site. Where clean water assets are shown on our records, we recommend that you contact our Water Pre-Development Team, via the following email address: DeveloperServicesWater@uuplc.co.uk. Further information for this service can be found on our website via the link below:

https://www.unitedutilities.com/builders-developers/larger-developments/pre-development/water-pre-dev/

Connection Application

Although we may discuss and agree discharge points and rates in principle, please be aware that you will have to apply for a formal sewer connection. This is so that we can assess the method of construction, Health & Safety requirements and to ultimately inspect the connection when it is made. Details of the application process and the form itself can be obtained from our website by following the link below:

https://www.unitedutilities.com/builders-developers/wastewater-services/sewer-connections/sewer-connection/

We recommend that the detailed design should confirm the locations of all utilities in the area and ensure that any proposed drainage solution considers routing and clash checks where required.

If we can be of any further assistance please don't hesitate to contact us further.

Kind regards,

United Utilities
Water for the North West

Ashleigh Bellerby
Assistant Developer Engineer
Developer Services & Metering
Customer Services
T: 07826891650
unitedutilities.com

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---------- Original Message ----------
From: seweradoptions@uuplc.co.uk [seweradoptions@uuplc.co.uk]
Sent: 22/08/2022 14:48
To: hannahbuchanan@betts-associates.co.uk
Subject: Our reference - 02687482

PRE DEVELOPMENT APPLICATION AT: Land Off White Haven Road – UU Ref 02687482

Please accept this email as receipt of your application received on 19.08.2022 for the above development. This has now been logged on our system and the job reference is 02687482

I have reviewed your application (and attachments) and can confirm this is suitable to be passed to Ashleigh for technical assessment. You will receive their response within 8 working days.

Hannah Buchanan

From: Hannah Buchanan
Sent: 06 September 2021 16:11
To: 'WastewaterDeveloperServices@uuplc.co.uk'
Subject: Sewer Flood Risk Information
Attachments: Location Plan.pdf

To whom it may concern,

Whitehaven Road, Cleator Moor, CA25 5PY

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

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

Kind Regards,

Hannah Buchanan *BSc (Hons)*
Graduate Flood Risk Analyst

BETTS HYDRO
Consulting Engineers

Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire, CH5 2LY
Chester +44 (0)1244 289041

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

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SUDS | STRUCTURAL SURVEYS | PARTY WALL DUTIES | INFILTRATION | GEOTECHNICAL

APPENDIX D: LPA/LLFA CORRESPONDENCE

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Hannah Buchanan

From: David Bechelli <David.Bechelli@copeland.gov.uk>
Sent: 13 September 2021 15:03
To: Hannah Buchanan
Subject: RE: Historic Flood Risk Information - Whitehaven Road, Cleator Moor, CA25 5PY

Hi Hannah,

Thanks.

You may have sent the location plan previously, but sometimes, the way e-mails are sent on, the attachments are lost.

I'm sure I've seen previous FRA's for proposed development of the site and as for the site itself, I don't hold any data, as the watercourse, open and culverted is main river and is referred to as Nor Beck Tributary or Nor Beck Drain.

I'm sure that the EA will have some information and likely some historic flood outlines.

However, I understand that there has been flooding associated with this watercourse and I can provide some rough background info:

- Due to a blockage caused by a matrass at the upstream end of the culvert (301171 515879), severe flooding occurred affecting a number of properties on the Coniston Park estate, immediately north west of the site. I think this may have been in 1999, before the watercourse was enmained.
- I think there may have been some more localised flooding affecting Crossing Close, immediately south east of the site, due to blockages of the trash screen on site (301067 515437).
- I think it was following surveys, the EA determined that culvert was not up to standard and undertook works to bring it up to standard, possibly 2011.
- I think further modelling have raised concerns that Nor Beck and Tributary culverts may be undersized and/or susceptible to blockages.

With previous FRA's for proposed development of the site, I think there may have been queries about the extent of Flood Zone, which could be based on historic flooding, rather than flood modelling, as from memory there is an old railway embankment forming the boundary of the site.

Regards

Dave

David Bechelli
Flood and Coastal Defence Engineer
Environmental Health
Copeland Borough Council

Tel: 01946 593048
Fax: 01946 592525
E-mail: David.Bechelli@copeland.gov.uk

Copeland Borough Council, Whitehaven Commercial Park, Moresby Parks, Whitehaven, Cumbria, CA28 8YD. Tel: 01946 598300. Fax: 01946 598303. www.copeland.gov.uk, info@copeland.gov.uk

From: Hannah Buchanan <hannahbuchanan@betts-associates.co.uk>
Sent: 13 September 2021 14:07
To: David Bechelli <David.Bechelli@copeland.gov.uk>
Subject: RE: Historic Flood Risk Information - Whitehaven Road, Cleator Moor, CA25 5PY

Hi David,

Thank you for contacting me, sorry that it didn't work previously!

I've attached the location plan here for you.

Kind Regards,

Hannah Buchanan *BSc (Hons)*
Graduate Flood Risk Analyst

BETTS HYDRO
Consulting Engineers

Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire, CH5 2LY
Chester +44 (0)1244 289041

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

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From: David Bechelli <David.Bechelli@copeland.gov.uk>
Sent: 13 September 2021 14:01
To: Hannah Buchanan <hannahbuchanan@betts-associates.co.uk>
Subject: Historic Flood Risk Information - Whitehaven Road, Cleator Moor, CA25 5PY

Hi Hannah,

Your request for the above was forwarded to me, but unfortunately the location plan wasn't attached.

Could you send me the location plan directly.

Regards

Dave

David Bechelli
Flood and Coastal Defence Engineer
Environmental Health
Copeland Borough Council

Tel: 01946 593048
Fax: 01946 592525
E-mail: David.Bechelli@copeland.gov.uk

Copeland Borough Council, Whitehaven Commercial Park, Moresby Parks, Whitehaven, Cumbria, CA28 8YD. Tel: 01946 598300. Fax: 01946 598303. www.copeland.gov.uk, info@copeland.gov.uk

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Hannah Buchanan

From: Hannah Buchanan
Sent: 06 September 2021 16:08
To: 'DMandLLFA_west@cumbria.gov.uk'
Subject: Historic Flood Risk Information
Attachments: Location Plan.pdf

To whom it may concern,

Whitehaven Road, Cleator Moor, CA25 5PY

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

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

Kind Regards,

Hannah Buchanan *BSc (Hons)*
Graduate Flood Risk Analyst

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APPENDIX E: LOCATION PLAN

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LOCATION PLAN

Whitehaven Road, Cleator Moor, CA25 5PY

OS X (Eastings)	301005
OS Y (Northings)	515520
Nat Grid	NY010155 / NY0100515520
Nearest Post Code	CA25 5PY
Lat (OSGB36)	N54:31:31 (54.5251511108862)
Long (OSGB36)	W3:31:47 (-3.5297541564898722)
Lat, Long (OSGB36)	54.5251511108862, -3.5297541564898722
Lat (WGS84)	N54:31:31 (54.52525838769935)
Long (WGS84)	W3:31:52 (-3.531077221833526)
Lat, Long (WGS84)	54.52525838769935, -3.531077221833526

APPENDIX F: TOPOGRAPHIC SURVEY

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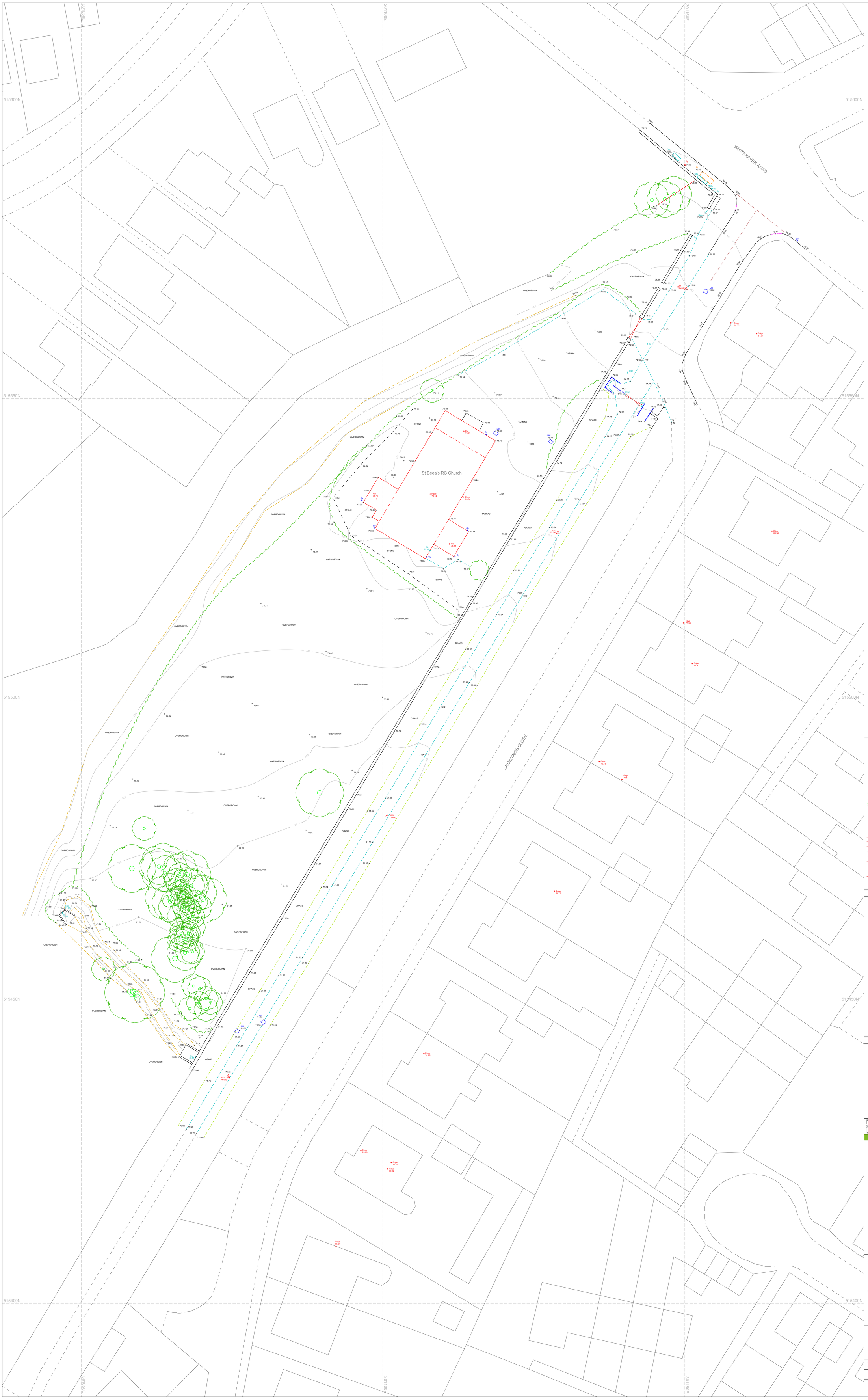

LEGEND

Buildings	Overhead Cable	IC	Inspection chamber	Bolt	Bollard
Wall	Concrete edge	PInv	Pipe invert	IB	Illuminated bollard
Kerb line	Tarmac edge	Gy	Gully	Bin	Rubbish bin
Line marking	Grass verge	Dp	Down pipe	Vp	Vent pipe
Drop kerb	Canopy/Overhang	Pipe	Pipe above ground	Grl	Ground light
Centre line	Verge	MH	Manhole	Lbox	Letter box
Bank Top	Bank Bottom	WL	Water level	Sty	Stile
AX1 100.000 Station and Name Station Level		Fl	Flood light	IFL	Internal floor level
Tree / Bush / Sapling		Lp	Lamp post	THL	Threshold level
Area of Undergrowth		Tp	Telegraph post	Sp	Sign post
Hedge		Ep	Electricity post	TH	Trialhole
Ridge 0.00 Ridge Level		Tl	Traffic light	BH	Borehole
Eave 0.00 Eaves Level		Bus	Bus stop	ELEC	Electric
Flat 0.00 Flat Roof Level		Sv	Stop valve	BT	British Telecom
Gate		St	Stop tap	C'box	Control box
200 W 1.2m Interwoven		Er	Earth rod	IC	Inspection chamber
Railing H1.1.2m Iron Railings		Wm	Water meter	R/wall	Retaining wall
Wire Fence W 2.0m Wire Mesh		Gv	Gas valve	UTL	Unable to lift
P & R W 1.2m Post & Rail		Av	Air valve	TCL	Tree canopy level
P & W W 1.2m Post & Wire		Wo	Wash out	G	Girth
CL H 1.2m Chain Link		Re	Rodding eye	MB	Multi Bowl
Panel Fence H 2.0m Wooden Panels		BB	Belisha beacon	Stmp	Tree Stump
Corp Fence H 2.0m Concrete Panels		CTV	Cable tv	CL:	Cover level
Stp Fence H 2.0m Steel Palisade		Mkr	Marker post	IL:	Invert level
		Gmkr	Gas marker post		
		So	Soffit		

NOTES

This plan should only be used for its original purpose. Axis Surveys accepts no responsibility for this plan if supplied to any party other than the original client. Do not scale, all dimensions should be checked on site prior to design and construction.

Drainage information (where applicable) has been visually inspected from the surface and therefore no allowance has been made for any sub surface entry into manholes, chambers or voids. Therefore any details relating to depths, sizes, ETC will be approximate only.

The contractor is to check and verify all building and site dimensions, levels and sewer invert levels at connection points before work starts.

Should there be any conflict between the details indicated on this drawing and those indicated on other drawings, the engineer should be informed prior to construction on site.

It is important to note that the same accuracies implied by the plotting scale are equally applicable to digital data supplied for CAD

Every effort if made to identify all visible above ground features, however is it should be borne in mind that there may be items obscured at the time of survey.

Visible features in the vicinity if the boundaries, as shown on this survey may not represent the extent of legally conveyed ownership.

THIS SURVEY HAS BEEN ORIENTATED TO THE ORDNANCE SURVEY (O.S) NATIONAL GRID (OSGB36) VIA A GLOBAL POSITION SYSTEM (GPS) AND THE O.S. ACTIVE NETWORK (OS NET).

A TRUE OSGB36 COORDINATE HAS BEEN ESTABLISHED NEAR TO THE SITE CENTRE VIA A TRANSFORMATION USING THE OSTN02 & OSGM02 TRANSFORMATION MODELS. THE SURVEY HAS BEEN CORRELATED TO THIS POINT AND A FURTHER ONE OR MORE OSGB36 POINTS ESTABLISHED TO CREATE A TRUE O.S. BEARING FOR ANGLE ORIENTATION.

SURVEY STATION INFORMATION

Station	Easting	Northing	Level
AX1	301150.265	515568.131	75.495
AX2	301129.009	515527.706	73.546
AX3	301100.679	515480.732	71.630
AX4	301074.354	515437.586	71.680

0 5 10 15 20m

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Burton-on-Trent, DE14 2WH

CLIENT: Elite Ecology

PROJECT: St Bega's Chapel
Whitehaven Road
Cleator Moor

TITLE: Topographical Survey

SCALE @A0	1:200	DATE	August 2021
DRAWN	LB	CHECKED	MB
REF NO.	3903	STATUS FINAL	SHEET n/a

APPENDIX G: PROPOSED PLANNING LAYOUT

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SNG Architecture Ltd.

South North Group
Greengate Business Centre,
OLDHAM, OL4 1FN.

Tel. 03308220011
Email. info@SNGarchitecture.com

Proposed Site Plan rev22A

1:500 @ A3

St Bega's Chapel Site, Crossings Close, Cleator Moor, CA25 5QH
Drw: SNG-SBOP-PSP22A

Site Boundary is indicative refer to Deeds

APPENDIX H: HYDRAULIC MODELLING ASSESSMENT

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BETTS HYDRO
CONSULTING ENGINEERS

WHITEHAVEN ROAD
CLEATOR MOOR

HYDRAULIC ASSESSMENT

For
South North Group Architecture Ltd
Greengate Business Centre
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Oldham
OL4 1FN

JULY 2022

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WHITEHAVEN ROAD
CLEATOR MOOR

HYDRAULIC ASSESSMENT

Document Tracking Sheet

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CONTENTS

Figures & Tables

Specialist Software

- Flood Modeller (4.6) – 2015 - 1D/2D linked Hydraulic Model
- TUFLOW Build 2016-03-AE-w64

Abbreviations & Acronyms

AEP	Annual Exceedance Probability
BGL	Below Ground Level
CC	Climate Change
EA	Environment Agency
FEH	Flood Estimation Handbook
FRA	Flood Risk Assessment
FZ	Flood Zone
Ha	Hectare
LLFA	Lead Local Flood Authority
mAOD	metres Above Ordnance Datum
NGR	National Grid Reference
NPPF	National Planning Policy Framework
OS	Ordnance Survey

ReFH	Revitalised Flood Hydrograph
SFRA	Strategic Flood Risk Assessment
TWL	Top Water Level

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1.0 INTRODUCTION

1.1 Commission

1.1.1 This Hydraulic Assessment was commissioned by South North Group Architecture to determine the existing flood risk posed to the land at Whitehaven Road, Cleator Moor and to identify and prove a potential flood mitigation measure.

1.2 Outline of Assessment

1.2.1 Betts Hydro has obtained the most recent Environment Agency model of the River Ehen and its tributaries, including the River Keekle, and Nor Beck, which runs through the site. The model was refined by added site specific topographical survey and reducing its computation grid size to improve its accuracy.

1.2.2 This Hydraulic Assessment report details the improvements made to the model, including topographical data used. It then presents the results in the existing scenario showing flood extents and depths in the 1% AEP (1 in 100 year), 1% AEP plus 30% climate change, and the 0.1% AEP (1 in 1000 year) flow return period events.

1.2.3 The assessment then presents the fluvial River Erewash 1% AEP (1 in 100 year), 1% AEP (1 in 100 year) including 50% climate change and the 0.1% AEP (1 in 1000 year) flow return period events in the proposed scenario. The assessment makes comparisons between the two in terms of changes in peak water depth and comments on the proposed development levels.

2.0 SITE LOCATION AND PROPOSED DEVELOPMENT

2.1 Location

2.1.1 The proposed development site is at the site of St. Bega chapel, Whitehaven Road, Cleator Moor. The nearest Ordnance Survey National Grid Reference is E: 385718, N: 363308 and the nearest postcode is CA25 5PY. The site location plan is shown in **Appendix A** and Edged in red in **Figure 1**.

Figure 1: Aerial Photograph of site (Betts Hydro, 2021)

2.2 Proposed Development

2.2.1 The proposed development is to consist of 11no. dwellings, an access road, parking and landscaping. A plan of the proposed development is shown in **Appendix B** and **Figure 2**.

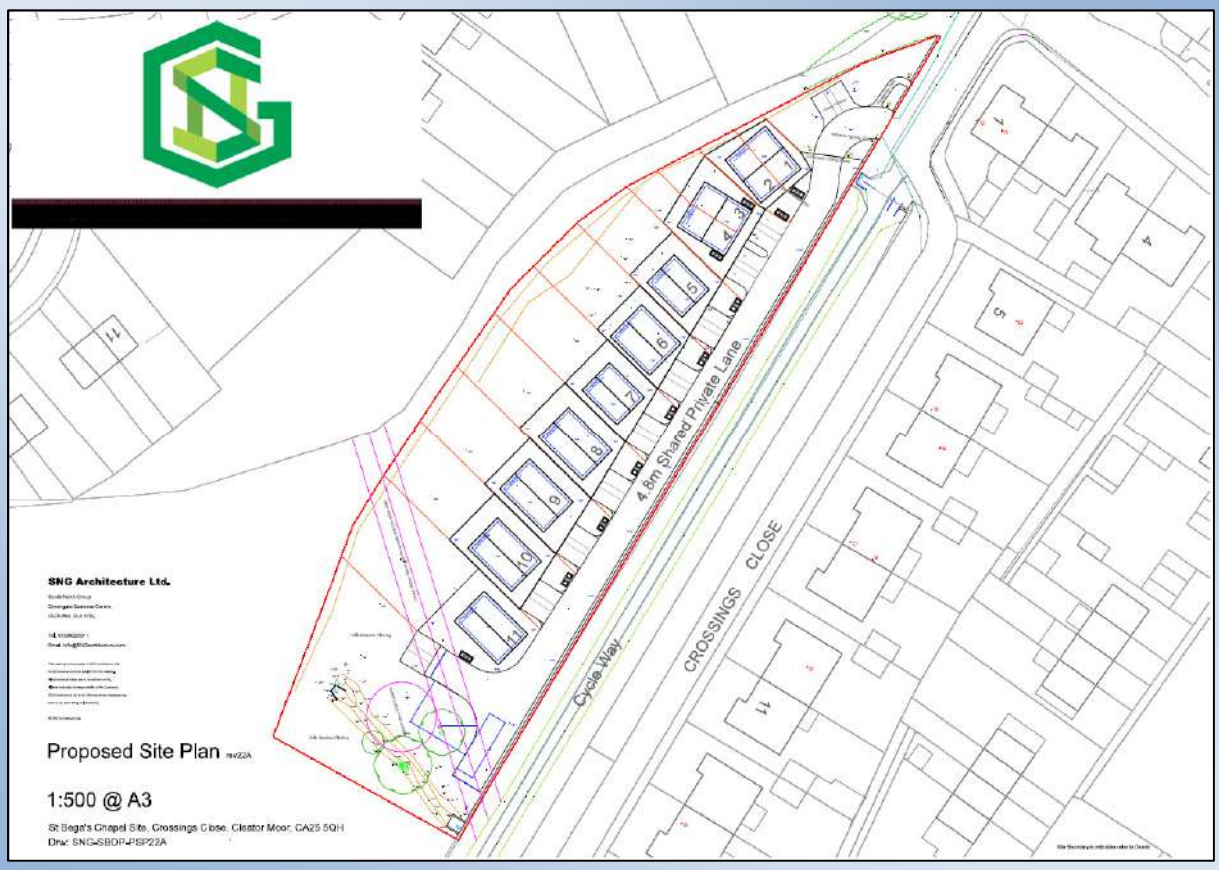

Figure 2: Indicative Proposed Development

3.0 ENVIRONMENT AGENCY MODEL REVIEW

3.1 River Ehen Model

3.1.1 The River Ehen model is a 1-dimensional/2-dimensional linked ISIS-TUFLOW model released as a result of the River Ehen Model Update (JBA, 2016).

3.1.2 The Environment Agency model is a large model extending from the River Keekle at Whitehaven down to the River Ehen estuary at Sellafield. The extent of the 2-D domain of the Environment Agency model is shown in **Figure 3**. Such a large model lacks the appropriate detail for a site specific Flood Risk Assessment and so some refinement was required.

Figure 3: Extent of Environment Agency 2D model

4.0 HYDRAULIC MODELLING

4.1 Model Modifications

4.1.1 The Environment Agency supplied River Ehen model was updated using the site specific topographical survey (**Appendix C**).

4.1.2 The model was also refined by reducing the 2-dimensional zone resolution from 4m to 2m and the length of the model reduced so that the downstream boundary at the railway at NGR 301191 E, 514312 N, as shown in model schematic in **Figure 4** and **Drawing no. HYD662/104/A** in **Appendix D**.

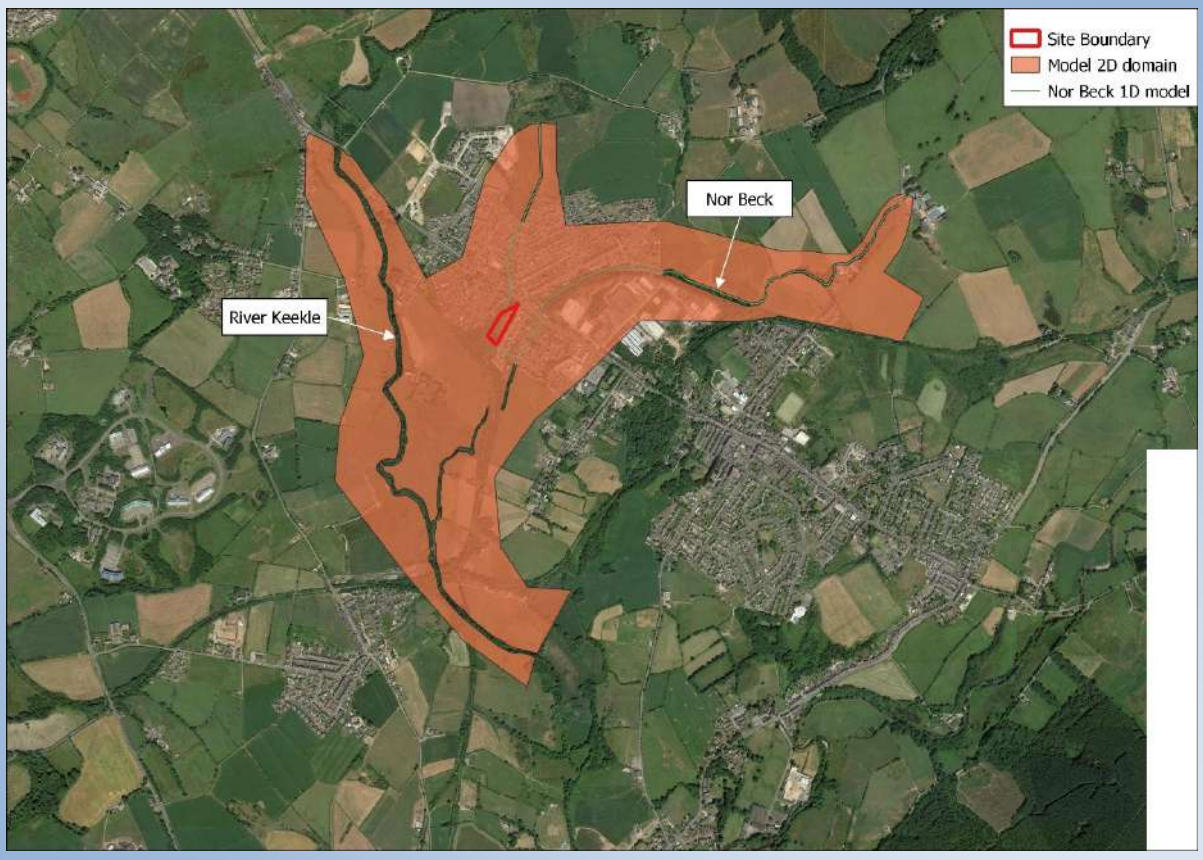

Figure 4: Extend of refined 2D model (Betts Hydro, 2022)

4.1.3 The model was truncated to produce a more site specific model. The downstream boundary of the model moved to node KEEK01_1612 and a normal depth boundary condition was applied.

Proposed Scenario

4.1.4 For the proposed scenario, changes in levels were made to the site. Information on the proposed levels is shown in **Figure 5**.

Figure 4: Proposed development finished floor levels

4.2 Existing Scenario

4.2.1 The baseline scenario includes the site topographical survey. The latest standard for climate change on fluvial flow in the region is 30%. The model was run in the following events and scenarios:

- Undefended 1 in 100 year event
- Undefended 1 in 1000 year event
- Defended 1 in 100 year event
- Defended 1 in 100 year event plus 30% climate change
- Defended 1 in 1000 year event

4.2.2 Undefended means that any formal flood defences have been removed from the model. The undefended scenarios define the Flood Zones 2 and 3. The defended scenarios include all formal flood defences and represent the actual flood risk to the site.

Undefended Flood Extents (Flood Zones)

4.2.3 The output from the undefended scenarios is shown on **Drawing no. HYD662/103/A** in **Appendix E.** The undefended 1 in 100 year flood extent is shown to cover approximately 50% of the site area. The undefended 1 in 1000 year flood extent covers a little more of the site.

4.2.4 These two scenarios are typically used to define Flood Zone 2 (1 in 1000 year) and Flood Zone 3 (1 in 100 year). The extents of these two events differ from the Environment Agency's published flood zone maps. For comparison, the Environment Agency flood zone extents are shown on **Drawing no. HYD662/102/A** in **Appendix E**. The largest difference is in the 1 in 1000 year extent (Flood Zone 2).

4.2.5 In this case, unless the flood zones are formally challenged, it is the Environment Agency published flood maps that will apply in a planning application.

Defended Flood Outputs

4.2.6 The defended 1 in 100 year flood depth is shown on **Drawing no. HYD662/201/A** in **Appendix E**. The flood extent is virtually identical to the undefended 1 in 100 year extent. This implies that the site does not benefit from any formal flood defences. The peak flood depth with the site is approximately 0.31m. The majority of the flooding on site is of a low depth (10mm or less) although there is a flood depth of approximately 0.18m adjacent to the church. **Drawing no. HYD662/202/A** in **Appendix E** shows the defended flood level in the 1 in 100 year event. The flood level ranges between approximately 71.70mAOD up to 73.11mAOD.

4.2.7 **Drawing no. HYD662/205/A** in **Appendix E** shows the defended 1 in 100 year event plus 30% climate change. Peak flood depth on site is approximately 0.32m in the southern part of the site close to Nor Beck. A flood depth of 0.20m is predicted by the church. This is slight increase when compared to the 1 in 100 year event flood depth. The remainder of flooding on site is mostly around 10mm or less. The defended flood level for 1 in 100 year plus climate change event is shown on **Drawing no. HYD662/206/A** in **Appendix E**. The peak flood level on site ranges between approximately 71.71mAOD and 73.13mAOD, which is a slight increase on the 1 in 100 year event.

4.2.8 The defended 1 in 1000 year flood depth is shown on **Drawing no. HYD662/209/A** in **Appendix E**. The flood extent is virtually identical to the undefended 1 in 1000 year extent. The peak flood depth with the site is approximately 0.33m. This is slight increase when compared to the 1 in 100 year climate change event flood depth. The majority of the flooding on site is around 10mm or less although there is a flood depth of approximately 0.21m adjacent to the church. **Drawing no. HYD662/202/A** in **Appendix E** shows the defended flood level in the 1 in 100 year event. The flood level ranges between approximately 71.72mAOD up to 73.14mAOD, which is a slight increase on the 1 in 100 year climate change event.

4.3 Proposed Development Scenario

4.3.1 The proposed development scenario model included an access road that acts as a flow conduit for overland flood flows and an indicative development footprint. The following flow events were modelled in the proposed scenario:

- Defended 1% AEP (1 in 100 year);
- Defended 1% AEP plus 30% climate change;
- Defended 0.1% AEP (1 in 1000 year);

4.3.2 The results of the simulations have been presented in the form of flood levels and flood depths in **Appendix F.**

Flood Depth

4.3.3 The flood depth for the 1% AEP event is shown in **Drawing no. HYD662/301/A**, in **Appendix F**. The flood depth within the development site area ranges from zero to 0.44m. The flood level in the 1% AEP event is shown on **Drawing no. HYD662/302/A** in **Appendix F** ranges from 71.70mAOD to 73.37mAOD.

4.3.5 **Drawing no. HYD662/305** in **Appendix F** shows the flood depth for the 1% AEP plus climate change event. The flood depth within the development site area ranges from zero to 0.46m. The flood level in the 1% AEP climate change event is shown on **Drawing no. HYD662/306/A** in **Appendix F** ranges from 71.71mAOD to 73.39mAOD

4.3.6 The 0.1% AEP (1 in 1000 year) flood depth is shown on Drawing no. **HYD662/309/A** in **Appendix F**. The flood depth within the development site area ranges from zero to 0.48m. The flood level in the 1% AEP event is shown on **Drawing no. HYD662/310/A** in **Appendix F** ranges from 71.71mAOD to 73.41mAOD.

4.5 Impact of Proposed Development

4.5.1 A comparison of flood depth between the existing scenario and the proposed development scenario in the 1% AEP event is provided in **Drawing no. HYD662/401/A** in **Appendix G**.

4.5.2 There is an increase in flood depth on the cycle path of 13mm in this area. It is also noted that there is no increase in flooding to the housing located within close proximity to the site (off Coniston Park and Crossings Close).

4.5.2 **Drawing no. HYD662/402/A** in **Appendix G** shows the change in flood extent. The areas shaded green show areas that no longer flood in the post development scenario and those in red show the areas that flood as a consequence of the development. There is a large area of the cycle path that would no longer flood in the post development scenario and just a small area outside the site that would see an increase in flooding.

4.5.3 In the 1% AEP event plus climate change there is predicted to be an increase in flood depth of 15mm on the adjacent cycle path, however there are large areas where a reduction in flood depth is predicted, including the existing housing to the south of the site, as shown on **Drawing no. HYD663/403/A.** There is a large area of the cycle path that is removed from the flood extent as a result of the development, as shown on **Drawing no. HYD662/404/A** in **Appendix G**.

4.5.4 The depth difference for the 0.1% AEP event is shown on **Drawing no. HYD662/405/A** in **Appendix G**. There is an increase in flood depth of 18mm on the cycle path adjacent to the site, but overall there is a reduction to flood depth to the existing housing and to the cycle path.

4.5.5 **Drawing no. HYD662/406/A** in **Appendix G** is shows the change in flood extent as a result of the development in the 0.1% AEP event. There is a large reduction in flood extent on the cycle path and Coniston Close.

4.6 Blockage and Sensitivity Analysis

4.6.1 The results of the blockage analysis are included within **Appendix H**. As shown on **Drawing no. HYD662/501/A** there is a 0.01m increase in flood level at the northern node onsite. At the southern node, there is an increase in flood level of 0.03m when compared to the proposed defended 1 in 100yr plus 30% Climate Change scenario.

4.6.2 A sensitivity analysis was carried out on the following model variables:

- Flow, 1 in 100 year plus climate change + 20%
- Manning's roughness coefficient, n+/- 20%
- Blockage of culvert 90%

4.6.3 The results of the sensitivity analysis are provided in **Appendix H**. When the 1 in 100 year climate change flow was increased by 20%, there was an increase of 0.02m at the northern node onsite, and a decrease of 0.01m at the southern node onsite as shown on **Drawing no. HYD662/502/A**. When the Manning's roughness was increased by 20%, the mean increase in level was 0.03m and the maximum increase was 0.3m, as shown on **Drawing no. HYD662/503/A**.

4.7 Discussion of Model Results

4.7.1 The modelling of the existing scenario has shown that the site is at risk of flooding in the fluvial 1% AEP, 1% AEP plus 30% Climate Change, and the 0.1% AEP events.

4.7.2 Modelling of the proposed development scenario has shown that the flood risk can be mitigated in events up to and including the 0.1% AEP fluvial event. The modelling has also shown that in the 1% AEP, 1% AEP plus climate change and the 0.1% AEP fluvial event, no increased flood risk to other properties will occur as a result of the proposed development and a net reduction in flood extent to land outside the site.

4.7.3 The sensitivity analysis has shown that peak water levels predicted by model are not especially sensitive to changes to Manning's roughness, or flow. If adequate freeboard is provided above the 1% AEP climate change level, then the development should remain free from flooding throughout its lifetime.

5.0 SUMMARY AND CONCLUSION

5.1 Summary of Results

5.1.1 The development site is at risk of fluvial flooding during the 1% AEP, 1% AEP plus 30% Climate Change, and the 0.1% AEP events from the River Ehen and its tributaries (River Keekle, and Nor Beck which is located onsite). The site is also identified to be at risk during the 1% AEP plus 30% Climate Change blockage scenario.

5.1.3 The impact of the proposed development on flood depths in vicinity of the site has is to reduce the flood extent overall in the surrounding area and does not increase flood depth to any existing properties.

5.2 Conclusion

5.2.1 The hydraulic assessment has shown that the proposed development can be built and be safe from flooding from the River Ehen and its tributaries in the 1% AEP, 1% AEP plus 30% climate change and 0.1% AEP events, and not increase flood risk to existing properties.