Flood Risk Assessment and Surface Water Drainage Strategy for Planning

Prepared for:
Cleator Mills Business Park Limited

December 2022

Location:
Cleator Mills
Cleator
Whitehaven
CA23 3DJ

Our reference:
92276-ManningElliott-CleatorMills

Unda Consulting Limited, Southpoint, Old Brighton Road, Gatwick, West Sussex, RH11 0PR
+44 (0) 1293 214 444
enquiries@unda.co.uk

Document Issue Record

Location:	Cleator Mills, Cleator, Whitehaven, CA23 3DJ				
Application:	Construction of unit G with proposed Parking				
Prepared for:	Cleator Mills Business Park Limited				
Title:	Flood Risk Assessment and Surface Water Drainage Strategy for Planning				
Project No.:	92276	**Date:**	22nd December 2022	**Issue No.:**	1.0
Written By:	A. Rousou, BSc (Hons)	**Checked By:**	E. Bouet, BSc (Hons)	**Authorised By:**	E. Bouet, BSc (Hons)

1. Introduction

1.1. This Flood Risk Assessment and Surface Water Drainage Strategy has been prepared by Unda Consulting Limited on behalf of Cleator Mills Business Park Limited, in support of a planning application for the construction of unit G with proposed parking at the site of the Cleator Mills, Cleator, Whitehaven, CA23 3DJ. This report assesses the flood risk and surface water drainage strategy for the proposed development.

1.2. The proposed planning application is for the construction of unit G with proposed parking. Post development the footprint of buildings will cover approximately 885m².

1.3. In order to mitigate flood risk posed by post development runoff, adequate control measures will be required within the site. This will ensure that surface water runoff is dealt with at source and the flood risk off site is not increased.

2. Existing Site:

2.1. The proposed development site is approximately 6,425m^2 and currently has industrial uses.

2.2. A topographical survey was undertaken by Edmondson Surveys and has been provided by the applicant. Upon review, this indicates that levels on site range between 59.16mAOD and 60.37mAOD.

Figure 1: Aerial view of the site (Source: Google)

Existing Ground Conditions:

2.3. The 1:50,000 BGS map shows the bedrock geology underlying the site to consist of Buttermere Formation – Mudstone and Sandstone.

2.4. According to 1:50,000 BGS mapping the site is underlain by Alluvium – Clay, Silt, Sand and Gravel superficial geological deposits.

2.5. The soil type taken from the UK soils website shows deep riverine clay, sands and gravels with a clay to sandy loam texture.

2.6. An intrusive site investigation was undertaken by B.A.F Contracting Ltd. A total of two trial pits were excavated at the site. Trial pit 1 shows that the site is underlain by Type 1, made ground, general fill, subbase, sandstone, sandy gravel/clays/ roots and Course Gravels/ Sharp Sands.

2.7. However, trial pit 2 shows that the site is underlain by Type 1, Mixed Fill/ Made Ground, Course Shingle/ Stone, Sandy gravel/ clays/ roots and Course dense sands/ gravel. Results for both trial pits can be found within the report Appendix.

2.8. Infiltration tests undertaken in the two trial pits indicate that there is the potential for infiltration at the site. Refer to the site investigation located within Appendix.

2.9. A third pit was dug which shows that groundwater is located 2.6m below the finished ground level.

2.10. The published Environment Agency Groundwater Source Protection Zone map shows the site is not located within an area classified as a Groundwater Source Protection Zone.

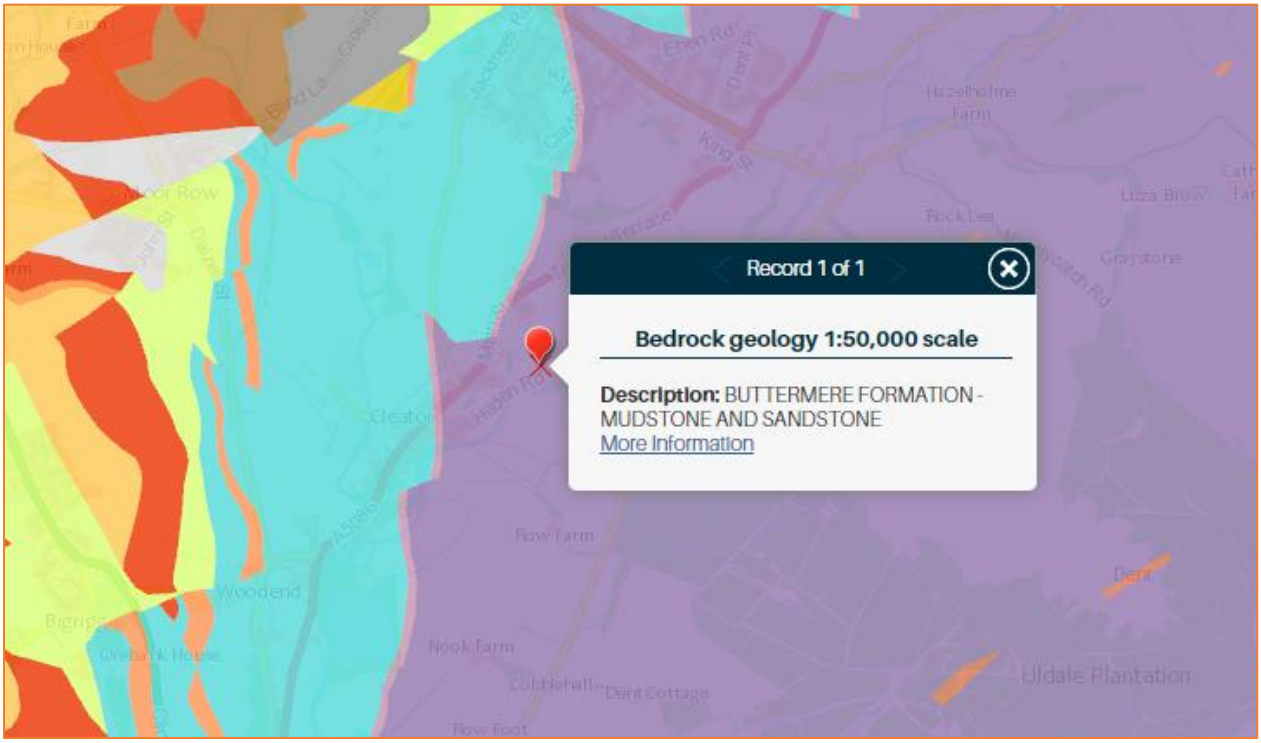


Figure 2: BGS Bedrock Geology (Source: BGS)

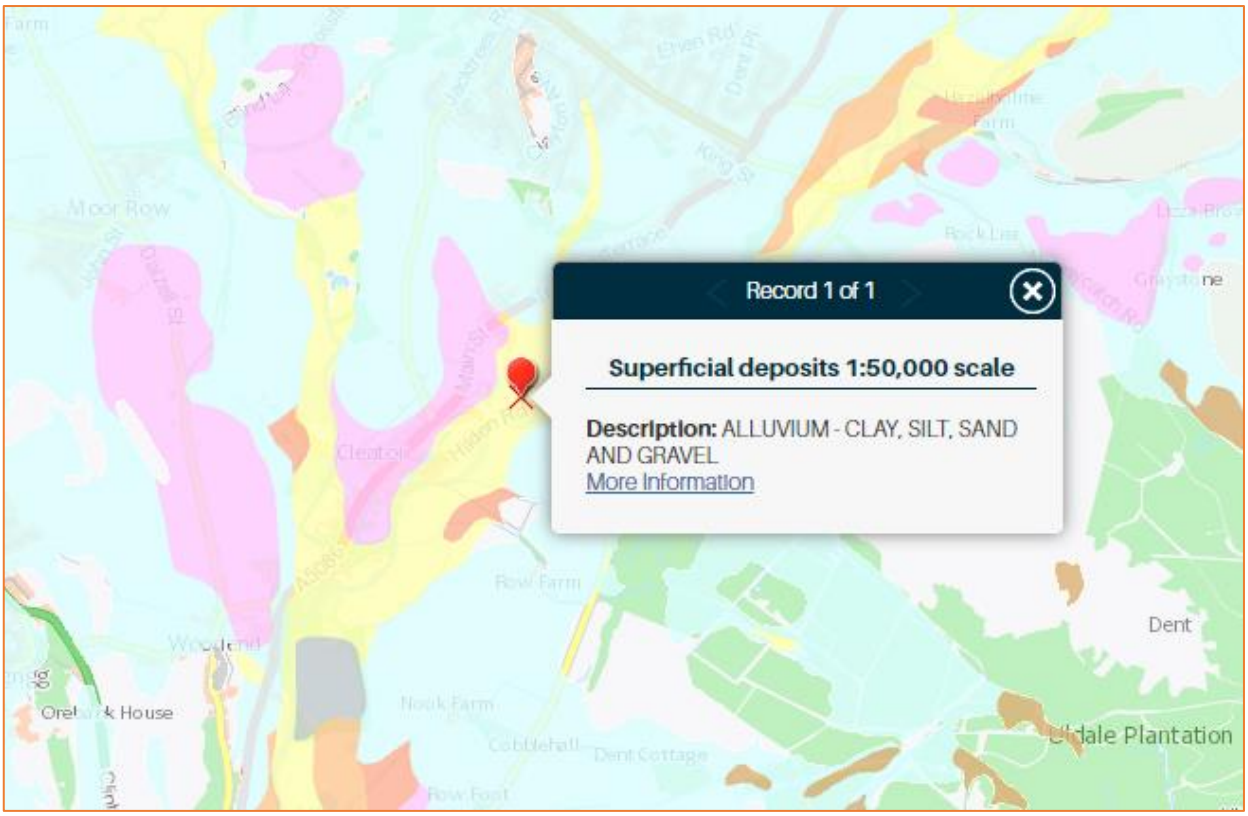


Figure 3: BGS Superficial Deposits (Source: BGS)

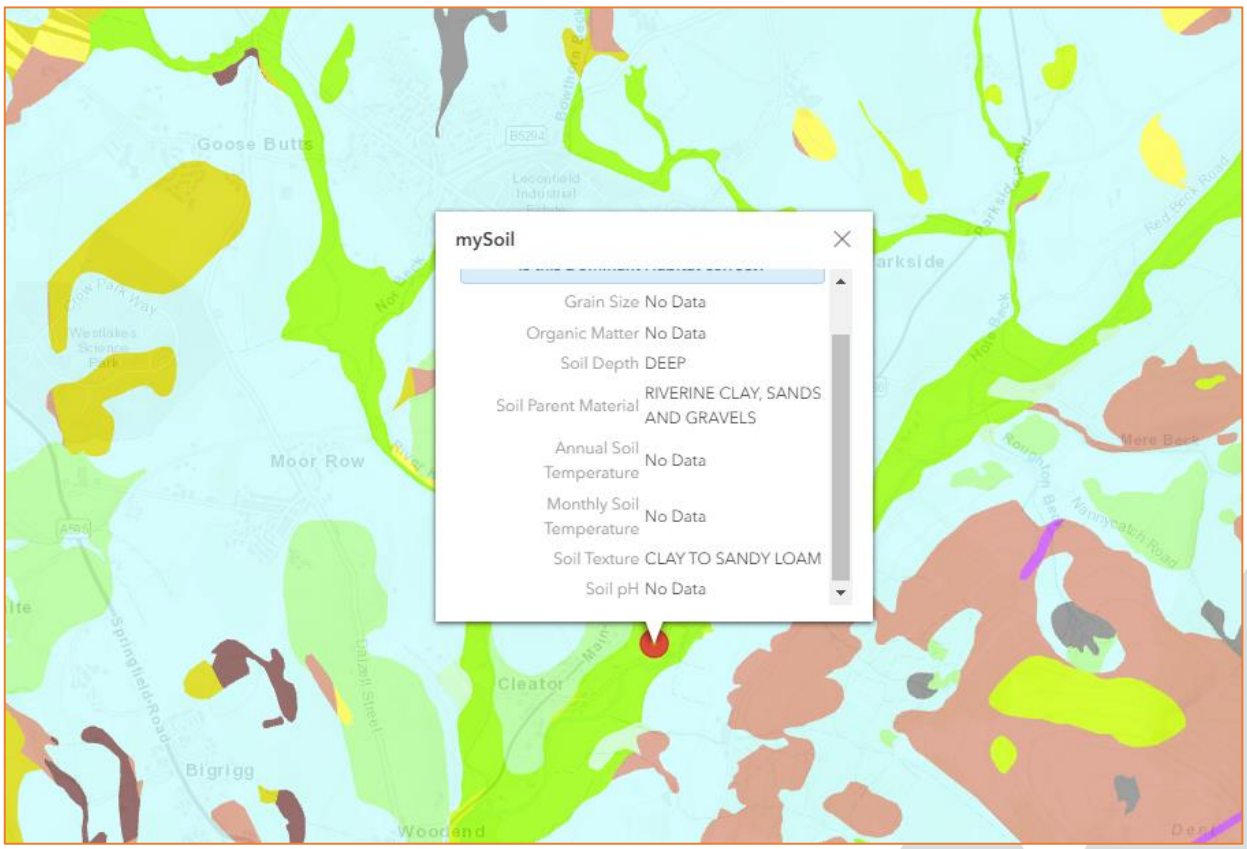


Figure 4: Soil Map (Source: UK Soils, BGS)

Nearby Watercourses / Drainage Features:

2.11. The closest watercourse to the site is the River Ehen located 38m south and 61m east pf the site. The Ehen catchment rises in the western fells of the Lake District National Park flowing from the remote Ennerdale Water down to the Irish Sea, north of Sellafield nuclear power station. In total the River Ehen has a length of 7.5 miles.

2.12. There are ditches located within the red line site boundary.

Existing Drainage:

2.13. Surface water generated within the site extents currently discharge to both ground and the River Ehen at an unattenuated rate.

3. Development Proposals:

Proposed Development:

3.1. The proposed planning application is for the construction of unit G with proposed parking.

3.2. Post development the footprint of buildings will cover approximately 885m².

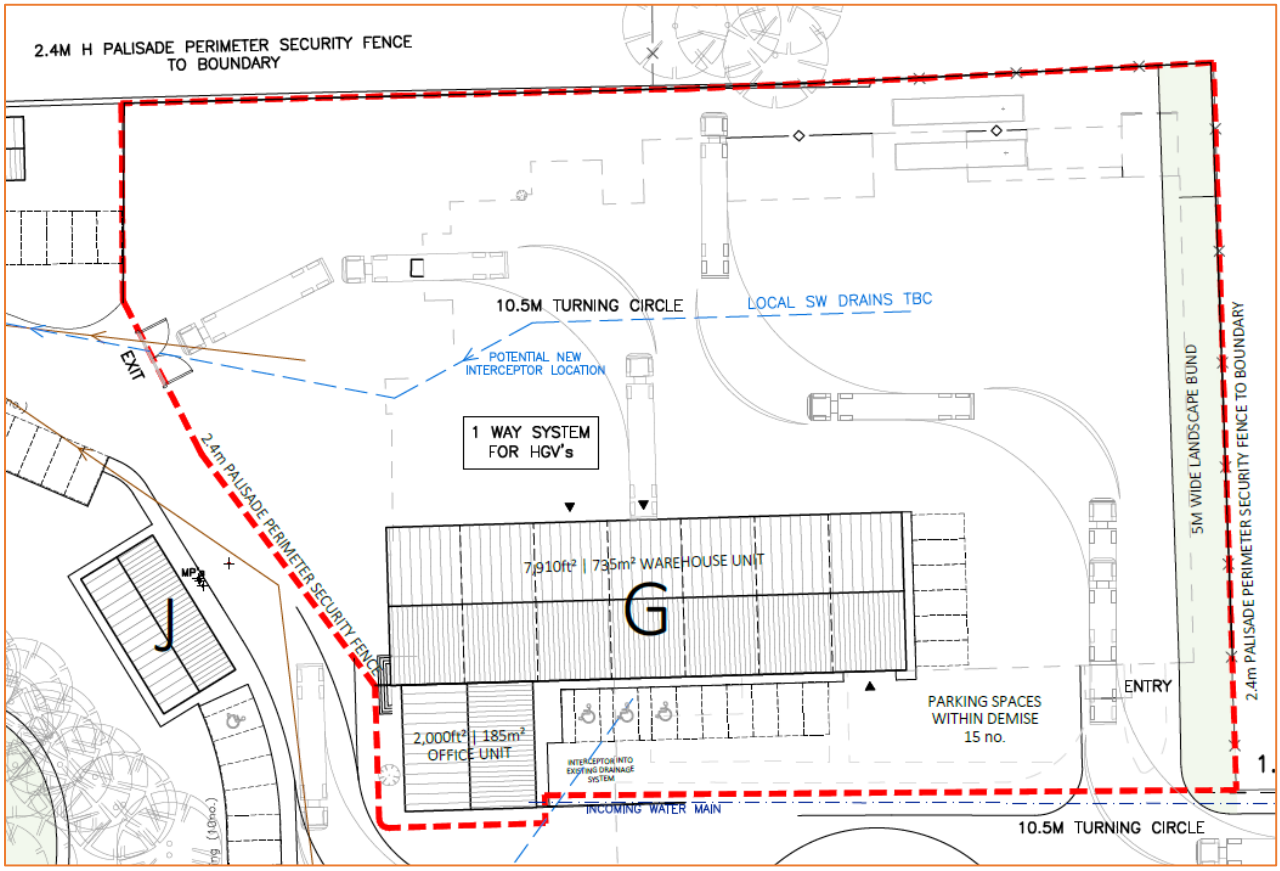


Figure 5: Proposed site layout plan (Source: Manning Elliot Partnership)

Vulnerability to flooding:

3.3. The NPPF classifies property usage by vulnerability to flooding. The existing site usage is classified as "less vulnerable" throughout, as it comprises of industrial uses. Post development, the site will remain "less vulnerable", as the application is for the construction of unit G with proposed Parking.

3.4. Accordingly, it is considered that the vulnerability of the site as a whole will remain the same post development.

4. Flood Risk Assessment:

Flood Zones:

4.1. Within planning, 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), available on the Environment Agency's website.

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)

Table 1: Environment Agency Flood Map for Planning (Rivers and Sea) (Source: EA)

4.2. 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.

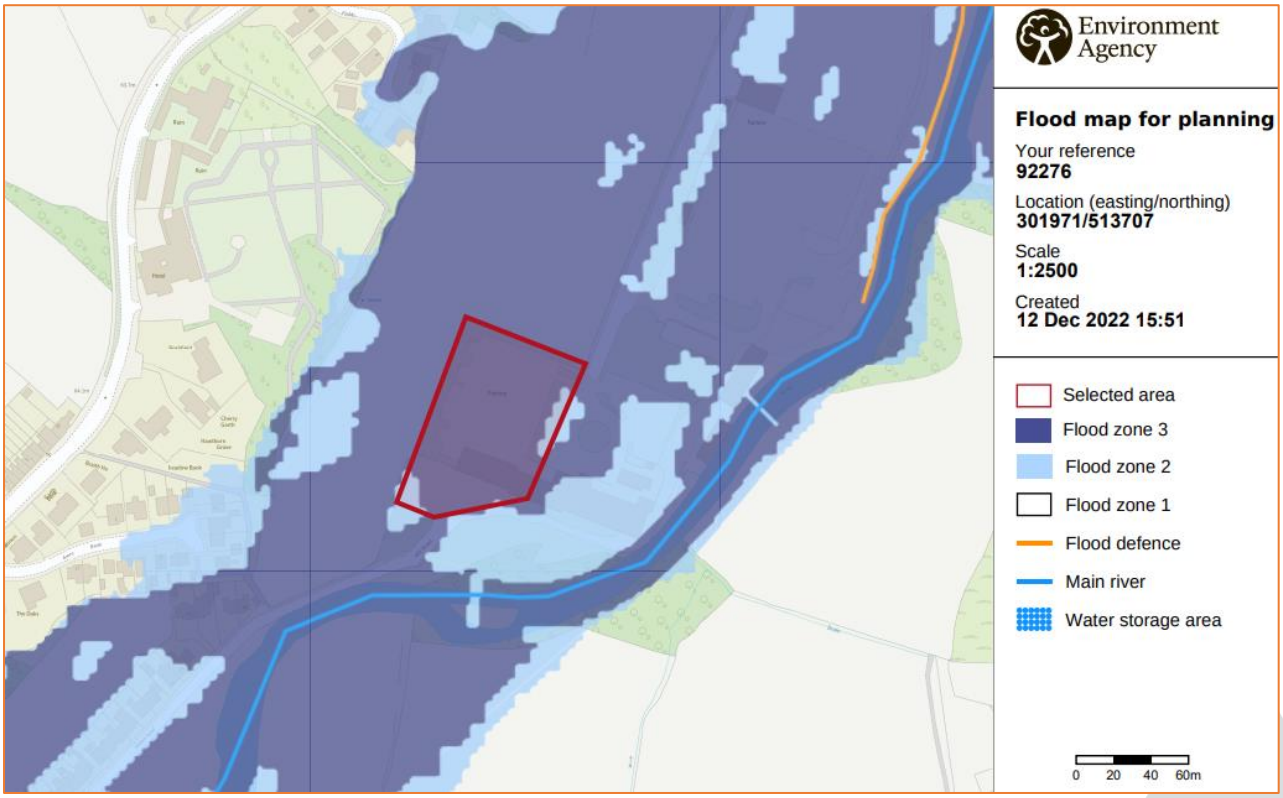


Figure 6: Environment Agency Flood Map for Planning (Rivers and Sea) (Source: EA)

4.3. The site is located partially within Flood Zone 3 (High Risk) which means it is defined as land having greater than a 1:100 annual probability of fluvial flooding. The site is also partially located within Flood Zone 2 (Medium Risk) which means it is defined as having land with between a 1:100 annual probability and 1:1000 annual probability of fluvial flooding.

Fluvial:

4.4. Ehen is a river in Cumbria, sourced at the west end of Ennerdale Water. From its source the Ehen runs west through Ennerdale Bridge where it is joined by Croasdale Beck (flowing from Banna Fell). Ennerdale Water itself is fed by the River Liza. The Ehen continues past Cleator Moor and Cleator, where it is fed by the River Keekle, moving southwards through Egremont and eventually running parallel to the Irish Sea which it eventually joins at Sellafield at the same point as the River Calder. In total the River Ehen has a length of 7.5 miles.

Detailed Flood Modelling:

4.5. Modelled flood levels and extents have been received from the Cumbria and Lancashire Area Environment Agency as part of a Product 4 data request. The EA Product 4 data is provided within the report Appendix. Flood levels and flows have been provided from the River Ehen 2015 model.

4.6. According to the data provided at Node "10" the undefended 1:100 and 1:1000 year flood levels are 60.22mAOD and 60.52mAOD respectively. When compared to onsite topographic levels of 59.16mAOD and 60.37mAOD the maximum flood depths for the 1:100 year and 1:1000 year events are 1.06m and 1.36m, respectively.

4.7. According to the data provided at Node "10" the site is outside of the defended 1:100 year flood event. However, the defended 1:1000 flood level is 60.51mAOD. When compared to onsite topographic levels of 59.16mAOD and 60.37mAOD the maximum flood depth for the 1:1000 year event is 1.35m.

4.8. The site is located within Flood Zone 3 and is classified as "more vulnerable". The Flood Risk Assessments: climate change allowances guidance –updated October 2021, states that the Central climate change allowance should be applied. The site falls within the South West Lakes Management Catchment, where the Central climate change allowance for the 2080's is a 30% increase in river flows.

4.9. As such, the most suitable modelled flood data provided in the River Ehen modelling is a 30% increase in flows, and as such this will be used for this assessment.

4.10. The undefended flood level for the 1:100 year plus 30% allowance for climate change is 60.34mAOD. When compared to onsite topographic levels of 59.16mAOD and 60.37mAOD the maximum flood depths for the 1:100 year plus 30% allowance for climate change is 1.18m.

4.11. The defended flood level for the 1:100 year plus 30% allowance for climate change is 60.20mAOD. When compared to onsite topographic levels of 59.16mAOD and 60.37mAOD the maximum flood depths for the 1:100 year plus 30% allowance for climate change is 1.04m.

4.12. The EA also provided flood levels from Cleator Moor 2009 model. According to the data provided at Node "9" the site is outside of the undefended 1:100 year flood event. However, the undefended 1:1000 flood level if 59.70mAOD. When compared to onsite topographic levels of 59.16mAOD and 60.37mAOD the maximum flood depth for the 1:1000 year event is 0.54m.

Flood Defences:

4.13. According to EA data there are a number of defences within vicinity to the site. These include 4 embankments with their standard of protection ranging from 5 – 100 years. For the full defence asset list please refer to the EA defence map in the report appendix.

Residual risk (breach or overtopping of flood defences):

4.14. Breaching of flood defences can cause rapid inundation of areas behind flood defences as flow in the river channel discharges through the breach. A breach can occur with little or no warning, although they are much more likely to concur with extreme river levels or tides when the stresses on flood defences are highest. Flood water flowing through a breach will normally discharge at a high velocity, rapidly filling up the areas behind the defences, resulting in significant damage to buildings and a high risk of loss of life. Breaches are most likely to occur in soft defences such as earth embankments although poorly maintained hard defences can also be a potential source of breach.

4.15. Overtopping of flood defences occurs when water levels exceed the protection level of raised flood defences. The worst case occurs when the fluvial or tidal levels exceed the defence level as this can lead to prolonged flooding. Less severe overtopping can occur when flood levels are below defence levels, but wave action causes cyclic overtopping, with intermittent discharge over the crest level of the defence. Flood defences are commonly designed with a freeboard to provide protection against overtopping

from waves. The risk from overtopping due to exceedance of the flood defence level is much more significant than the risk posed by wave overtopping.

4.16. Exceedance of the flood defence level can lead to prolonged and rapid flooding with properties immediately behind the defences at highest risk.

Historical Flood Records:

4.17. The Environment Agency confirm the site is outside of any historical flood extents.

Tidal:

4.18. Due to the site topography and distance to the nearest coast/ tidal watercourse, the risk of tidal flooding is considered to be very low.

Pluvial:

4.19. Pluvial (surface water) flooding happens when rainwater does not drain away through the normal drainage systems or soak into the ground, but lies on or flows over the ground instead.

4.20. In 2013 the EA, working with Lead Local Flood Authorities (LLFAs), produced an updated Flood Map for Surface Water. It is considered to represent a significant improvement on the previous surface water flood maps available, both in terms of method and representation of the risk of flooding. The modelling techniques and data used are considerably improved, and also incorporated locally produced mapping where this is available to represent features best modelled at a local scale.

4.21. The Flood Map for Surface Water assesses flooding scenarios as a result of rainfall with the following chance of occurring in any given year (annual probability of flooding is shown in brackets):

- 1:30 (3.3%)
- 1:100 (1%)
- 1:1000 (0.1%)

4.22. The mapping below shows the Risk of Flooding from Surface Water with the site located approximately 250m south west of the crosshair. Please note that the EA to not consider this information suitable to be used to identify the risk to individual properties or sites. It is useful to raise awareness in areas which may be at risk and may require additional investigation.

4.23. The EA Risk of Flooding from Surface Water Map suggests that the majority of the site lies within an area of “Very Low” to “High” risk of flooding from surface water.

Figure 7: Extract from Environment Agency RoFSW map (Source: EA)

Groundwater:

4.24. Groundwater flooding occurs as a result of water rising up from the underlying rocks or from water flowing from abnormal springs. This tends to occur after much longer periods of sustained high rainfall. Higher rainfall means more water will infiltrate into the ground and cause the water table to rise above normal levels. Groundwater tends to flow from areas where the ground level is high, to areas where the ground level is low. In low-lying areas the water table is usually at shallower depths anyway, but during very wet periods, with all the additional groundwater flowing towards these areas, the water table can rise up to the surface causing groundwater flooding.

4.25. Groundwater flooding is most likely to occur in low-lying areas underlain by permeable rocks (aquifers). These may be extensive, regional aquifers, such as chalk or sandstone, or may be localised sands or river gravels in valley bottoms underlain by less permeable rocks. Groundwater flooding takes longer to dissipate because groundwater moves much more slowly than surface water and will take time to flow away underground.

4.26. No information has been provided to suggest the site has previously been flooded from groundwater sources.

Sewer:

4.27. Sewer flooding occurs when the sewer network cannot cope with the volume of water that is entering it. It is often experienced during times of heavy rainfall when large amounts of surface water overwhelm the sewer network causing flooding. Temporary problems such as blockages, siltation, collapses and equipment or operational failures can also result in sewer flooding.

4.28. All Water Companies have a statutory obligation to maintain a register of properties/areas which have reported records of flooding from the public sewerage system, and this is shown on the DG5 Flood Register. This includes records of flooding from foul sewers, combined sewers and surface water sewers which are deemed to be public and therefore maintained by the Water Company. The DG5 register records of flood incidents resulting in both internal property flooding and external flooding incidents. Once a property is identified on the DG5 register, water companies can typically put funding in place to address the issues and hence enable the property to be removed from the register. It should be noted that flooding from land drainage, highway drainage, rivers/watercourses and private sewers is not recorded within the register.

4.29. No information has been provided to suggest the site has previously been flooded from sewer sources.

Other Sources:

4.30. The EA Risk of Flooding from Reservoirs Map suggests that the site lies within the "Maximum extent of flooding" from reservoir failure. The EA also advise on their website that reservoir flooding is extremely unlikely. All major reservoirs have to be inspected by specialist dam and reservoir Engineers. These inspections are monitored and enforced by the EA themselves. The risk to the site from reservoir flooding is therefore minimal and is far lower than that relating to the potential for fluvial flooding to occur.

4.31. No further information has been provided to suggest the site is susceptible to from the failure of canals or other artificial infrastructure from the risk of flooding.

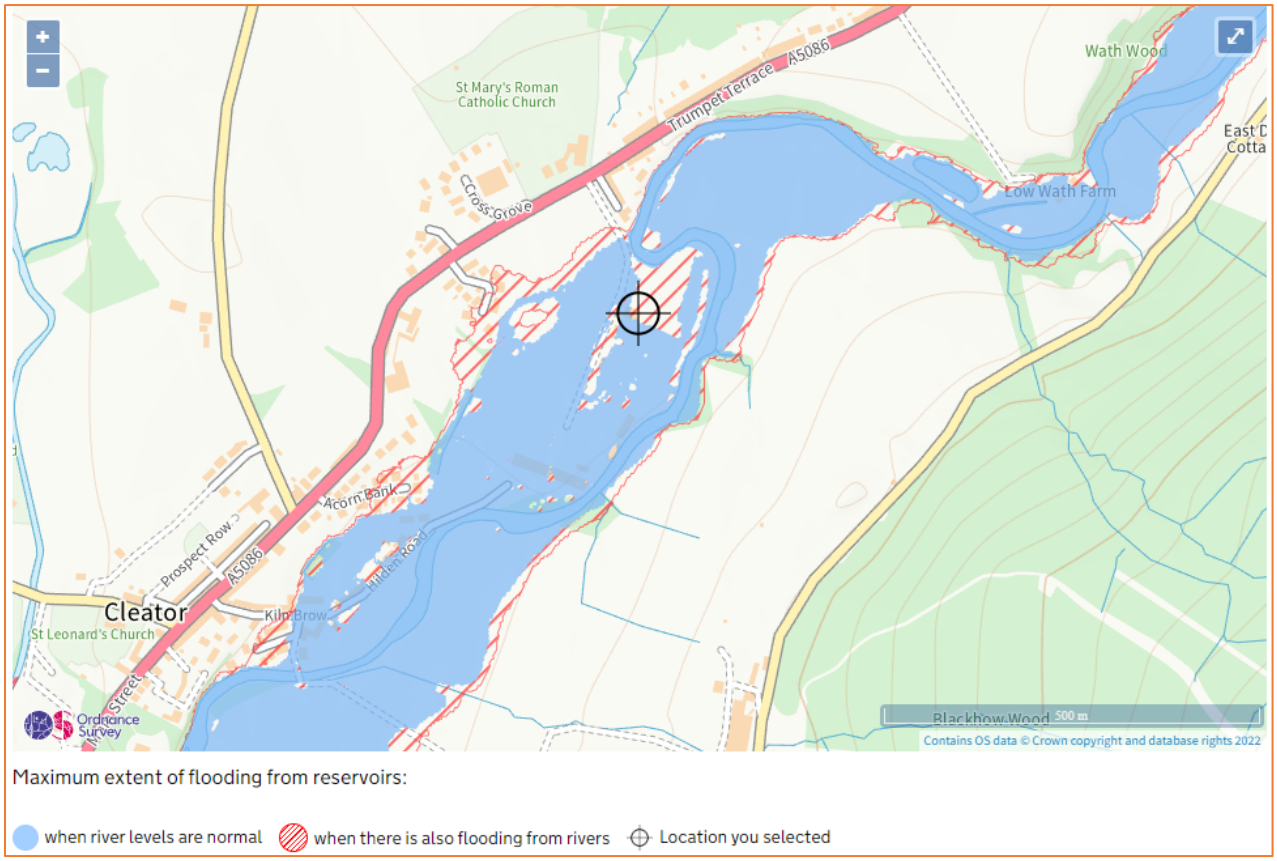


Figure 8: Extract from Environment Agency Reservoir Flood Risk Map (Source: EA)

5. Surface Water Drainage Strategy:

5.1. In order to mitigate flood risk posed by post development runoff, adequate control measures will need to be considered within the site. This will ensure that surface water runoff is dealt with at source and flood risk is not increased elsewhere.

Drainage Hierarchy:

5.2. The drainage strategy for the site has been prepared according to the drainage discharge hierarchy from *CIRIA C753 The Suds Manual*, as follows:

- Infiltration to the maximum extent that is practical;
- Discharge to surface waters;
- Discharge to surface water sewer.

Infiltration Potential:

5.3. Infiltration testing has been undertaken at the site and provided for use within this report. The lowest infiltration rate of 0.001171 m/s has been utilised within the below calculations.

5.4. It is therefore proposed that all post development runoff is discharged to ground

Proposed Discharge Rate:

5.5. Existing greenfield runoff rates for the total site have been calculated as 4.4l/s for the 1:1 annual runoff event, 8.5l/s for the 1:30 year event and 10.4l/s for the 1:100 year event. Refer to calculations in Appendix.

5.6. Surface Water runoff from all impermeable areas will discharge into a cellular storage soakaway located beneath the HGV yard.

5.7. It is proposed to discharge post development runoff to ground, therefore, there will be no off-site discharge post development.

Cellular Storage Soakaways

5.8. Runoff from all impermeable areas (6,425m^2) will be collected and stored in a cellular storage soakaway located beneath the HGV yard.

5.9. From the cellular soakaway storage units, runoff will gradually infiltrate into the underlying strata.

5.10. Preliminary calculations indicate that sufficient storage required to attenuate runoff from the proposed impermeable areas arising from the critical 1:100 year + 50% climate change event can be provided within a cellular soakaway structure of dimensions 205m^2 x 0.4m deep x 0.95 (void ratio).

5.11. Preliminary calculations indicated that some 77.9m^3 of storage is required to attenuate the runoff for all storms up to and including the 1:100 year + 50% climate change event.

5.12. Please note that the levels of the cellular storage within the Micro drainage calculations are arbitrary for modelling purposes.

5.13. All preliminary surface water drainage calculations have been undertaken using MicroDrainage software. Refer to the Appendix.

Water Quality:

5.14. Runoff from roof areas is relatively uncontaminated, and does not warrant a complex treatment process to improve quality prior to discharge to ground. Nevertheless, it is suggested to include debris / sediment traps on any new drainage.

5.15. However, all Surface Water runoff from the impermeable ground surfaces will be required to pass through an oil interceptor prior to discharge to soakaway feature.

Design Exceedance:

5.16. Should the onsite drainage system fail under extreme rainfall events or blockage, flooding may occur within the site. In the event of the drainage system failure, the runoff flow can be managed through detailing the new external levels to direct water away from structures.

Adoption and Maintenance:

5.17. It is proposed that all SuDS facilities will be maintained privately by the end user.

5.18. A draft Maintenance Schedule is outlined in the Table below.

Cellular Soakaways

5.19. The design of soakaways should include monitoring points where the water level in the system can be observed or measured. This can either be via an inspection well or inspection cover. The useful life and effective operation of an infiltration component is related to the frequency of maintenance and the risk of sediment being introduced into the system.

5.20. It is not envisaged that silt build up within the cellular soakaway will require a rigorous maintenance regime so long as silt is removed from upstream catch pits and inspection chambers on a regular basis. Notwithstanding this, a suitable maintenance regime for the systems will comprise routine inspection and silt removal (as necessary). Inspection should be undertaken using CCTV equipment within the infiltration tank. Camera access can be gained via inspection chambers and inlet pipework located at each end of the tunnels.

5.21. Silt removal can be achieved by jetting the inspection tunnels. Jetting should be undertaken in accordance with current jetting guidelines, in particular the Code of Practice for Sewer Jetting published by The Water Research Centre. Jetting at 150bar at 300l/min should be more than adequate in removing any build-up of material within the soakaway.

5.22. A standard jet head with rear facing nozzles should be used. The head should be fed to the far end of the crate tunnel via the nearest inspection chamber, activated and retracted. As the nozzle is removed, debris will be swept back into the inspection chamber where it can then be removed with the use of a standard gully sucker. This method will ensure the effective removal of gross solids (carrier bags, cans, leaf litter etc.) from the system. Whilst 100% removal cannot be guaranteed, it has been shown that this jetting method will also remove an element of finer material which would otherwise be 'lost' within the system.

Pipework and Catchpits:

5.23. It is not envisaged that silt build up within the pipework systems will require a rigorous maintenance regime so long as silt is removed from upstream catch pits on a regular basis. Notwithstanding this, a suitable maintenance regime for the systems will comprise of routine inspection (every three months) and silt removal (as necessary).

Drainage Element	Maintenance Requirement	Frequency
Gutters & downpipes	Inspect and remove silt and debris	To be inspected every three months and silt/ debris removed as necessary.
Catchpits and inspection chambers	Inspect and remove silt	To be inspected every three months and silt/ debris removed as necessary. Flow control to be checked for blockages.
Oil Separator		Annually, under service agreement.
Cellular Soakaways	Inspect and remove silt and debris	To be inspected annually and silt removed as necessary.

Table 2: Suggested Maintenance Regime for Elements of the Drainage Infrastructure

Note: In addition to the above maintenance requirements, it is recommended that all drainage elements are inspected:

- Following the first storm event
- Monthly for the first 3 months following commissioning

6. Flood Risk Mitigation:

Physical Design Measures:

6.1. The site is show to be within Flood Zone 3 (High Probability) according to the Environment Agency Flood Map for Planning (Rivers and Sea).

6.2. In order to help protect against flooding during extreme events, flood resistant design measures could be implemented into the proposed building, in consultation with the Local Authority building control department. These measures can include the following:

- Solid concrete basement and ground floor, with waterproof membrane;
- Waterproof screed used on floors;
- Closed-cell foam used in wall cavities;
- Waterproof basement and ground floor internal render;
- External walls rendered resistant to flooding to first floor level;
- Exterior ventilation outlets, utility points and air bricks fitted with removable waterproof covers;
- Boilers, control and water storage / immersion installed at ground floor level or above where possible;
- Gas meter installed at ground floor level or above where possible;
- Plumbing insulation of closed-cell design;
- Non-return valves fitted to all drain and sewer outlets;
- Manhole covers secured;
- Anti-syphon fitted to all toilets.

The applicant should also consider the use of demountable flood defence barriers to defend ground level doorways and low windows below the breach flood level on site.

Fluvial floodplain storage:

6.3. The NPPF requires that where development is proposed in undefended areas of floodplain, which lie outside of the functional floodplain, the implications of ground raising operations for flood risk elsewhere needs to be considered. Raising existing ground levels may reduce the capacity of the floodplain to accommodate floodwater and increase the risk of flooding by either increasing the depth of flooding to existing properties at risk or by extending the floodplain to cover properties normally outside of the floodplain. Flood storage capacity can be maintained by lowering ground levels either within the curtilage of the development or elsewhere in the floodplain, in order to maintain at least the same volume of flood storage capacity within the floodplain.

6.4. In undefended tidal areas, raising ground levels is unlikely to impact on maximum tidal levels so the provision of compensatory storage should not be necessary.

6.5. For development in a defended flood risk area, the impact on residual flood risk to other properties needs to be considered. New development behind flood defences can increase the residual risk of flooding if the flood defences are breached or overtopped by changing the conveyance of the flow paths or by displacing flood water elsewhere. If the potential impact on residual risk is unacceptable then mitigation should be provided.

6.6. Whilst the site is situated in Flood Zone 3, when using the Environment Agency Flood Map for Planning (Rivers and Sea), the development will provide betterment due to there being an overall decrease in built footprint.

7. Discussion and Conclusions:

7.1. This Flood Risk Assessment and Surface Water Drainage Strategy has been prepared by Unda Consulting Limited on behalf of Cleator Mills Business Park Limited, in support of a planning application for the construction of unit G with proposed parking at the site of the Cleator Mills, Cleator, Whitehaven, CA23 3DJ. This report assesses the flood risk and surface water drainage strategy for the proposed development.

7.2. The proposed planning application is for the construction of unit G with proposed parking. Post development the footprint of buildings will cover approximately 885m².

7.3. In order to mitigate flood risk posed by post development runoff, adequate control measures will be required within the site. This will ensure that surface water runoff is dealt with at source and the flood risk off site is not increased.

7.4. The proposed development site is approximately 6,425m² and currently has industrial uses.

7.5. A topographical survey was undertaken by Edmondson Surveys and has been provided by the applicant. Upon review, this indicates that levels on site range between 59.16mAOD and 60.37mAOD.

7.6. The proposed planning application is for the construction of unit G with proposed parking.

7.7. Post development the footprint of buildings will cover approximately 885m².

7.8. The 1:50,000 BGS map shows the bedrock geology underlying the site to consist of Buttermere Formation – Mudstone and Sandstone.

7.9. According to 1:50,000 BGS mapping the site is underlain by Alluvium – Clay, Silt, Sand and Gravel superficial geological deposits.

7.10. The soil type taken from the UK soils website shows deep riverine clay, sands and gravels with a clay to sandy loam texture.

7.11. The site is located partially within Flood Zone 3 (High Risk) which means it is defined as land having greater than a 1:100 annual probability of fluvial flooding. The site is also partially located within Flood Zone 2 (Medium Risk) which means it is defined as having land with between a 1:100 annual probability and 1:1000 annual probability of fluvial flooding.

7.12. Modelled flood levels and extents have been received from the Cumbria and Lancashire Area Environment Agency as part of a Product 4 data request. The EA Product 4 data is provided within the report Appendix. Flood levels and flows have been provided from the River Ehen 2015 model.

7.13. According to the data provided at Node "10" the undefended 1:100 and 1:1000 year flood levels are 60.22mAOD and 60.52mAOD respectively. When compared to onsite topographic levels of 59.16mAOD and 60.37mAOD the maximum flood depths for the 1:100 year and 1:1000 year events are 1.06m and 1.36m, respectively.

7.14. According to the data provided at Node "10" the site is outside of the defended 1:100 year flood event. However, the defended 1:1000 flood level is 60.51mAOD. When compared to onsite topographic levels of 59.16mAOD and 60.37mAOD the maximum flood depth for the 1:1000 year event is 1.35m.

7.15. The site is located within Flood Zone 3 and is classified as "more vulnerable". The Flood Risk Assessments: climate change allowances guidance –updated October 2021, states that the Central climate change allowance should be applied. The site falls within the South West Lakes Management Catchment, where the Central climate change allowance for the 2080's is a 30% increase in river flows.

7.16. As such, the most suitable modelled flood data provided in the River Ehen modelling is a 30% increase in flows, and as such this will be used for this assessment.

7.17. The undefended flood level for the 1:100 year plus 30% allowance for climate change is 60.34mAOD. When compared to onsite topographic levels of 59.16mAOD and 60.37mAOD the maximum flood depths for the 1:100 year plus 30% allowance for climate change is 1.18m.

7.18. The defended flood level for the 1:100 year plus 30% allowance for climate change is 60.20mAOD. When compared to onsite topographic levels of 59.16mAOD and 60.37mAOD the maximum flood depths for the 1:100 year plus 30% allowance for climate change is 1.04m.

7.19. The EA also provided flood levels from Cleator Moor 2009 model. According to the data provided at Node "9" the site is outside of the undefended 1:100 year flood event. However, the undefended 1:1000 flood level if 59.70mAOD. When compared to onsite topographic levels of 59.16mAOD and 60.37mAOD the maximum flood depth for the 1:1000 year event is 0.54m.

7.20. According to EA data there are a number of defences within vicinity to the site. These include 4 embankments with their standard of protection ranging from 5 – 100 years. For the full defence asset list please refer to the EA defence map in the report appendix.

7.21. The Environment Agency confirm the site is outside of any historical flood extents.

7.22. Due to the site topography and distance to the nearest coast/ tidal watercourse, the risk of tidal flooding is considered to be very low.

7.23. The EA Risk of Flooding from Surface Water Map suggests that the majority of the site lies within an area of "Very Low" to "High" risk of flooding from surface water.

7.24. In order to help protect against flooding during extreme events, flood resistant design measures could be implemented into the proposed buildings, as outlined in section 6.2.

7.25. Infiltration testing has been undertaken at the site and provided for use within this report. The lowest infiltration rate of 0.001171 m/s has been utilised within the below calculations.

7.26. It is therefore proposed that all post development runoff is discharged to ground

7.27. Existing greenfield runoff rates for the total site have been calculated as 4.4l/s for the 1:1 annual runoff event, 8.6l/s for the 1:30 year event and 10.5l/s for the 1:100 year event. Refer to calculations in Appendix.

7.28. Surface Water runoff from all impermeable areas will discharge into a cellular storage soakaway located beneath the HGV yard.

7.29. It is proposed to discharge post development runoff to ground, therefore, there will be no off-site discharge post development.

7.30. Runoff from all impermeable areas (6,425m^2) will be collected and stored in a cellular storage soakaway located beneath the HGV yard.

7.31. From the cellular soakaway storage units, runoff will gradually infiltrate into the underlying strata.

7.32. Preliminary calculations indicate that sufficient storage required to attenuate runoff from the proposed impermeable areas arising from the critical 1:100 year + 50% climate change event can be provided within a cellular soakaway structure of dimensions 205m^2 x 0.4m deep x 0.95 (void ratio).

7.33. Preliminary calculations indicated that some 77.9m^3 of storage is required to attenuate the runoff for all storms up to and including the 1:100 year + 50% climate change event.

7.34. All preliminary surface water drainage calculations have been undertaken using MicroDrainage software. Refer to the Appendix.

7.35. Runoff from roof areas is relatively uncontaminated, and does not warrant a complex treatment process to improve quality prior to discharge to ground. Nevertheless, it is suggested to include debris / sediment traps on any new drainage.

7.36. However, all Surface Water runoff from the impermeable ground surfaces will be required to pass through an oil interceptor prior to discharge to soakaway feature.

7.37. Should the onsite drainage system fail under extreme rainfall events or blockage, flooding may occur within the site. In the event of the drainage system failure, the runoff flow can be managed through detailing the new external levels to direct water away from structures.

7.38. This drainage strategy has been undertaken in accordance with the principles set out in NPPF. We can conclude that providing the development adheres to the conditions advised above, the said development proposals can be accommodated without increasing flood risk within the locality in accordance with objectives set by Central Government and the EA.

Unda Consulting Limited

December 2022

8. Appendix

A - Plans by others:

- Topographical site survey – Edmondson Surveys Ltd.
- Proposed plans – Manning Elliot Partnership.

B - Flood Data:

- EA Product 4 Information Response.

C - MicroDrainage Calculations:

- ICP SUDS Greenfield Runoff Calculations;
- Cellular Soakaway Calculations.

D - Plans:

- Proposed Drainage Layout.

E – Reporting by others:

- Infiltration Testing Report – B.A.F Contracting Ltd;

Key

- MH Manhole
- BT British Telecom Manhole
- IC Inspection Cover
- LP Lamp Post
- ST Stop Tap
- SV Stop Valve
- G Gully
- TP Telegraph Pole
- FH Fire Hydrant
- WM Water Meter
- Wall
- Fence – Post & Wire
- Fence – Post & Rail
- Fence – Metal Railings
- Kerbline – Channel
- Edge of Path/Track
- Top of Bank
- Bottom of Bank
- Gate
- Face of Hedge/Bushes

General Notes.

Drawing based on Edmondson Surveys Ltd. Topographical Survey drawing E2533-01-A dated 2010-11-04-08

Site Area including Access Road
= 67188 sqm 16.60 acre 6.72 ha

Revisions.

MANNING ELLIOTT
Chartered Architects and Designers

Suite 1, Manelli House
4 Crowper Road
Penrith, Cumbria
CA11 9BN

Telephone: 01768 865800

E-mail:
post@manning-elliott.co.uk

Residential Development Land at Cleator Mills

Existing Site Plan

Preliminary Issue

SCALE	DATE	DRAWN BY
1:500 (A0)	JUN 2013	DMC

NORTH ASSOCIATES LTD

13	22	02a

REVISIONS:

Revision	--	00.00.00
DESCRIPTION		

MILL STREET

2.4M H PALISADE PERIMETER SECURITY FENCE TO BOUNDARY

DRAINAGE EASEMENT

DRAINAGE EASEMENT

F 108m² / 1160ft²

6710

EXIT

Parking (12no.)

10.5M TURNING CIRCLE

1 WAY SYSTEM FOR HGV's

2.4m PALISADE PERIMETER SECURITY FENCE

G 735m² / 7910ft² WAREHOUSE UNIT

G

2,000ft² / 185m² OFFICE UNIT

PARKING SPACES WITHIN DEMISE 15 no.

ENTRY

5M WIDE LANDSCAPE BUND

2.4m PALISADE PERIMETER SECURITY FENCE TO BOUNDARY

PROPOSED HOUSING DEV.

SITE AREA
1.65AC | 6,710M²

HOUSING WATER MAIN

10.5M TURNING CIRCLE

HGV EXIT ROUTE

Parking (12no.)

F 287m² / 3095ft²

E2 210m² / 2260ft²

E1 420m² / 4520ft²

Parking (3no.)

Parking (3no.)

Parking (20no.)

PARKING SPACES WITHIN DEMISE 43 no.

EXISTING MILL BUILDING 1

H 112m² / 1205ft²

RIVERSIDE WALK

RIVER EHEN

PEDESTRIAN ROUTE

E1 COMPOUND
527m² / 1729ft²

D 420m² / 4520ft²

B 210m² / 2260ft²

A2 180m² / 1936ft²

A1 330m² / 3552ft²

Sellafield Park & Ride

River Ehen

N

MANNINGELLIOTT PARTNERSHIP

Chartered Architects & Designers

Manelli House, Suite 1
Cowper Road, Penrith
Cumbria CA11 9BN

t: 01768 868 800
e: post@manning-elliott.co.uk
w: manning-elliott.co.uk

project title:

Commercial Development
Cleator Mills, Cumbria

GenR8 North Ltd.

drawing title:

Masterplan as Proposed

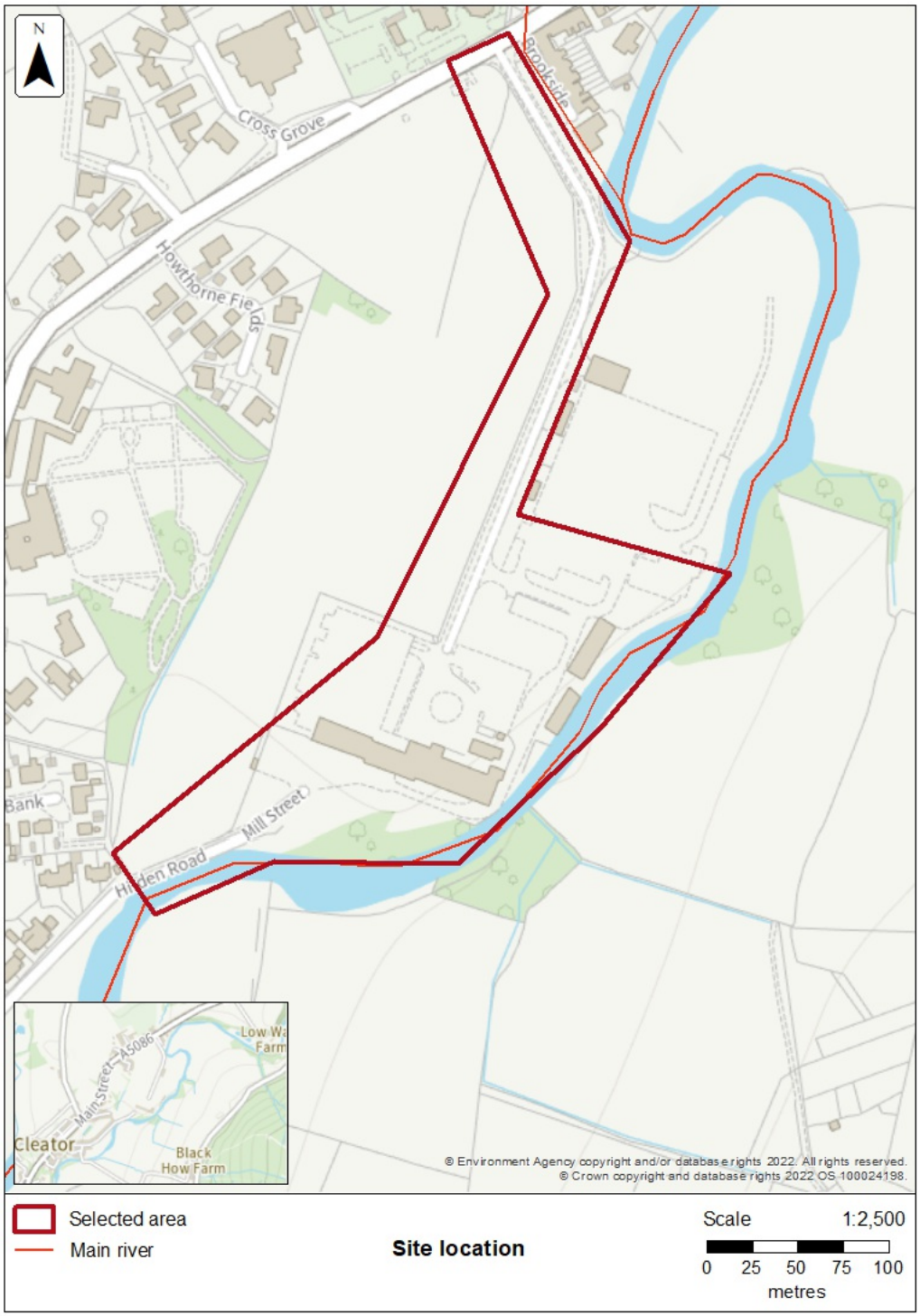
issue stage:

FOR DISCUSSION

date:	drawn:	scale @ A3:
OCT 22	CS	1:1000

drawing number:	revision:
1701C-200	-

Flood risk assessment data



s)

for.

How to use this information

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

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

Included in this document

In this document you'll find:

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

Surface water and other sources of flooding

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

- surface water
- ordinary watercourses
- reservoirs

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

About the models used

Model name: Cleator Moor 2009
Scenario(s): No defences exist fluvial
Date: 1 March 2009

Model name: Ehen 2015
Scenario(s): Defended fluvial, defences removed fluvial, defended climate change fluvial, defences removed climate change fluvial
Date: 11 July 2016

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

Terminology used

Annual exceedance probability (AEP)

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

Metres above ordnance datum (mAOD)

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

Flood map for planning (rivers and the sea)

Your selected location is in flood zone 3.

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

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

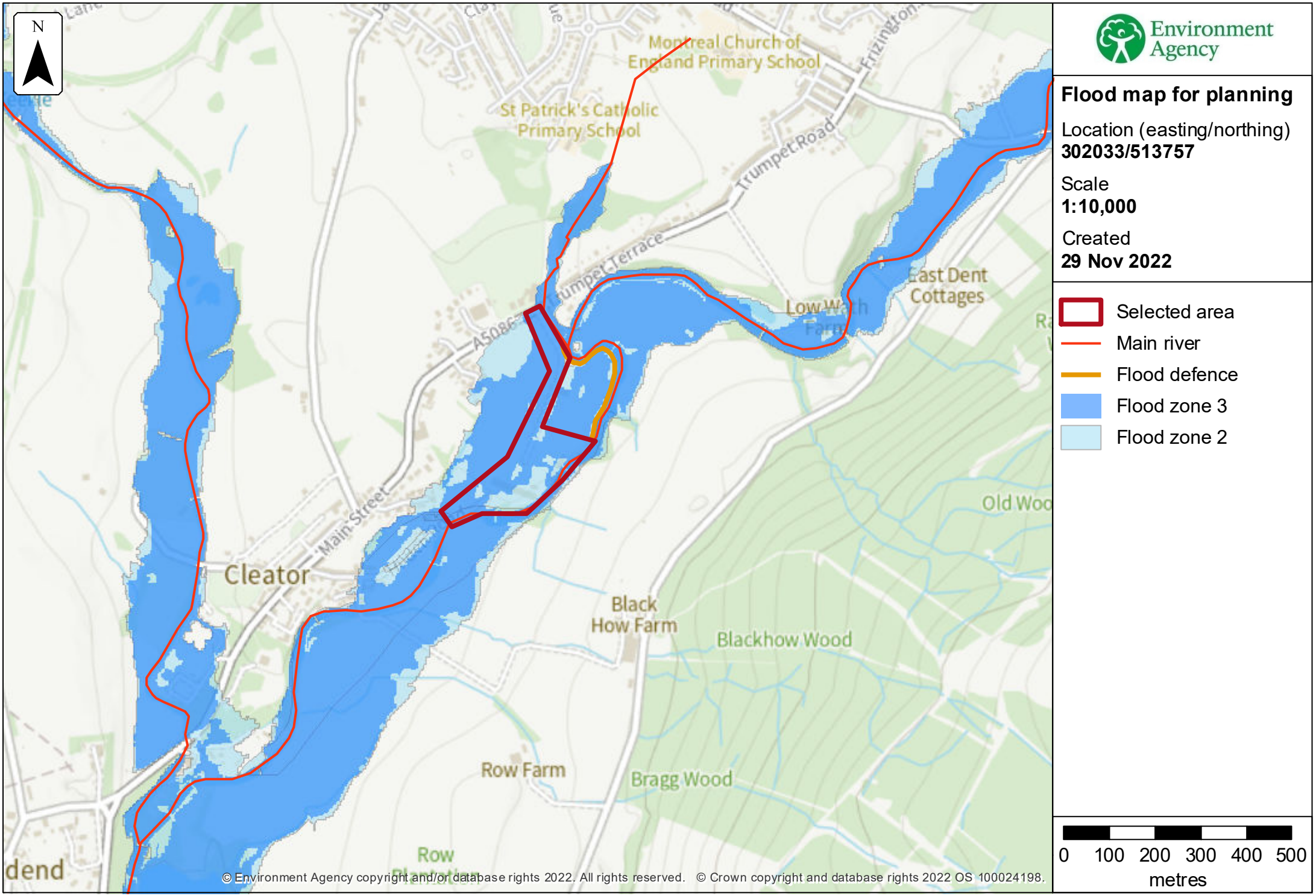
Flood zone 2 shows the area at risk of flooding for an undefended flood event with:

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

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

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

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


N
Montreal Church of England Primary School
St Patrick's Catholic Primary School
Trumpet Road
Trumpet Terrace
A5086
East Dent Cottages
Main Street
Cleator
Black How Farm
Blackhow Wood
Row Farm
Bragg Wood
Row
dend
Old Woo
Environment Agency
Flood map for planning
Location (easting/northing)
302033/513757
Scale
1:10,000
Created
29 Nov 2022
Selected area
Main river
Flood defence
Flood zone 3
Flood zone 2
0 100 200 300 400 500
metres
© Environment Agency copyright and/or database rights 2022. All rights reserved. © Crown copyright and database rights 2022 OS 100024198.

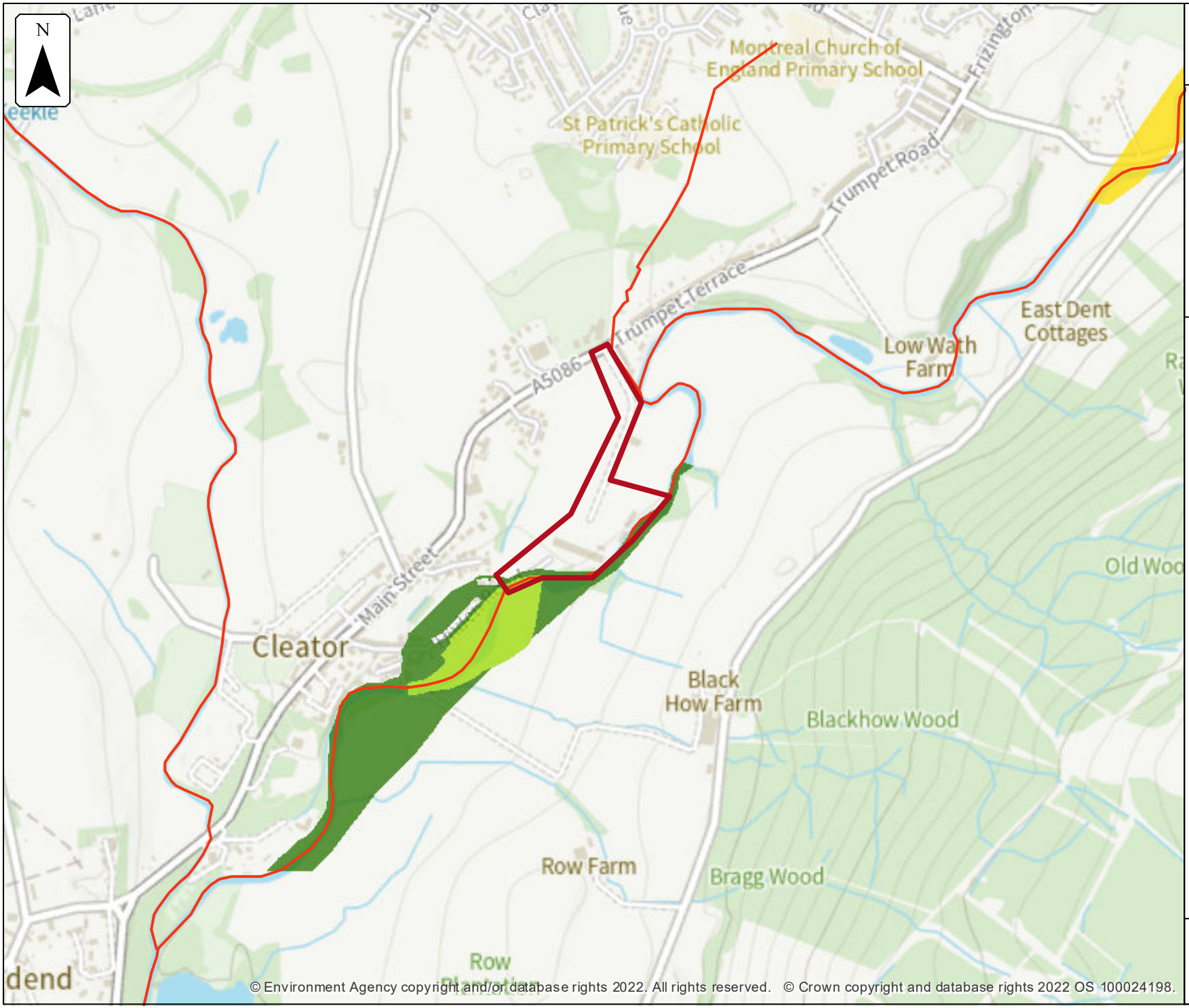
Historic flooding

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

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

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

Download recorded flood outlines in GIS format



Environment Agency

Historic flood map

Location (easting/northing)
302033/513757

Scale
1:10,000

Created
29 Nov 2022

Selected area
Main river

Date of flood event
October, 2017
November, 2009
October, 1977

0 100 200 300 400 500
metres

Historic flood event data

Start date	End date	Source of flood	Cause of flood	Affects location
11 October 2017	12 October 2017	main river	channel capacity exceeded (no raised defences)	Yes
19 November 2009	22 November 2009	main river	channel capacity exceeded (no raised defences)	Yes
24 October 1977	24 October 1977	unknown	unknown	No

Flood defences and attributes

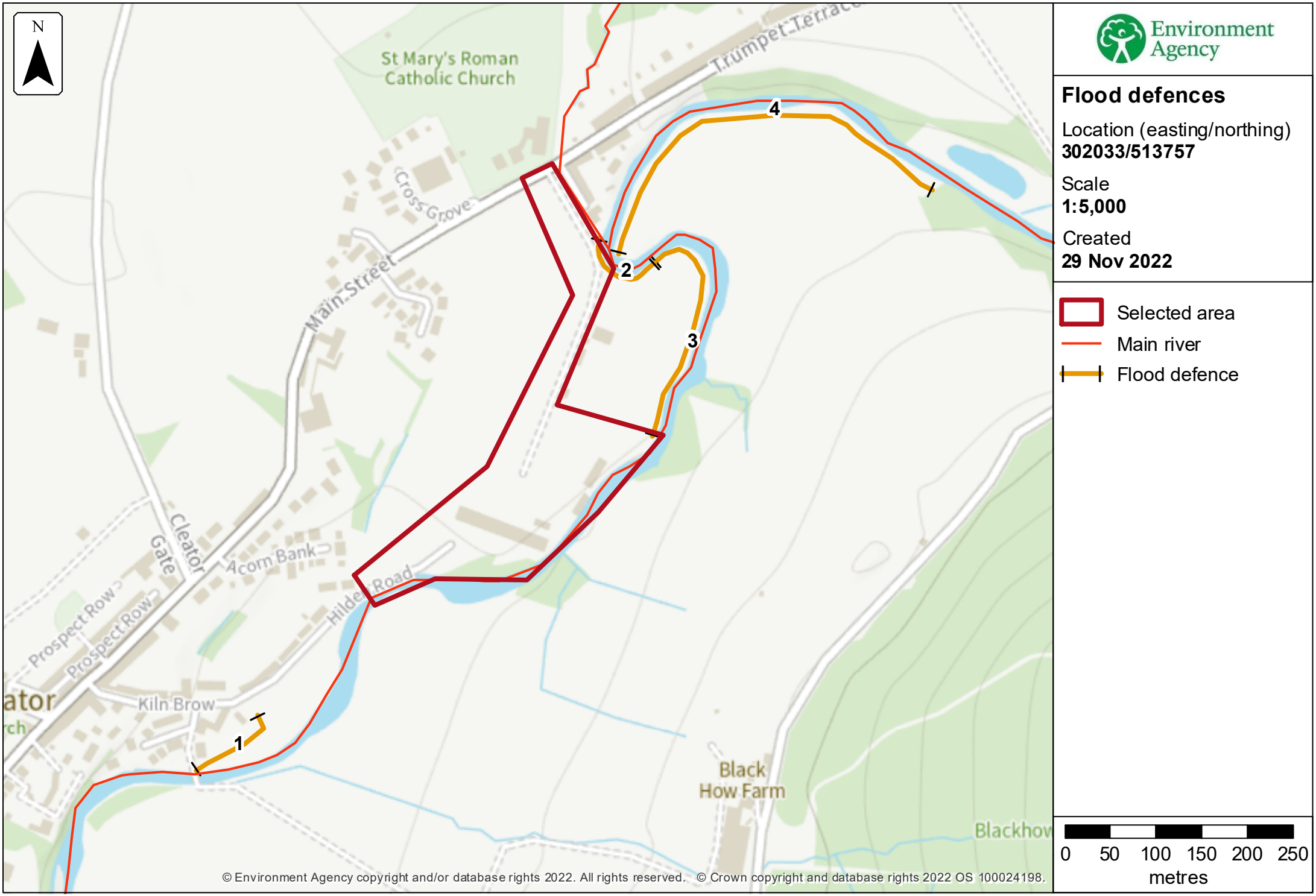
The flood defences map shows the location of the flood defences present.

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

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

Use this information:

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



Environment Agency

Flood defences

Location (easting/northing)
302033/513757

Scale
1:5,000

Created
29 Nov 2022

Selected area
Main river
Flood defence

0 50 100 150 200 250
metres

Flood defences data

Label	Asset ID	Asset Type	Standard of protection (years)	Current condition	Downstream actual crest level (mAOD)	Upstream actual crest level (mAOD)	Effective crest level (mAOD)
1	37886	Embankment	100	Fair	57.15	57.15	57.15
2	37628	Embankment	100	Fair	64.52	64.52	64.52
3	37627	Embankment	100	Fair	62.49	63.40	62.49
4	80487	Embankment	5	Poor	63.84	65.35	63.84

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

Modelled data

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

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

Climate change

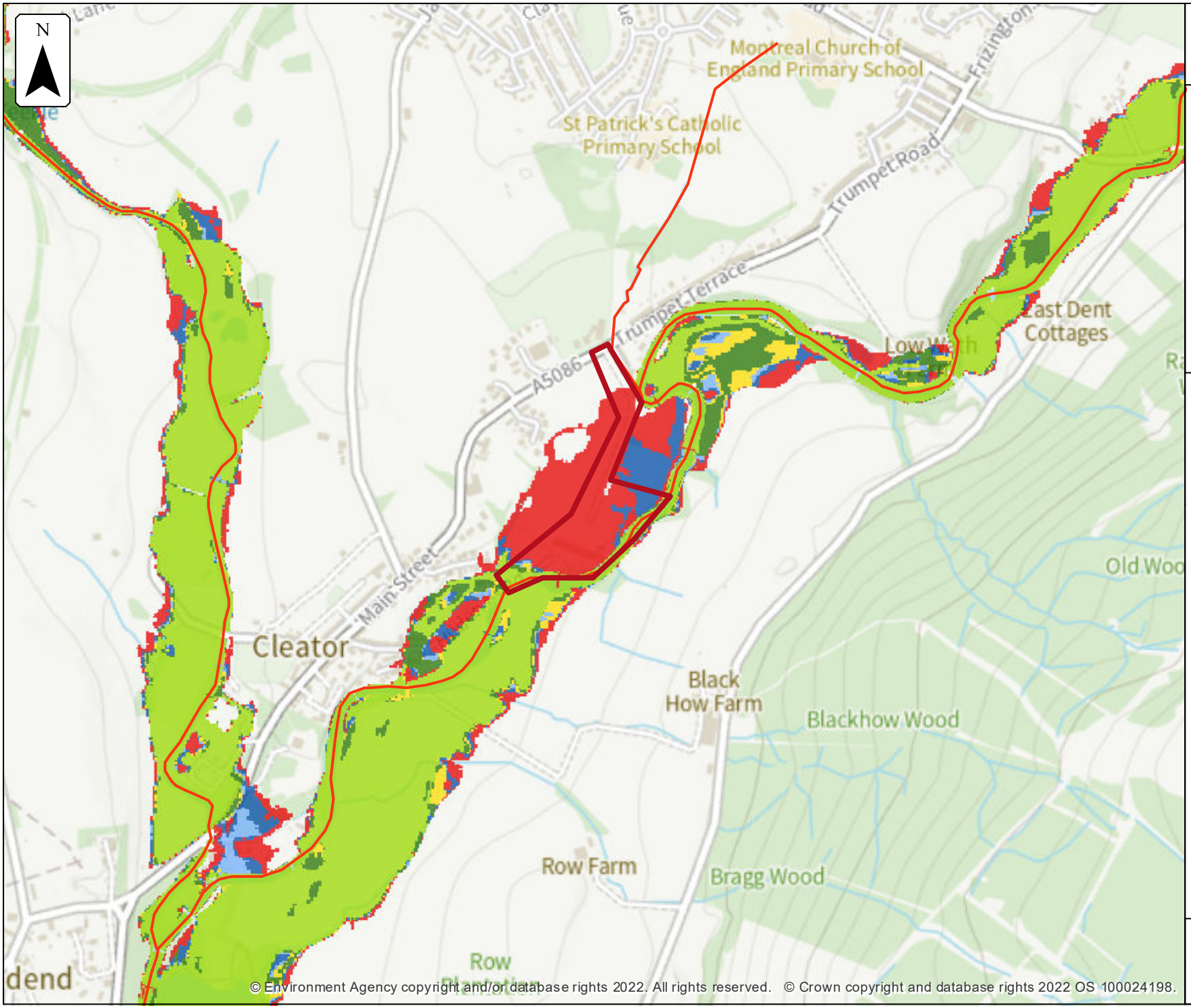
The climate change data included in the models may not include the latest flood risk assessment climate change allowances. Where the new allowances are not available you will need to consider this data and factor in the new allowances to demonstrate the development will be safe from flooding.

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

Modelled scenarios

The following scenarios are included:

- Defended modelled fluvial: risk of flooding from rivers where there are flood defences
- Defences removed modelled fluvial: risk of flooding from rivers where flood defences have been removed
- No defences exist modelled fluvial: risk of flooding from rivers where there are no flood defences
- Defended climate change modelled fluvial: risk of flooding from rivers where there are flood defences, including estimated impact of climate change
- Defences removed climate change modelled fluvial: risk of flooding from rivers where flood defences have been removed, including estimated impact of climate change



Environment Agency

Defended modelled fluvial extent

Location (easting/northing)
302033/513757

Scale
1:10,000

Created
29 Nov 2022

Model name
Ehen 2015

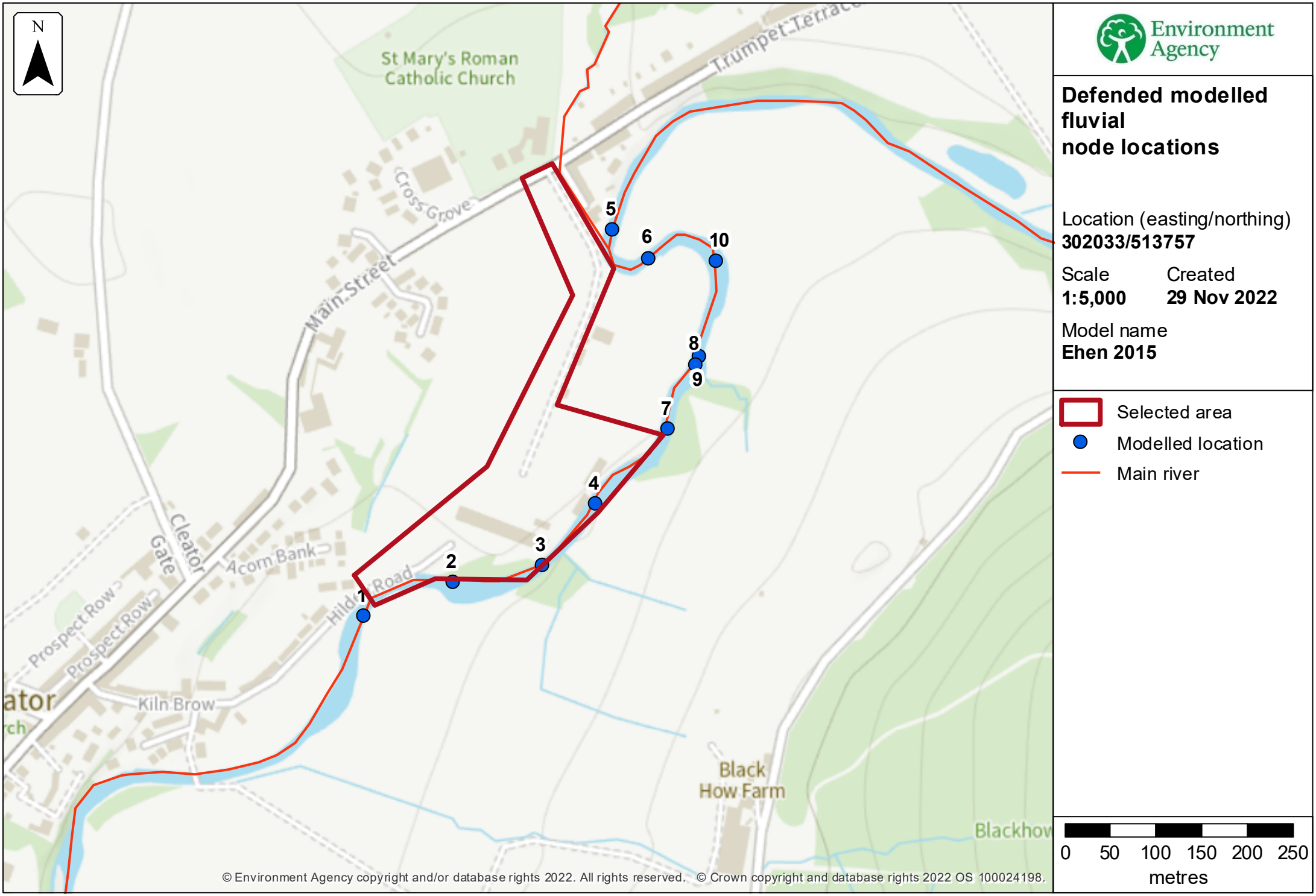
- Selected area
- Main river

Modelled flood extent

- 5% AEP
- 2% AEP
- 1.33% AEP
- 1% AEP
- 0.5% AEP
- 0.1% AEP

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

0 100 200 300 400 500
metres

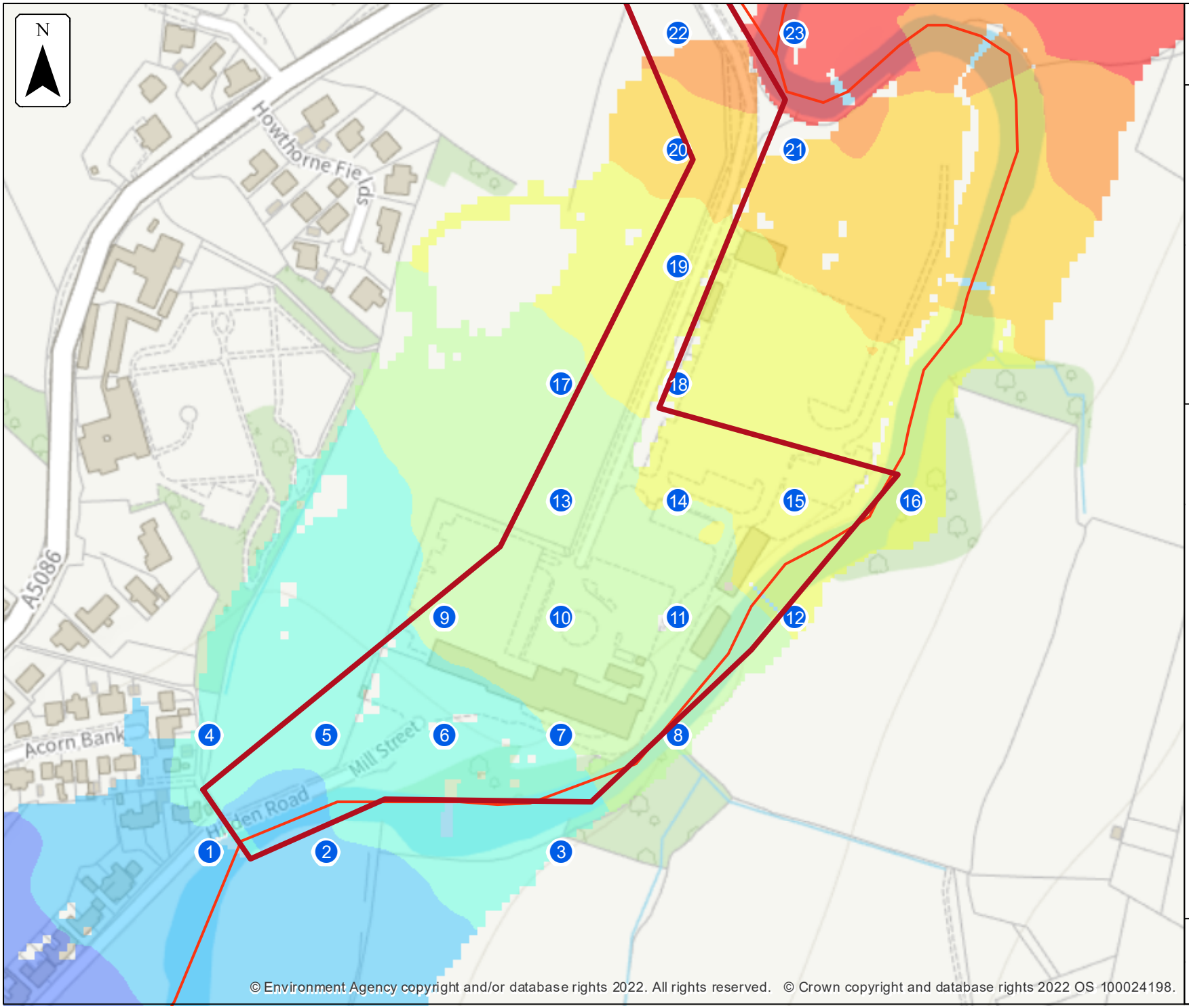

N
St Mary's Roman Catholic Church
Trumpet Terrace
Cross Grove
Main Street
Cleator Gate
Acorn Bank
Prospect Row
Prospect Row
Kiln Brow
Hilldale Road
Black How Farm
1
2
3
4
5
6
7
8
9
10
Environment Agency
Defended modelled fluvial node locations
Location (easting/northing)
302033/513757
Scale
1:5,000
Created
29 Nov 2022
Model name
Ehen 2015
Selected area
Modelled location
Main river
0 50 100 150 200 250
metres
© Environment Agency copyright and/or database rights 2022. All rights reserved. © Crown copyright and database rights 2022 OS 100024198.

Modelled node locations data

Defended

Label	Modelled location ID	Easting	Northing	5% AEP		2% AEP		1.33% AEP		1% AEP		0.5% AEP		0.1% AEP	
				Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow
1	1204241	301853	513572	58.27	82.65	58.37	90.31	58.42	96.04	58.45	99.52	58.53	109.80	58.75	145.36
2	1204324	301951	513609	58.91	97.30	58.99	111.30	59.04	121.70	59.06	127.64	59.07	144.44	59.23	202.06
3	1204006	302049	513627	59.51	97.43	59.64	111.97	59.73	123.07	59.77	129.25	59.88	146.48	60.20	208.94
4	1204731	302107	513695	60.06	97.39	60.24	111.66	60.38	122.25	60.45	128.10	60.56	144.66	61.04	200.69
5	1204197	302126	513995	63.83	85.08	63.90	92.13	63.94	95.29	63.97	96.51	64.02	100.49	64.15	115.41
6	1203893	302165	513964	63.23	84.31	63.42	89.70	63.55	91.20	63.62	91.36	63.78	92.75	64.13	99.83
7	1204604	302187	513777	60.45	97.36	60.63	111.89	60.74	122.97	60.81	129.14	60.95	146.02	61.39	196.74
8	1204603	302218	513848	61.01	97.06	61.21	111.01	61.35	121.17	61.43	126.74	61.61	141.56	62.12	184.17
9	1204634	302221	513857	61.71	97.06	61.88	111.01	61.99	121.17	62.05	126.74	62.19	141.56	62.54	184.17
10	1204329	302239	513961	62.18	97.31	62.32	111.80	62.42	122.09	62.47	127.21	62.64	140.22	63.14	172.62

Data in this table comes from the Ehen 2015 model.
Level values are shown in mAOD, and flow values are shown in cubic metres per second.
Any blank cells show where a particular scenario has not been modelled for this location.



Environment Agency

Defended modelled fluvial extent and height

Location (easting/northing)
302033/513757

Scale
1:2,500

Created
29 Nov 2022

Model name
Ehen 2015

Selected area

Main river

Modelled 2D grid
Water level in mAOD

- 0 - 57.0
- 57.0 - 58.0
- 58.0 - 59.0
- 59.0 - 60.0
- 60.0 - 61.0
- 61.0 - 62.0
- 62.0 - 63.0
- 63.0 - 64.0
- 64.0 - 65.0

This map shows the 0.1% AEP height data

0 25 50 75 100
metres

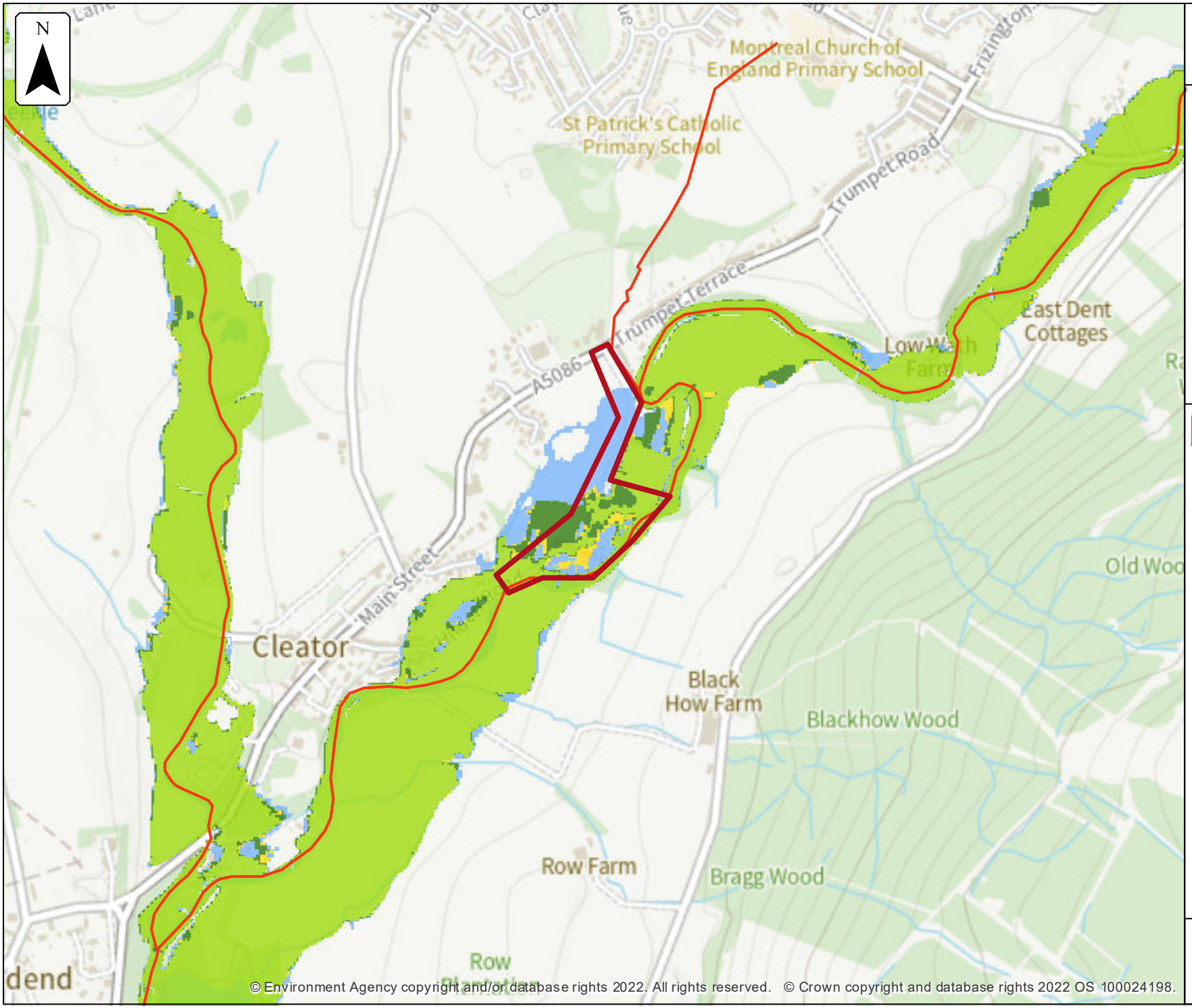
Sample point data

Defended

Label	Easting	Northing	5% AEP		2% AEP		1.33% AEP		1% AEP		0.5% AEP		0.1% AEP	
			Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height
1	301846	513587	0.33	58.23	0.43	58.34	0.48	58.39	0.49	58.41	0.55	58.47	0.76	58.67
2	301903	513587	0.26	58.57	0.32	58.63	0.36	58.67	0.38	58.69	0.43	58.74	0.59	58.91
3	302017	513587	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
4	301846	513644	NoData	NoData	NoData	NoData	0.04	58.65	0.06	58.68	0.12	58.75	0.42	59.05
5	301903	513644	NoData	NoData	NoData	NoData	NoData	NoData	0.03	58.71	0.10	58.78	0.37	59.05
6	301960	513644	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.01	59.44
7	302017	513644	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.20	60.02
8	302074	513644	2.26	59.65	2.41	59.80	2.51	59.90	2.56	59.95	2.67	60.06	3.03	60.42
9	301960	513701	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.38	60.26
10	302017	513701	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.34	60.51
11	302074	513701	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.06	60.78
12	302131	513701	NoData	NoData	NoData	NoData	0.09	60.39	0.15	60.46	0.24	60.57	0.71	61.04
13	302017	513758	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.20	60.61
14	302074	513758	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.15	60.99
15	302131	513758	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.17	60.90	0.60	61.33
16	302188	513758	0.34	60.39	0.52	60.57	0.64	60.69	0.70	60.76	0.84	60.90	1.28	61.34

Label	Easting	Northing	5% AEP		2% AEP		1.33% AEP		1% AEP		0.5% AEP		0.1% AEP	
			Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height
17	302017	513815	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.20	60.89
18	302074	513815	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.36	61.57
19	302074	513872	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.29	61.61
20	302074	513929	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.10	62.49
21	302131	513929	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.07	62.73
22	302074	513986	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
23	302131	513986	NoData	NoData	0.01	63.71	0.03	63.79	0.04	63.84	0.13	63.92	0.34	64.14
24	302017	514043	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
25	302074	514043	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData

Data in this table comes from the Ehen 2015 model.
Height values are shown in mAOD, and depth values are shown in metres.
Any blank cells show where a particular scenario has not been modelled for this location.
Cells which contain text 'NoData' for a scenario show that return period has been modelled but there is no flood risk for that return period for that location.



Environment Agency

Defended climate change modelled fluvial extent

Location (easting/northing)
302033/513757

Scale
1:10,000

Created
29 Nov 2022

Model name
Ehen 2015

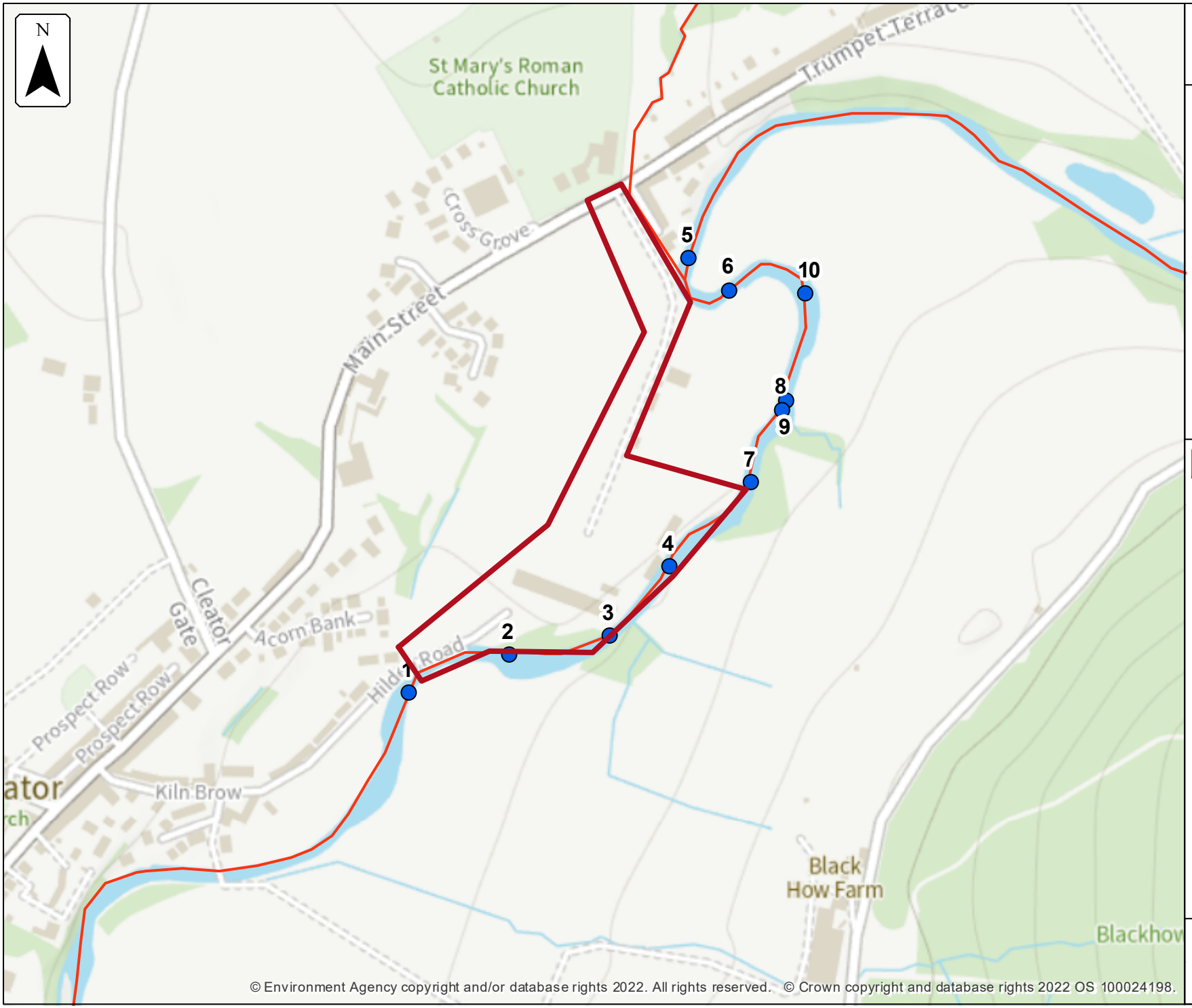
- Selected area
- Main river

Modelled flood extent

- 1.0% AEP (+20%)
- 1.0% AEP (+30%)
- 1.0% AEP (+35%)
- 1.0% AEP (+70%)

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

0 100 200 300 400 500
metres



Environment Agency

Defended climate change modelled fluvial node locations

Location (easting/northing)
302033/513757

Scale
1:5,000

Created
29 Nov 2022

Model name
Ehen 2015

Selected area
Modelled location
Main river

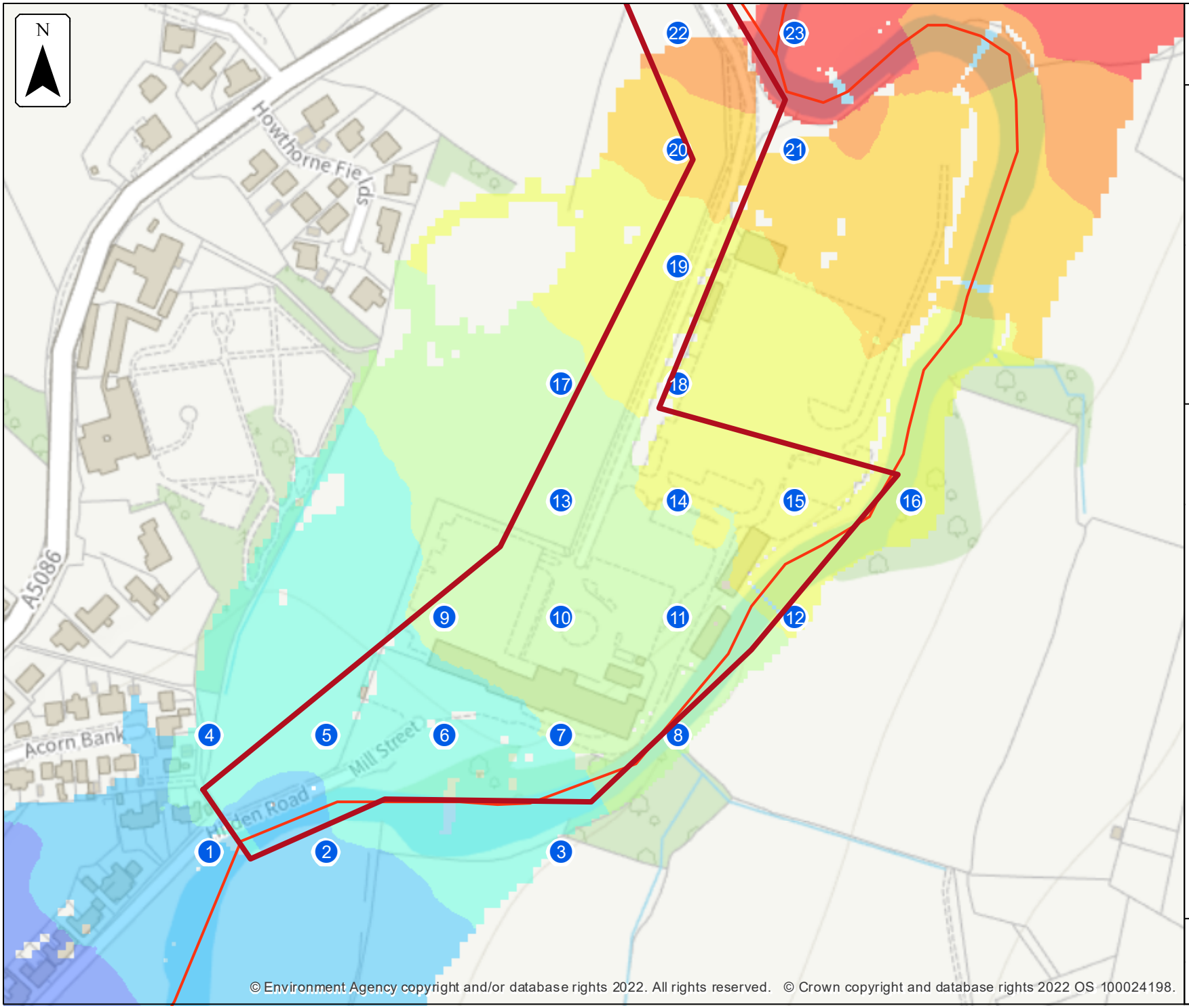
0 50 100 150 200 250
metres

Modelled node locations data

Defended climate change

Label	Modelled location ID	Easting	Northing	1.0% AEP (+20%)		1.0% AEP (+30%)		1.0% AEP (+35%)		1.0% AEP (+70%)	
				Level	Flow	Level	Flow	Level	Flow	Level	Flow
1	1204241	301853	513572	58.55	113.29	58.60	120.69	58.63	124.06	58.75	146.16
2	1204324	301951	513609	59.08	150.01	59.10	162.12	59.12	167.84	59.23	203.31
3	1204006	302049	513627	59.91	152.21	59.98	164.96	60.01	171.17	60.21	210.34
4	1204731	302107	513695	60.60	149.93	60.69	161.56	60.84	166.19	61.05	201.99
5	1204197	302126	513995	64.03	101.48	64.06	103.91	64.07	105.40	64.15	115.84
6	1203893	302165	513964	63.82	93.24	63.91	94.09	63.95	94.72	64.13	100.13
7	1204604	302187	513777	61.0	151.25	61.11	162.28	61.16	167.47	61.40	197.91
8	1204603	302218	513848	61.67	145.97	61.78	155.28	61.83	159.73	62.13	185.09
9	1204634	302221	513857	62.23	145.97	62.31	155.28	62.35	159.73	62.54	185.09
10	1204329	302239	513961	62.69	143.88	62.80	151.51	62.86	155.13	63.15	173.29

Data in this table comes from the Ehen 2015 model.
Level values are shown in mAOD, and flow values are shown in cubic metres per second.
Any blank cells show where a particular scenario has not been modelled for this location.



Environment Agency

Defended climate change modelled fluvial extent and height

Location (easting/northing)
302033/513757

Scale
1:2,500

Created
29 Nov 2022

Model name
Ehen 2015

Selected area

Main river

Modelled 2D grid
Water level in mAOD

- 0 - 57.0
- 57.0 - 58.0
- 58.0 - 59.0
- 59.0 - 60.0
- 60.0 - 61.0
- 61.0 - 62.0
- 62.0 - 63.0
- 63.0 - 64.0
- 64.0 - 65.0

This map shows the 1.0% AEP +70% height data

0 25 50 75 100
metres

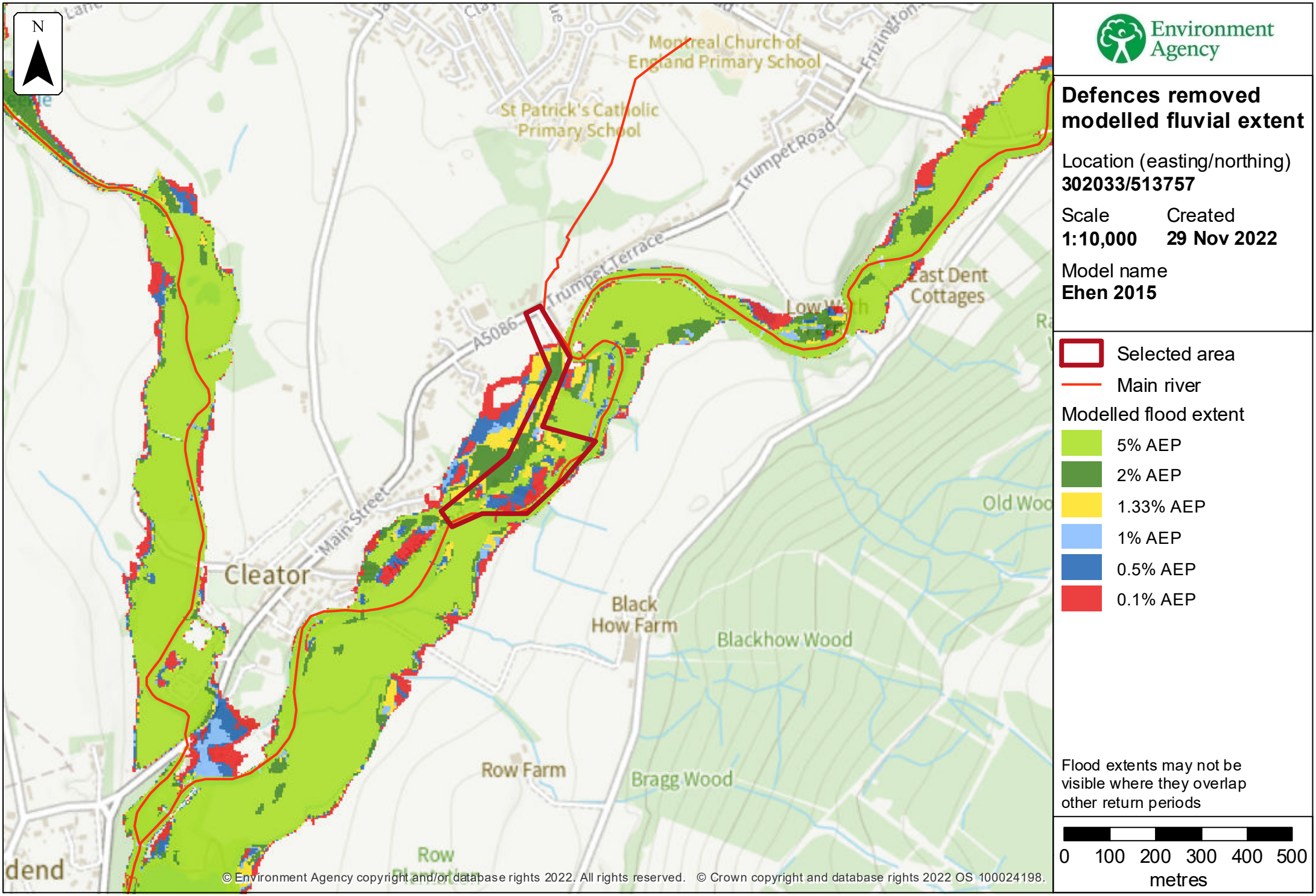
Sample point data

Defended climate change

Label	Easting	Northing	1% AEP (+20%)		1% AEP (+30%)		1% AEP (+35%)		1% AEP (+70%)	
			Depth	Height	Depth	Height	Depth	Height	Depth	Height
1	301846	513587	0.58	58.49	0.64	58.54	0.66	58.56	0.79	58.69
2	301903	513587	0.44	58.75	0.47	58.77	0.49	58.79	0.60	58.90
3	302017	513587	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
4	301846	513644	0.14	58.77	0.22	58.83	0.25	58.86	0.45	59.06
5	301903	513644	0.12	58.80	0.16	58.84	0.18	58.87	0.37	59.05
6	301960	513644	NoData	NoData	NoData	NoData	NoData	NoData	0.01	59.48
7	302017	513644	NoData	NoData	NoData	NoData	0.06	59.88	0.19	60.02
8	302074	513644	2.70	60.09	2.71	60.18	2.77	60.24	2.97	60.44
9	301960	513701	NoData	NoData	0.13	60.00	0.17	60.04	0.41	60.28
10	302017	513701	0.05	60.19	0.10	60.20	0.13	60.23	0.42	60.52
11	302074	513701	NoData	NoData	0.01	60.71	0.02	60.71	0.09	60.78
12	302131	513701	0.28	60.61	0.39	60.70	0.53	60.84	0.74	61.05
13	302017	513758	NoData	NoData	0.01	60.44	0.03	60.46	0.19	60.62
14	302074	513758	NoData	NoData	0.02	60.89	0.02	60.90	0.12	61
15	302131	513758	0.22	60.95	0.29	61.04	0.34	61.09	0.59	61.34
16	302188	513758	0.89	60.95	0.80	61.06	0.87	61.13	1.10	61.35

Label	Easting	Northing	1% AEP (+20%)		1% AEP (+30%)		1% AEP (+35%)		1% AEP (+70%)	
			Depth	Height	Depth	Height	Depth	Height	Depth	Height
17	302017	513815	NoData	NoData	NoData	NoData	NoData	NoData	0.21	60.89
18	302074	513815	NoData	NoData	0.16	61.29	0.21	61.35	0.44	61.58
19	302074	513872	NoData	NoData	NoData	NoData	NoData	NoData	0.37	61.61
20	302074	513929	NoData	NoData	NoData	NoData	NoData	NoData	0.15	62.50
21	302131	513929	NoData	NoData	NoData	NoData	NoData	NoData	0.08	62.72
22	302074	513986	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
23	302131	513986	0.15	63.95	0.67	64.00	0.69	64.03	0.81	64.14
24	302017	514043	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
25	302074	514043	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData

Data in this table comes from the Ehen 2015 model.
Height values are shown in mAOD, and depth values are shown in metres.
Any blank cells show where a particular scenario has not been modelled for this location.
Cells which contain text 'NoData' for a scenario show that return period has been modelled but there is no flood risk for that return period for that location.



Environment Agency

Defences removed modelled fluvial extent

Location (easting/northing)
302033/513757

Scale
1:10,000

Created
29 Nov 2022

Model name
Ehen 2015

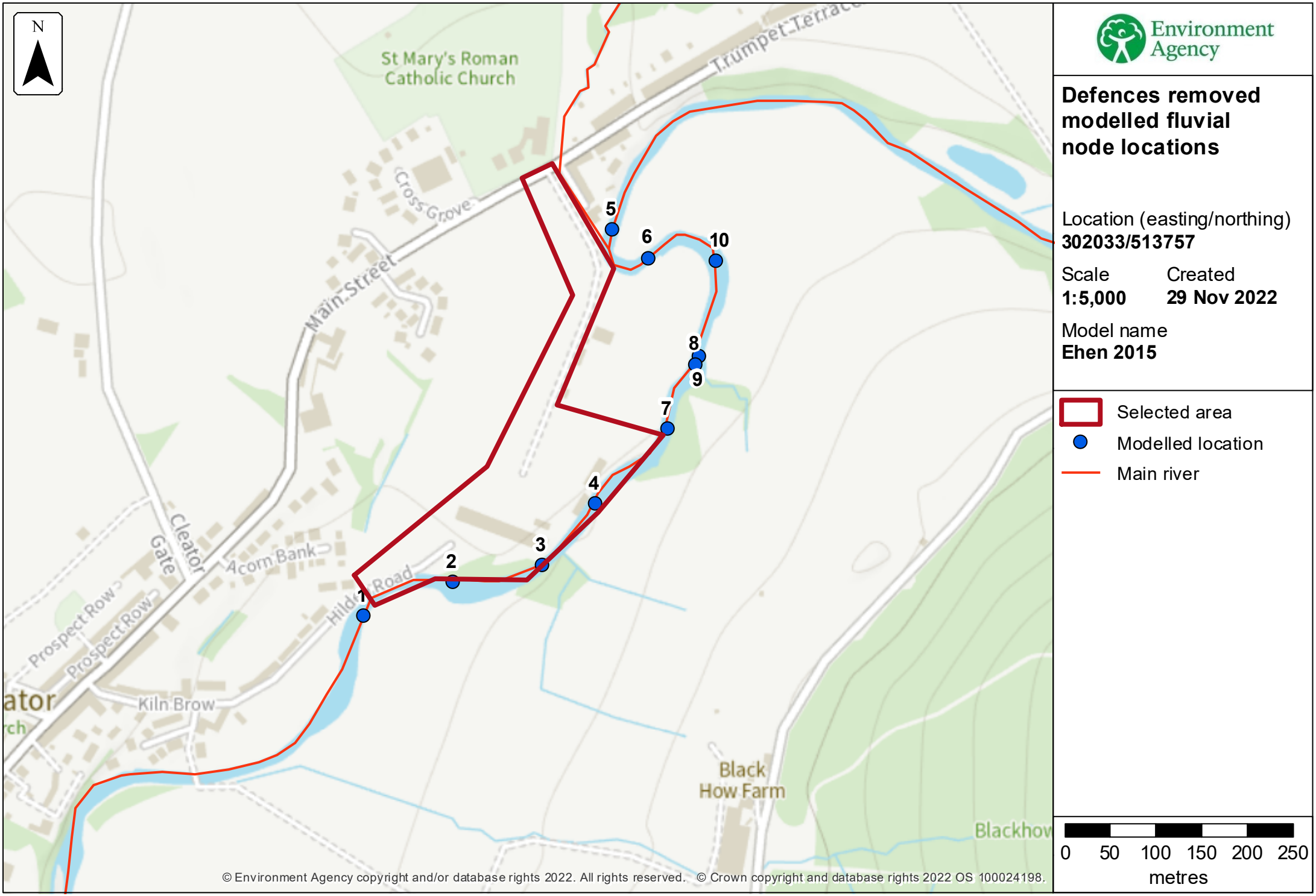
- Selected area
- Main river

Modelled flood extent

- 5% AEP
- 2% AEP
- 1.33% AEP
- 1% AEP
- 0.5% AEP
- 0.1% AEP

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

0 100 200 300 400 500
metres



Environment Agency

Defences removed modelled fluvial node locations

Location (easting/northing)
302033/513757

Scale
1:5,000

Created
29 Nov 2022

Model name
Ehen 2015

Selected area
Modelled location
Main river

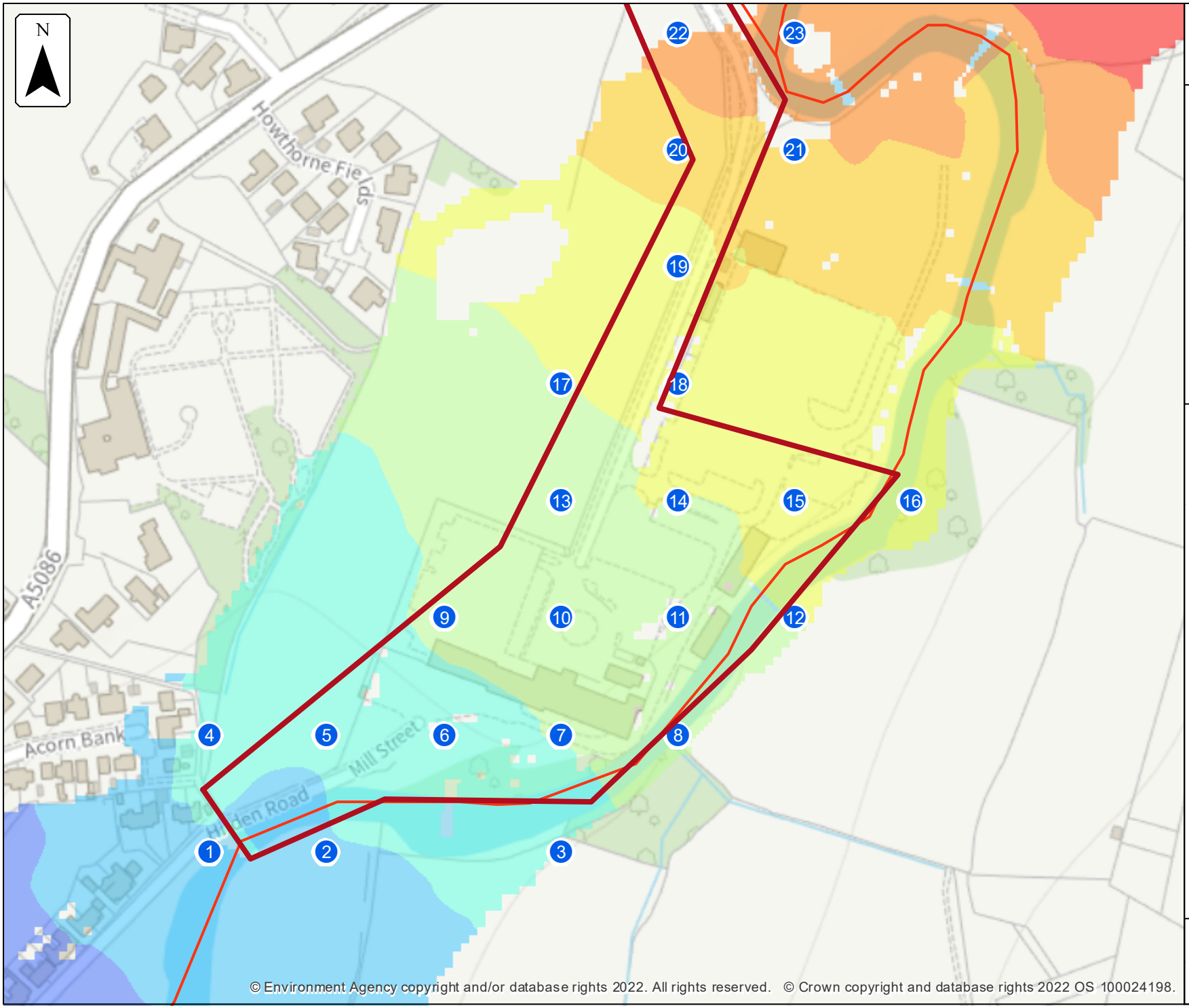
0 50 100 150 200 250
metres

Modelled node locations data

Defences removed

Label	Modelled location ID	Easting	Northing	5% AEP		2% AEP		1.33% AEP		1% AEP		0.5% AEP		0.1% AEP	
				Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow
1	1204241	301853	513572	58.27	82.59	58.36	90.04	58.42	95.58	58.45	98.62	58.52	107.69	58.74	142.23
2	1204324	301951	513609	58.91	97.19	58.99	110.76	59.04	120.69	59.06	125.92	59.08	140.34	59.22	194.81
3	1204006	302049	513627	59.51	97.31	59.63	111.40	59.73	121.99	59.77	127.55	59.85	142.42	60.16	201.0
4	1204731	302107	513695	60.06	97.23	60.24	110.98	60.37	121.06	60.43	126.27	60.55	140.36	61.0	193.56
5	1204197	302126	513995	63.65	67.76	63.71	70.90	63.74	73.53	63.76	75.13	63.79	79.92	63.92	97.29
6	1203893	302165	513964	63.24	68.69	63.37	71.02	63.44	72.75	63.47	73.63	63.54	75.78	63.75	86.33
7	1204604	302187	513777	60.45	96.51	60.63	109.95	60.75	120.01	60.81	125.21	60.95	139.14	61.32	192.85
8	1204603	302218	513848	61.0	95.76	61.22	106.94	61.37	115.06	61.44	119.09	61.61	129.31	62.19	164.86
9	1204634	302221	513857	61.69	95.76	61.83	106.94	61.93	115.06	61.97	119.09	62.08	129.31	62.46	164.86
10	1204329	302239	513961	62.16	95.33	62.29	104.34	62.39	109.63	62.44	111.99	62.57	118.0	63.03	135.65

Data in this table comes from the Ehen 2015 model.
Level values are shown in mAOD, and flow values are shown in cubic metres per second.
Any blank cells show where a particular scenario has not been modelled for this location.



Environment Agency

Defences removed modelled fluvial extent and height

Location (easting/northing)
302033/513757

Scale
1:2,500

Created
29 Nov 2022

Model name
Ehen 2015

Selected area

Main river

Modelled 2D grid
Water level in mAOD

- 0 - 57.0
- 57.0 - 58.0
- 58.0 - 59.0
- 59.0 - 60.0
- 60.0 - 61.0
- 61.0 - 62.0
- 62.0 - 63.0
- 63.0 - 64.0
- 64.0 - 65.0

This map shows the 0.1% AEP height data

0 25 50 75 100
metres

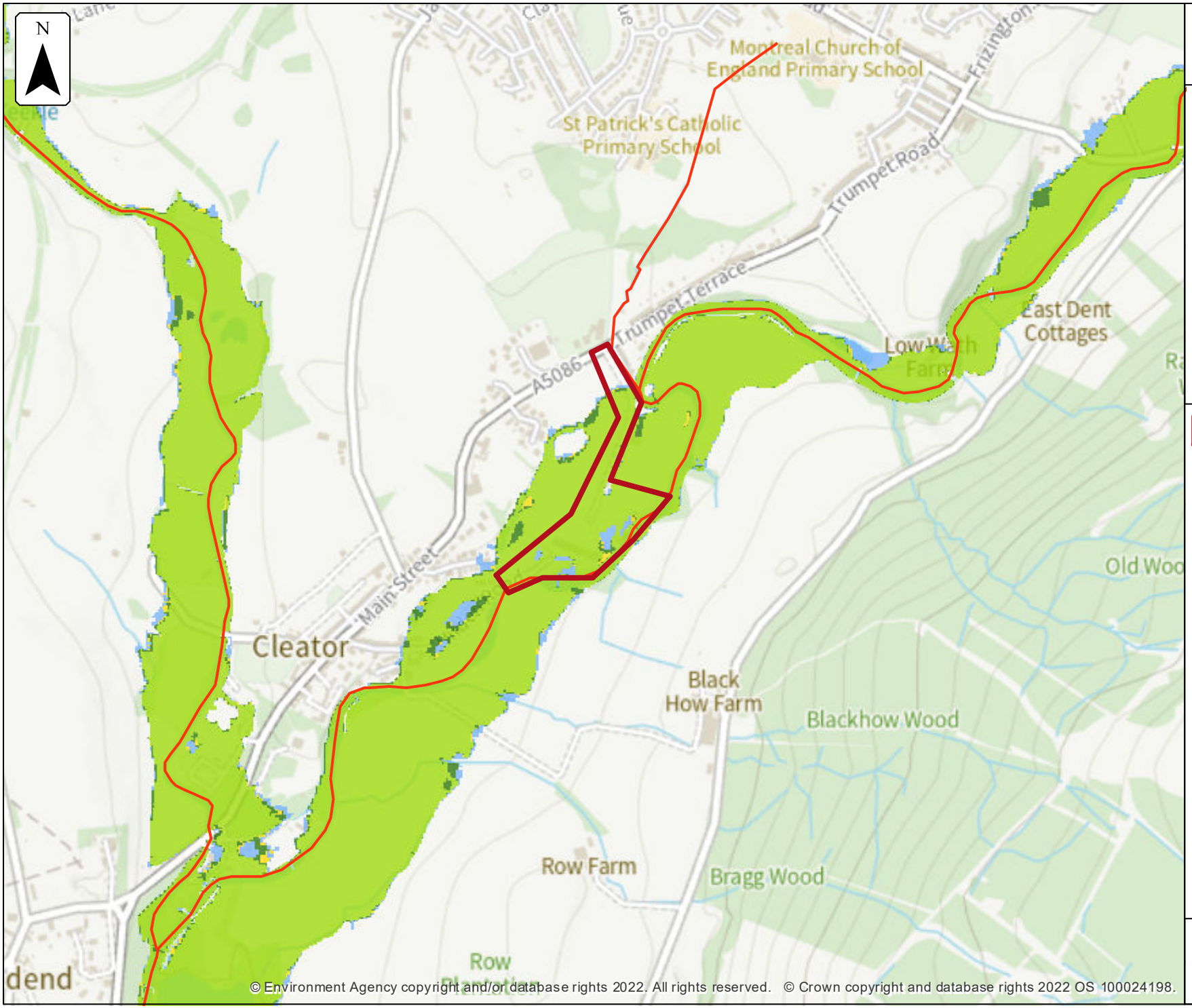
Sample point data

Defences removed

Label	Easting	Northing	5% AEP		2% AEP		1.33% AEP		1% AEP		0.5% AEP		0.1% AEP	
			Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height
1	301846	513587	0.33	58.23	0.43	58.34	0.47	58.39	0.49	58.41	0.55	58.47	0.75	58.67
2	301903	513587	0.26	58.57	0.32	58.63	0.36	58.67	0.38	58.70	0.44	58.75	0.60	58.92
3	302017	513587	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
4	301846	513644	NoData	NoData	NoData	NoData	0.04	58.65	0.06	58.68	0.13	58.76	0.41	59.04
5	301903	513644	NoData	NoData	0.03	58.70	0.07	58.75	0.12	58.79	0.19	58.87	0.38	59.06
6	301960	513644	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.01	59.42	0.02	59.44
7	302017	513644	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.08	59.89	0.21	60.02
8	302074	513644	2.26	59.65	2.40	59.79	2.50	59.89	2.55	59.94	2.65	60.04	2.99	60.38
9	301960	513701	NoData	NoData	0.10	59.97	0.16	60.03	0.19	60.06	0.26	60.13	0.41	60.28
10	302017	513701	0.05	60.19	0.06	60.21	0.07	60.22	0.07	60.22	0.10	60.26	0.35	60.52
11	302074	513701	NoData	NoData	NoData	NoData	NoData	NoData	0.01	60.70	0.01	60.70	0.04	60.76
12	302131	513701	NoData	NoData	NoData	NoData	0.08	60.38	0.13	60.44	0.23	60.56	0.67	61.00
13	302017	513758	NoData	NoData	0.03	60.44	0.08	60.49	0.11	60.52	0.15	60.57	0.25	60.66
14	302074	513758	NoData	NoData	NoData	NoData	0.03	60.86	0.03	60.87	0.04	60.88	0.11	60.96
15	302131	513758	0.21	60.94	0.25	60.98	0.28	61.01	0.29	61.03	0.33	61.07	0.51	61.24
16	302188	513758	0.34	60.40	0.52	60.58	0.64	60.70	0.70	60.76	0.83	60.89	1.22	61.28

Label	Easting	Northing	5% AEP		2% AEP		1.33% AEP		1% AEP		0.5% AEP		0.1% AEP	
			Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height
17	302017	513815	NoData	NoData	NoData	NoData	0.04	60.73	0.07	60.76	0.17	60.86	0.30	60.99
18	302074	513815	NoData	NoData	NoData	NoData	NoData	NoData	0.14	61.34	0.18	61.38	0.36	61.57
19	302074	513872	NoData	NoData	0.07	61.35	0.13	61.44	0.17	61.48	0.26	61.58	0.41	61.73
20	302074	513929	NoData	NoData	0.01	62.37	0.01	62.40	0.04	62.43	0.10	62.50	0.16	62.55
21	302131	513929	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.01	62.65	0.11	62.78
22	302074	513986	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
23	302131	513986	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	0.01	63.70	0.06	63.86
24	302017	514043	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
25	302074	514043	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData

Data in this table comes from the Ehen 2015 model.
Height values are shown in mAOD, and depth values are shown in metres.
Any blank cells show where a particular scenario has not been modelled for this location.
Cells which contain text 'NoData' for a scenario show that return period has been modelled but there is no flood risk for that return period for that location.



Environment Agency

Defences removed climate change modelled fluvial extent

Location (easting/northing)
302033/513757

Scale
1:10,000

Created
29 Nov 2022

Model name
Ehen 2015

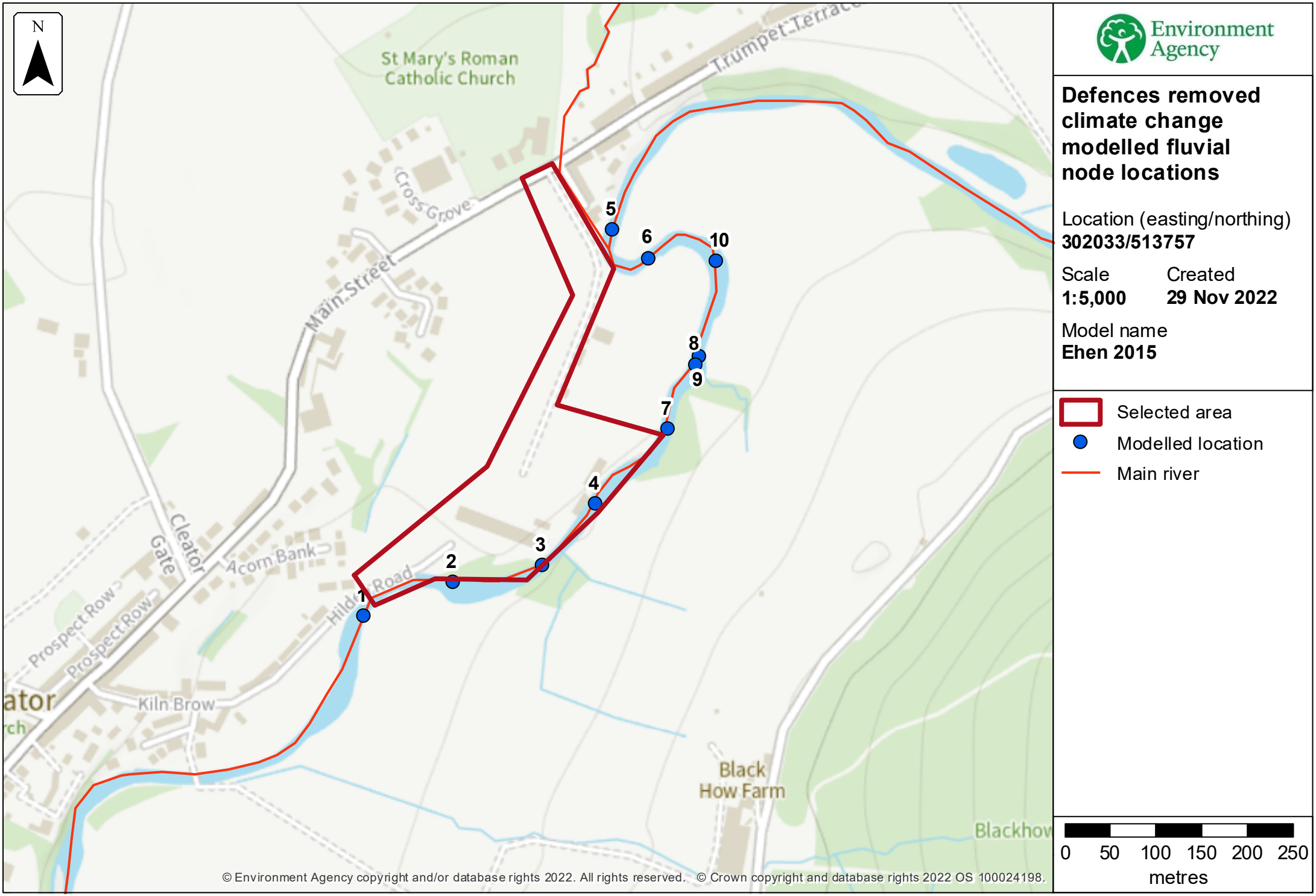
- Selected area
- Main river

Modelled flood extent

- 1.0% AEP (+20%)
- 1.0% AEP (+30%)
- 1.0% AEP (+35%)
- 1.0% AEP (+70%)

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

0 100 200 300 400 500
metres



Environment Agency

Defences removed climate change modelled fluvial node locations

Location (easting/northing)
302033/513757

Scale
1:5,000

Created
29 Nov 2022

Model name
Ehen 2015

Selected area
Modelled location
Main river

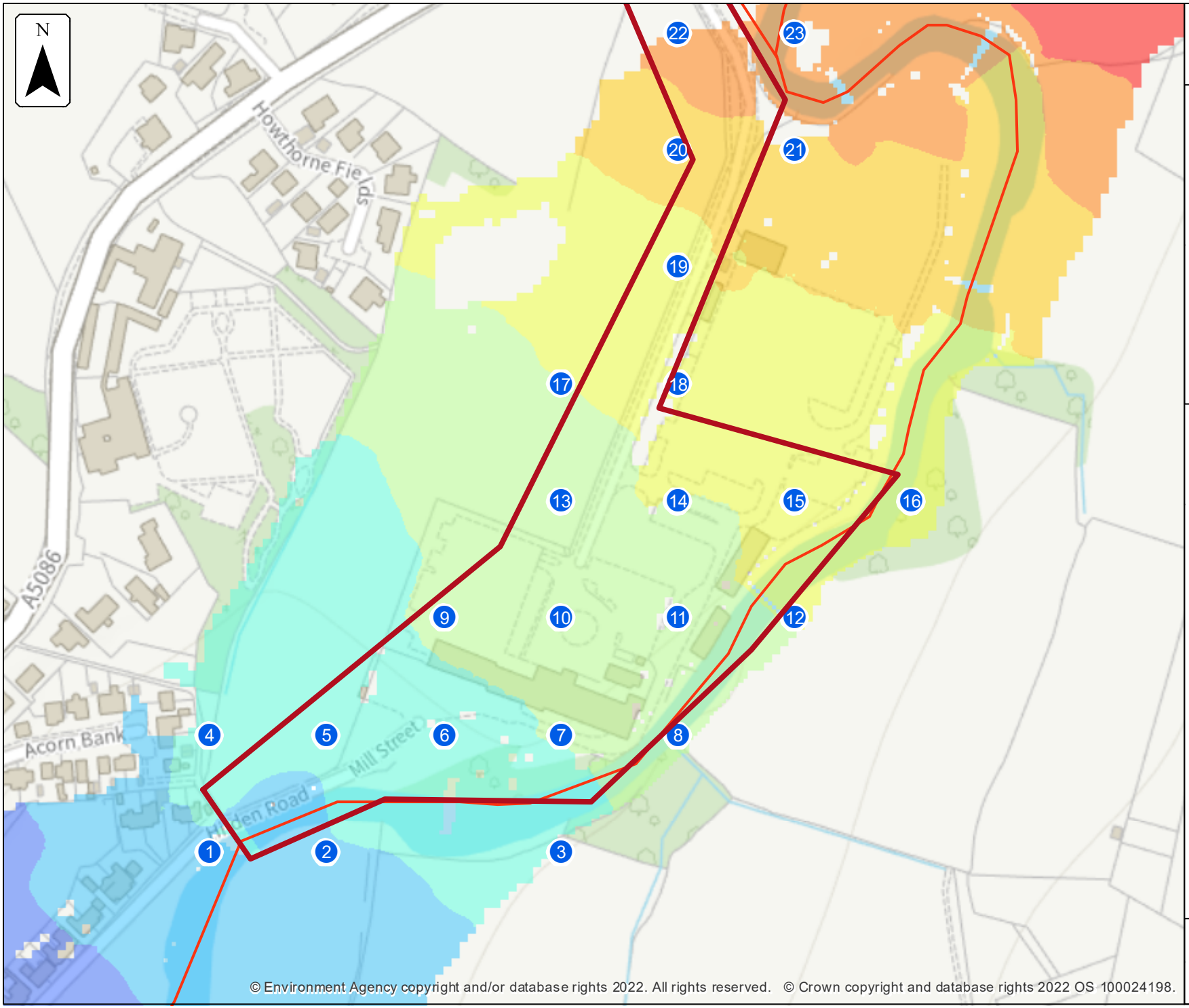
0 50 100 150 200 250
metres

Modelled node locations data

Defences removed climate change

Label	Modelled location ID	Easting	Northing	1.0% AEP (+20%)		1.0% AEP (+30%)		1.0% AEP (+35%)		1.0% AEP (+70%)	
				Level	Flow	Level	Flow	Level	Flow	Level	Flow
1	1204241	301853	513572	58.54	110.41	58.61	117.99	58.63	121.31	58.75	143.44
2	1204324	301951	513609	59.09	144.55	59.11	156.65	59.12	161.61	59.23	196.85
3	1204006	302049	513627	59.88	146.85	59.96	159.58	59.98	164.80	60.17	203.36
4	1204731	302107	513695	60.56	144.74	60.66	156.33	60.69	161.19	61.01	195.68
5	1204197	302126	513995	63.80	81.06	63.84	84.09	63.85	85.81	63.93	98.02
6	1203893	302165	513964	63.56	76.12	63.62	77.18	63.63	77.91	63.76	86.71
7	1204604	302187	513777	60.98	143.26	61.09	154.87	61.13	159.58	61.33	195.01
8	1204603	302218	513848	61.66	132.38	61.79	140.77	61.84	144.40	62.21	165.95
9	1204634	302221	513857	62.11	132.38	62.19	140.77	62.22	144.40	62.48	165.95
10	1204329	302239	513961	62.61	119.51	62.71	123.68	62.76	125.08	63.05	136.17

Data in this table comes from the Ehen 2015 model.
Level values are shown in mAOD, and flow values are shown in cubic metres per second.
Any blank cells show where a particular scenario has not been modelled for this location.



Environment Agency

Defences removed climate change modelled fluvial extent and height

Location (easting/northing)
302033/513757

Scale
1:2,500

Created
29 Nov 2022

Model name
Ehen 2015

Selected area

Main river

Modelled 2D grid
Water level in mAOD

- 0 - 57.0
- 57.0 - 58.0
- 58.0 - 59.0
- 59.0 - 60.0
- 60.0 - 61.0
- 61.0 - 62.0
- 62.0 - 63.0
- 63.0 - 64.0
- 64.0 - 65.0

This map shows the
1.0% AEP +70% height data

0 25 50 75 100
metres

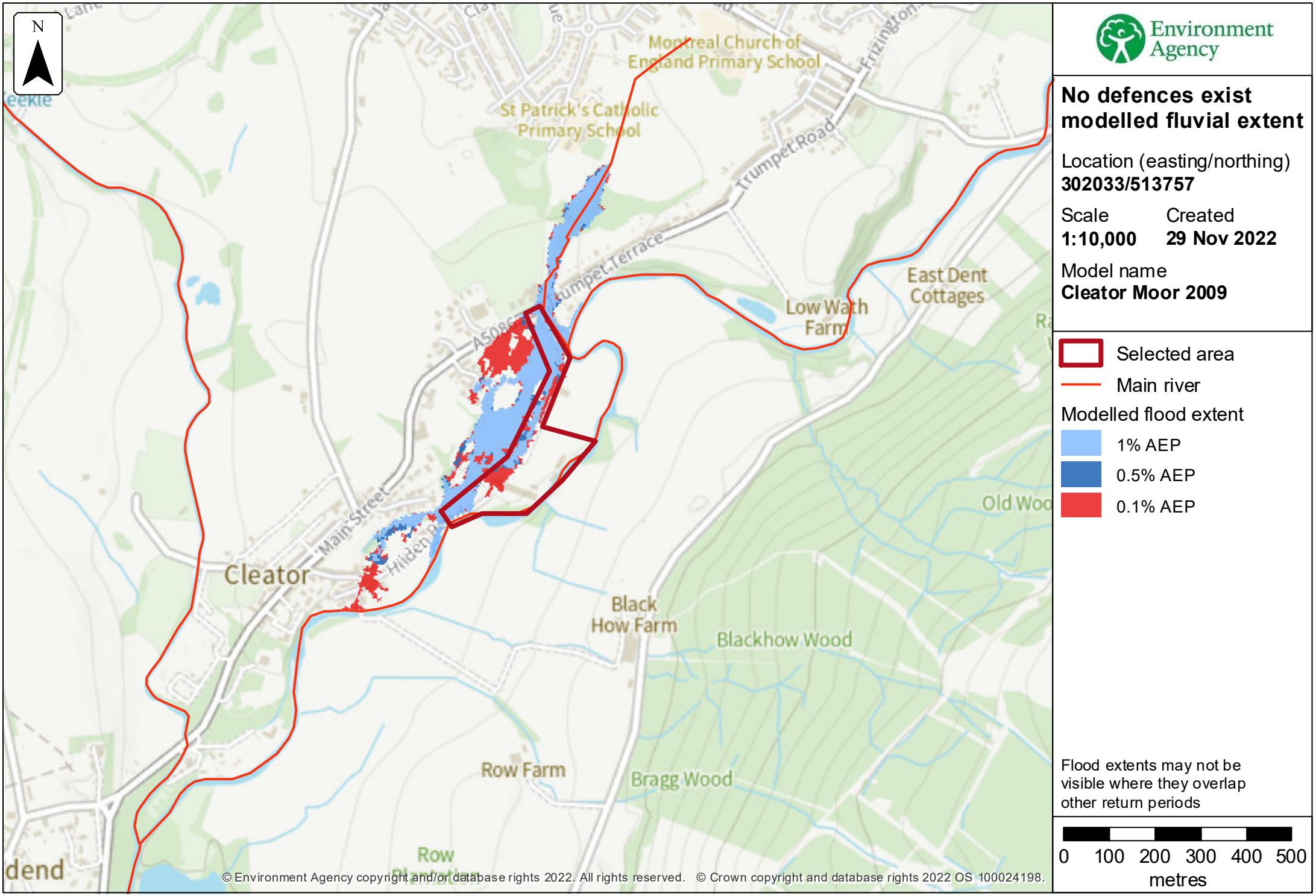
Sample point data

Defences removed climate change

Label	Easting	Northing	1% AEP (+20%)		1% AEP (+30%)		1% AEP (+35%)		1% AEP (+70%)	
			Depth	Height	Depth	Height	Depth	Height	Depth	Height
1	301846	513587	0.57	58.48	0.64	58.54	0.66	58.56	0.79	58.69
2	301903	513587	0.45	58.77	0.50	58.80	0.51	58.81	0.62	58.92
3	302017	513587	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
4	301846	513644	0.15	58.78	0.24	58.85	0.26	58.87	0.44	59.05
5	301903	513644	0.21	58.89	0.25	58.93	0.27	58.95	0.39	59.07
6	301960	513644	0.01	59.42	0.00	59.44	0.00	59.44	0.01	59.48
7	302017	513644	0.09	59.90	0.10	59.92	0.11	59.94	0.20	60.03
8	302074	513644	2.67	60.06	2.69	60.15	2.71	60.18	2.94	60.41
9	301960	513701	0.27	60.15	0.32	60.19	0.34	60.21	0.43	60.30
10	302017	513701	0.12	60.28	0.24	60.34	0.27	60.37	0.44	60.54
11	302074	513701	0.01	60.70	0.02	60.71	0.02	60.72	0.06	60.75
12	302131	513701	0.25	60.57	0.36	60.66	0.39	60.70	0.71	61.01
13	302017	513758	0.16	60.57	0.18	60.61	0.19	60.62	0.24	60.67
14	302074	513758	0.04	60.89	0.03	60.91	0.03	60.92	0.08	60.96
15	302131	513758	0.35	61.08	0.36	61.11	0.37	61.12	0.50	61.26
16	302188	513758	0.87	60.93	0.78	61.03	0.82	61.07	1.04	61.29

Label	Easting	Northing	1% AEP (+20%)		1% AEP (+30%)		1% AEP (+35%)		1% AEP (+70%)	
			Depth	Height	Depth	Height	Depth	Height	Depth	Height
17	302017	513815	0.18	60.88	0.23	60.91	0.25	60.93	0.30	60.99
18	302074	513815	0.20	61.41	0.33	61.46	0.34	61.48	0.46	61.59
19	302074	513872	0.28	61.59	0.41	61.65	0.42	61.66	0.50	61.74
20	302074	513929	0.11	62.51	0.18	62.53	0.19	62.54	0.21	62.56
21	302131	513929	0.01	62.66	0.05	62.69	0.06	62.70	0.14	62.78
22	302074	513986	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
23	302131	513986	0.01	63.71	0.42	63.76	0.43	63.77	0.53	63.87
24	302017	514043	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
25	302074	514043	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData

Data in this table comes from the Ehen 2015 model.
Height values are shown in mAOD, and depth values are shown in metres.
Any blank cells show where a particular scenario has not been modelled for this location.
Cells which contain text 'NoData' for a scenario show that return period has been modelled but there is no flood risk for that return period for that location.



Environment Agency

No defences exist modelled fluvial extent

Location (easting/northing)
302033/513757

Scale
1:10,000

Created
29 Nov 2022

Model name
Cleator Moor 2009

Selected area

Main river

Modelled flood extent

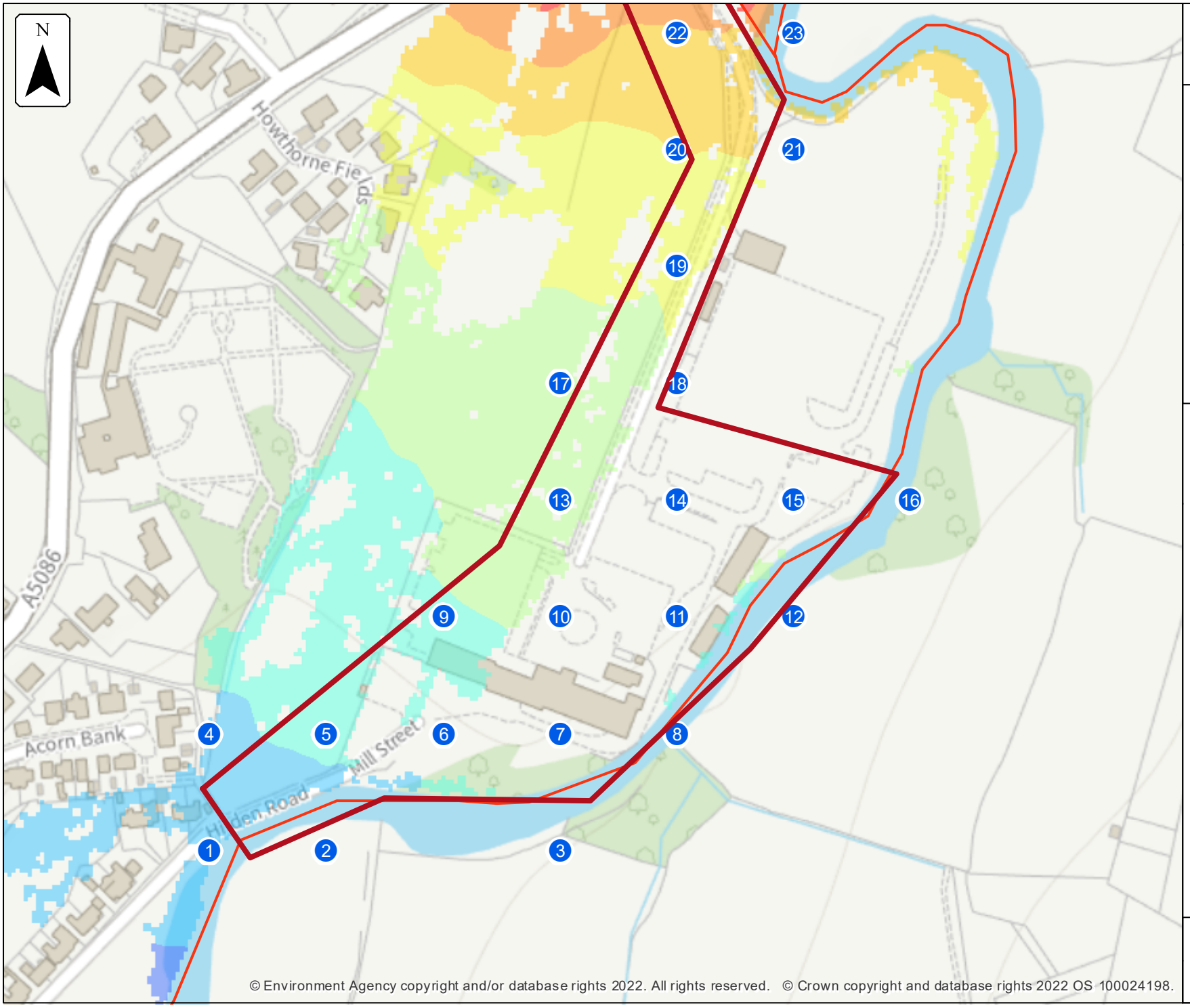
1% AEP

0.5% AEP

0.1% AEP

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

0 100 200 300 400 500
metres



Environment Agency

No defences exist modelled fluvial extent and height

Location (easting/northing)
302033/513757

Scale
1:2,500

Created
29 Nov 2022

Model name
Cleator Moor 2009

Selected area

Main river

Modelled 2D grid
Water level in mAOD

- 0 - 56.0
- 56.0 - 57.25
- 57.25 - 58.5
- 58.5 - 59.75
- 59.75 - 61.0
- 61.0 - 62.25
- 62.25 - 63.5
- 63.5 - 64.75
- 64.75 - 66.0

This map shows the 0.1% AEP height data

0 25 50 75 100
metres

Sample point data

No defences exist

Label	Easting	Northing	5% AEP		2% AEP		1.33% AEP		1% AEP		0.5% AEP		0.1% AEP	
			Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height
1	301846	513587							0.21	57.92	0.21	57.92	0.21	57.92
2	301903	513587							NoData	NoData	NoData	NoData	NoData	NoData
3	302017	513587							NoData	NoData	NoData	NoData	NoData	NoData
4	301846	513644							0.02	58.32	0.02	58.33	0.02	58.35
5	301903	513644							0.12	58.56	0.13	58.58	0.16	58.61
6	301960	513644							NoData	NoData	NoData	NoData	NoData	NoData
7	302017	513644							NoData	NoData	NoData	NoData	NoData	NoData
8	302074	513644							NoData	NoData	NoData	NoData	NoData	NoData
9	301960	513701							NoData	NoData	NoData	NoData	0.06	59.70
10	302017	513701							NoData	NoData	NoData	NoData	NoData	NoData
11	302074	513701							NoData	NoData	NoData	NoData	NoData	NoData
12	302131	513701							NoData	NoData	NoData	NoData	NoData	NoData
13	302017	513758							NoData	NoData	0.08	60.23	0.10	60.25
14	302074	513758							NoData	NoData	NoData	NoData	NoData	NoData
15	302131	513758							NoData	NoData	NoData	NoData	NoData	NoData
16	302188	513758							NoData	NoData	NoData	NoData	NoData	NoData

Label	Easting	Northing	5% AEP		2% AEP		1.33% AEP		1% AEP		0.5% AEP		0.1% AEP	
			Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height
17	302017	513815							0.11	60.57	0.11	60.58	0.13	60.59
18	302074	513815							NoData	NoData	NoData	NoData	NoData	NoData
19	302074	513872							0.07	61.11	0.08	61.12	0.11	61.16
20	302074	513929							0.04	62.26	0.04	62.27	0.05	62.28
21	302131	513929							NoData	NoData	NoData	NoData	NoData	NoData
22	302074	513986							0.15	63.34	0.16	63.35	0.19	63.38
23	302131	513986							NoData	NoData	NoData	NoData	NoData	NoData
24	302017	514043							NoData	NoData	NoData	NoData	NoData	NoData
25	302074	514043							NoData	NoData	NoData	NoData	NoData	NoData

Data in this table comes from the Cleator Moor 2009 model.
Height values are shown in mAOD, and depth values are shown in metres.
Any blank cells show where a particular scenario has not been modelled for this location.
Cells which contain text 'NoData' for a scenario show that return period has been modelled but there is no flood risk for that return period for that location.

Strategic flood risk assessments

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

This should give you information about:

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

About this data

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

Flood risk activity permits

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

Find out more about flood risk activity permits

Help and advice

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

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

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	0.643	Urban	0.000
SAAR (mm)	1145	Region Number	Region 10

Results l/s

QBAR Rural	5.0
QBAR Urban	5.0
Q100 years	10.4
Q1 year	4.4
Q30 years	8.5
Q100 years	10.4

Summary of Results for 100 year Return Period (+50%)

Half Drain Time : 6 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m^3)	Status
15 min Summer	9.908	0.308	119.9	60.1	Flood Risk
30 min Summer	9.947	0.347	119.9	67.5	Flood Risk
60 min Summer	9.914	0.314	119.9	61.1	Flood Risk
120 min Summer	9.782	0.182	119.9	35.4	Flood Risk
180 min Summer	9.684	0.084	119.9	16.5	O K
240 min Summer	9.648	0.048	115.7	9.3	O K
360 min Summer	9.637	0.037	89.3	7.2	O K
480 min Summer	9.631	0.031	73.8	5.9	O K
600 min Summer	9.626	0.026	63.0	5.1	O K
720 min Summer	9.623	0.023	55.8	4.5	O K
960 min Summer	9.619	0.019	45.0	3.7	O K
1440 min Summer	9.614	0.014	34.2	2.7	O K
2160 min Summer	9.611	0.011	25.8	2.1	O K
2880 min Summer	9.609	0.009	21.0	1.7	O K
4320 min Summer	9.607	0.007	16.2	1.3	O K
5760 min Summer	9.606	0.006	13.8	1.2	O K
7200 min Summer	9.605	0.005	11.4	1.0	O K
8640 min Summer	9.604	0.004	10.2	0.9	O K
10080 min Summer	9.604	0.004	9.0	0.8	O K
15 min Winter	9.957	0.357	119.9	69.4	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m^3)	Time-Peak (mins)
15 min Summer	111.474	0.0	13
30 min Summer	79.335	0.0	21
60 min Summer	54.122	0.0	38
120 min Summer	35.605	0.0	68
180 min Summer	27.329	0.0	96
240 min Summer	22.429	0.0	124
360 min Summer	16.991	0.0	184
480 min Summer	13.921	0.0	242
600 min Summer	11.911	0.0	302
720 min Summer	10.478	0.0	362
960 min Summer	8.546	0.0	478
1440 min Summer	6.392	0.0	712
2160 min Summer	4.764	0.0	1088
2880 min Summer	3.858	0.0	1416
4320 min Summer	2.876	0.0	2160
5760 min Summer	2.336	0.0	2872
7200 min Summer	1.989	0.0	3664
8640 min Summer	1.747	0.0	4280
10080 min Summer	1.566	0.0	5088
15 min Winter	111.474	0.0	14

Summary of Results for 100 year Return Period (+50%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	9.980	0.380	119.9	74.0	Flood Risk
60 min Winter	9.891	0.291	119.9	56.7	Flood Risk
120 min Winter	9.685	0.085	119.9	16.6	O K
180 min Winter	9.643	0.043	103.7	8.4	O K
240 min Winter	9.636	0.036	85.7	6.9	O K
360 min Winter	9.627	0.027	65.4	5.3	O K
480 min Winter	9.622	0.022	53.4	4.3	O K
600 min Winter	9.619	0.019	46.2	3.7	O K
720 min Winter	9.617	0.017	40.2	3.3	O K
960 min Winter	9.614	0.014	33.0	2.7	O K
1440 min Winter	9.610	0.010	24.6	2.0	O K
2160 min Winter	9.608	0.008	18.6	1.5	O K
2880 min Winter	9.606	0.006	15.0	1.3	O K
4320 min Winter	9.605	0.005	11.4	0.9	O K
5760 min Winter	9.604	0.004	10.2	0.9	O K
7200 min Winter	9.604	0.004	9.0	0.8	O K
8640 min Winter	9.603	0.003	7.8	0.7	O K
10080 min Winter	9.603	0.003	6.6	0.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
30 min Winter	79.335	0.0	23
60 min Winter	54.122	0.0	40
120 min Winter	35.605	0.0	68
180 min Winter	27.329	0.0	94
240 min Winter	22.429	0.0	122
360 min Winter	16.991	0.0	184
480 min Winter	13.921	0.0	244
600 min Winter	11.911	0.0	302
720 min Winter	10.478	0.0	360
960 min Winter	8.546	0.0	476
1440 min Winter	6.392	0.0	726
2160 min Winter	4.764	0.0	1084
2880 min Winter	3.858	0.0	1436
4320 min Winter	2.876	0.0	2356
5760 min Winter	2.336	0.0	2896
7200 min Winter	1.989	0.0	3624
8640 min Winter	1.747	0.0	3992
10080 min Winter	1.566	0.0	4832

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	17.900	Shortest Storm (mins)	15
Ratio R	0.253	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+50

Time Area Diagram

Total Area (ha) 0.643

Time (mins) From:	To:	Area (ha)
0	4	0.643

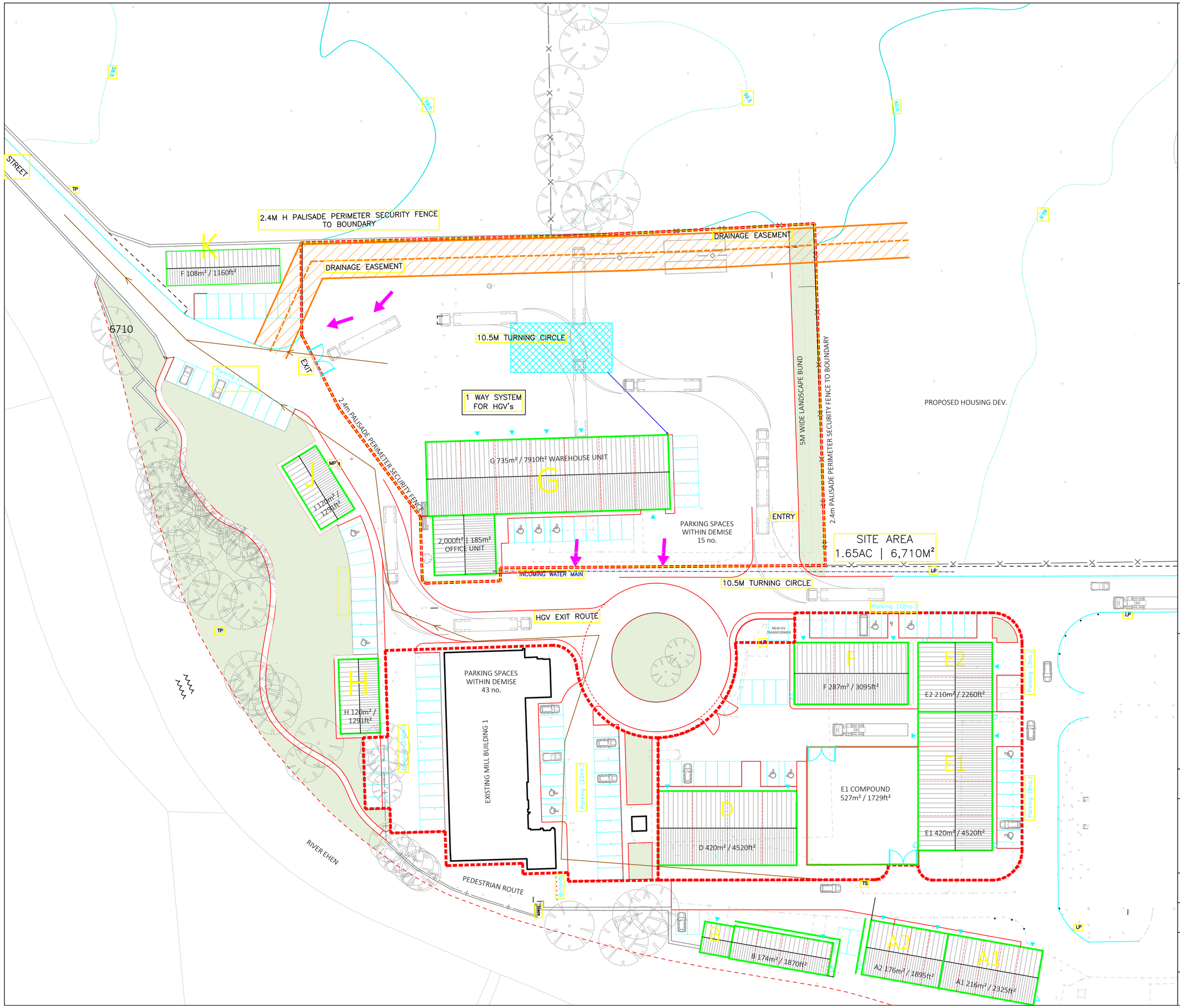
Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 9.600 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 4.21200 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	205.0	205.0	0.400	205.0	205.0



Notes:

1. Discharge of surface water via a cellular storage soakaway. Preliminary calculations indicate that sufficient storage required to attenuate runoff arising from the proposed increase in impermeable areas, during the critical 1 in 100 year + 50% Climate Change event, can be provided within cellular storage soakaway of dimensions 205m² x 0.4m deep x 0.95 (voids).

Legend

- Proposed Cellular Storage Soakaway
- Proposed Surface Water Pipework
- Proposed Surface Water Downpipe
- Design Exceedance Route

Unda Consulting Ltd
Southpoint
Old Brighton Road
Gatwick
RH11 0PR

Tel: 01293 214444
Email: info@unda.co.uk
Web: www.unda.co.uk

Client:
Cleator Mills Business Park Limited

Site Address:
Cleator Mills
Cleator
Whitehaven
CA23 3DJ

Job Reference:	Date:
92276-ManningElliott-CleatorMills	20-Dec-22
Drawing Number:	**Revision:**
92276-01	v1

Designed by:	Drawn by:	Checked by:
AR	AR	EB

Scale:	Disclaimer:
1:500@A2	The drawings provided are for planning purposes only.

Unit 1

Cleator Mills

Cleator

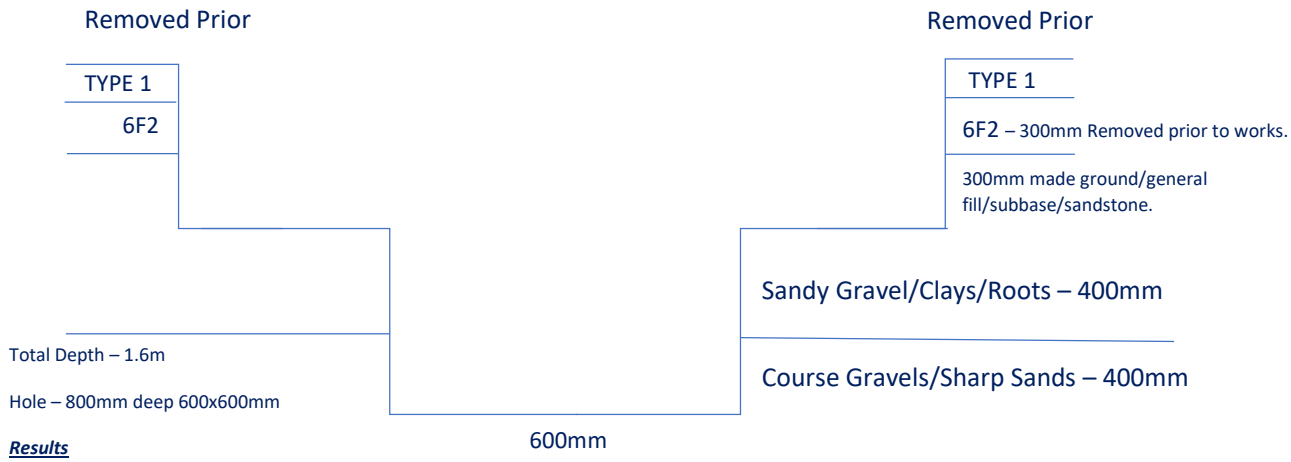
Whitehaven

Cumbria

CA23 3DX

Cleator Mills Percolation Test – FAO Mark Walker

Trail Pit 1



Total Depth – 1.6m

Hole – 800mm deep 600x600mm

Results

Test 1 Friday 2nd December 2022 @ 14.00hrs;

- 100% Drain time = 3m40s
- 75% Drain to 25% = 2m20s

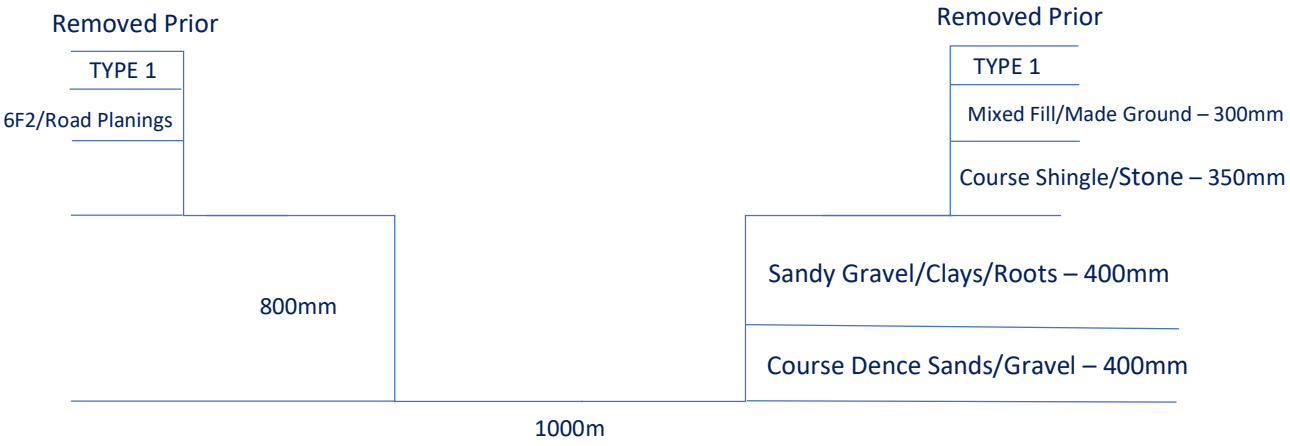
Test 2 Saturday 3rd December 2022 @ 14.00hrs;

- 100% Drain Time = 3m50s
- 75% Drain to 25% = 2m00s

Test 3 Sunday 4th December 2022 @ 14.00hrs,

- 100% Drain Time = 4m15s
- 75% Drain to 25% = 1m50s

Trail Pit 2



Results

Test 1 Friday 2nd December 2022 @ 15.00hrs;

- 100% Drain Time = 3m12s
- 75% Drain to 25% = 1m40s

Test 2 Saturday 3rd December 2022 @ 15.00hrs;

- 100% Drain Time = 3m20s
- 75% Drain to 25% = 1m45s

Test 3 Sunday 4th December 2022 @ 15.00hrs;

- 100% Drain Time = 3m15s
- 75% Drain to 25% = 1m50s