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Flood Risk Assessment

Proposed Vehicle Body Workshop
Millom Road, Millom

W Milligan and Sons Ltd

Ref: K39647.FRA/001

Version	Date	Prepared By	Checked By	Approved By
Original	2nd November 2022	E. Henderson	T. Melhuish	O. Sugden

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GLOSSARY OF TERMS

AEP	Annual Exceedance Probability
AOD	Above Ordnance Datum
BGL	Below Ground Level
BGS	British Geological Society
CC	Climate Change
CCC	Cumbria County Council
DSM	Digital Surface Model
DTM	Digital Terrain Model
EA	Environment Agency
FFL	Finished Floor Level
FRA	Flood Risk Assessment
GIS	Geographical Information System
LLFA	Lead Local Flood Authority
NPPF	National Planning Policy Framework
OS	Ordnance Survey
RGP	RG Parkins & Partners Ltd
SFRA	Strategic Flood Risk Assessment

1. INTRODUCTION

1.1 BACKGROUND

This report has been prepared by R. G. Parkins & Partners Ltd (RGP) for W Milligan and Sons Ltd in support of their proposal to construct a new motor body repair works on Millom Road in Millom, Cumbria.

RGP has been appointed to undertake a Flood Risk Assessment in accordance with the National Planning Policy Framework (NPPF) to support a planning application that fulfils the requirements of the Local Planning Authority, the Lead Local Flood Authority and the Environment Agency.

The following study assesses flood risk to the proposed development and demonstrates the proposed development will not adversely affect flood risk elsewhere.

1.2 PLANNING POLICY

The NPPF[1] and its Planning Practice Guidance[2] states '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 the future; or land that may be subject to other sources of flooding, where its development would introduce a more vulnerable use'.

1.3 THE DEVELOPMENT IN THE CONTEXT OF PLANNING POLICY

The area covered by the application is 0.354 ha (hectares) and by reference to the Environment Agency Flood Map, the site lies in Flood Zone 3.

Owing to the size of the development, it is classed as minor development (less than 1 ha) in accordance with The Town and Country Planning Order 2015[3].

Table 2 of the NPPF's Planning Practice Guidance[2] classifies each development into a vulnerability class, depending on the type of development, as outlined in Table 1.1. The site is to be developed for a motor body works (i.e. 'general industry') and is therefore classified as 'less vulnerable'. 'Less Vulnerable' development classes are deemed acceptable in terms of flood risk within Flood Zones 1, 2 and 3a but are not generally considered acceptable within Flood Zone 3b. Flood zones 3a and 3b are subdivisions of Flood Zone 3.

Table 1.1 Vulnerability classification

Vulnerability Classification	Development
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 operation during flooding. Emergency dispersal points. Basement dwellings. Caravans, mobile homes, and park homes intended for permanent residential use. Installations requiring hazardous substances consent.
More Vulnerable	Hospitals. Residential institutions such as residential care homes, children's 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 education 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 distributions; non-residential institutions not included in the 'more vulnerable' class; and assemble and leisure. Land and buildings used for agriculture and forestry. Waste treatment (except landfill & hazardous waste facilities). Minerals working & processing (except for sand & 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 & pumping stations. Sewage transmission infrastructure & pumping stations. Sand & gravel working. Docks, marinas, and wharves. Navigation facilities. Ministry of Defence installations. Ship building, repairing & dismantling, dockside fish processing & refrigeration & compatible activities requiring a waterside location. Water based recreation (excluding sleeping accommodation). Lifeguard and coastguard stations. Amenity open space, nature conservation & 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 & evacuation plan.

2. SITE CHARACTERISATION

2.1 SITE LOCATION

The site is located off Millom Road in Millom (see Figure 2.1) at National Grid Reference SD 17772 80279.

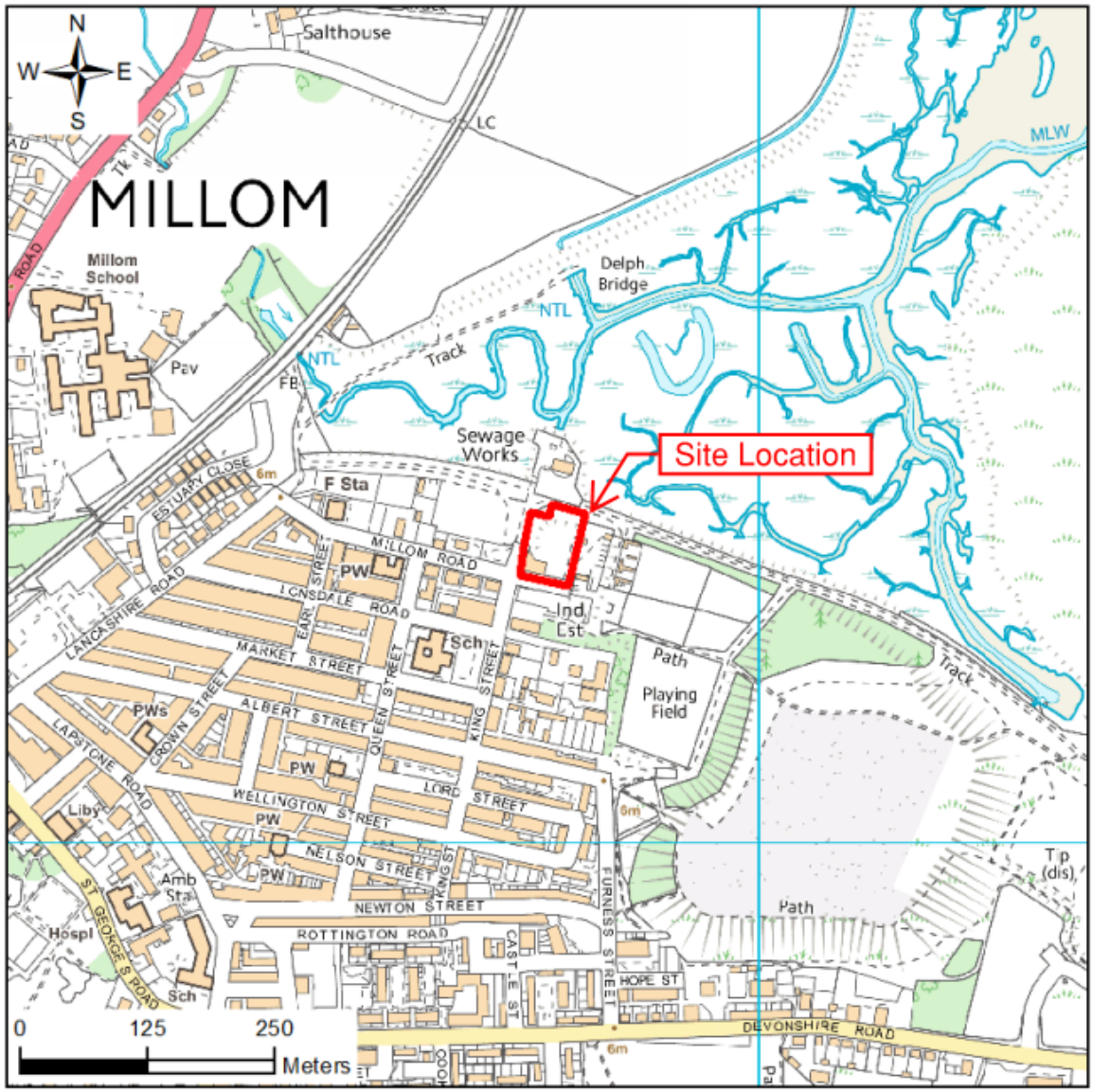


Figure 2.1 Site location

2.2 SITE DESCRIPTION

The site is currently partly occupied by the existing W Milligan and Sons Ltd garage with the remainder of the site being used for vehicle parking. The site is bounded to the north by a raised embankment, to the west by scrubland, to the south by the Millom urban area and to the east by further vehicle parking. The raised embankment is an old railway line that separates this part of Millom from the coastal salt marshes to the north. This embankment which is approximately 2.5-3.0 m higher than the site acts as a de-facto defence against coastal flooding although it is not

classified as an Environment Agency asset. It is not clear at this stage who owns or maintains this embankment as a flood defence.

Figure 2.2 shows the site topography identified from LiDAR. This shows that most of the site is relatively flat at an elevation of around 5.0 mAOD but the northern end of the site is higher at around 6.5 to 7.5 mAOD.

The site is accessed through Millom via either Millom Road or King Street.

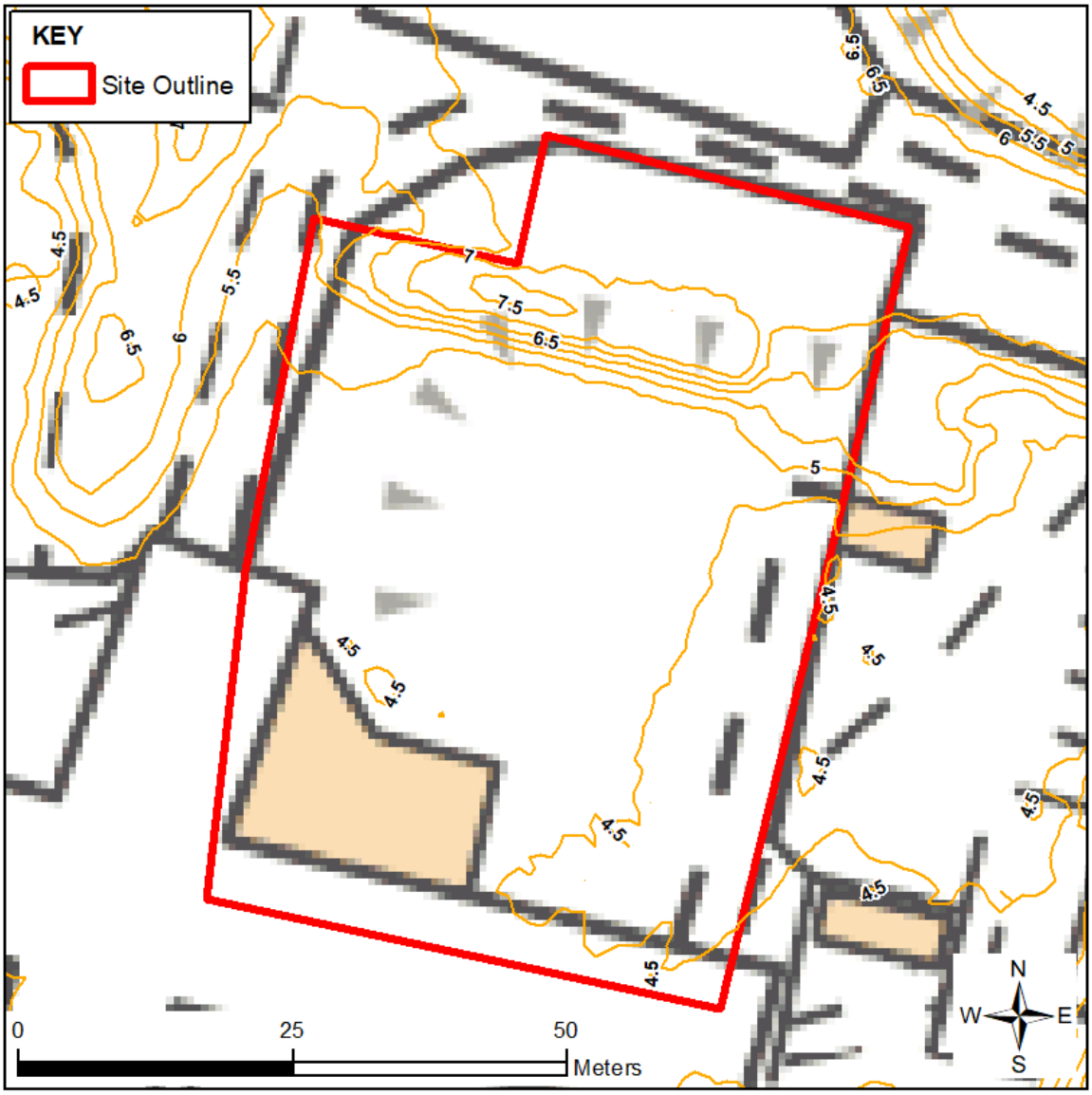


Figure 2.2 Site topography

2.3 GEOLOGY & HYDROGEOLOGY

British Geological Survey (BGS)[4] and Land Information Systems (LandIS)[5] mapping indicates the site is underlain by the geological sequences outlined in Table 2.1.

Table 2.1 Site geological summary

Geological Unit	Classification	Description	Aquifer Classification
Soil	Soilscape 21	Loamy and clayey soils of coastal flats with naturally high groundwater	N/A
Drift	Raised Marine Deposits	Sand and gravel	Summary: Secondary Undifferentiated
Solid	Low Furness Basal Formation	Conglomerate And Sandstone, Interbedded	Summary: Secondary A

Although the above soil conditions are recorded on desktop data, it is probable that at this location the underlying ground is comprised of fill owing to its industrial history. The site was formerly part of the Millom Town Gasworks from the late 1800s to the mid' 1900s.

2.4 HYDROLOGY

The hydrology of the site has three components which are (i) rainfall runoff from the site; (ii) rainfall infiltration into the soils on the site and (iii) the proximity of the sea at high tide when it covers part or all of the Millom saltmarsh. The relative low elevation of the site relative to Millom saltmarsh will also mean that groundwater levels in the site are likely to be close to the surface.

2.5 EXISTING SEWERS

There are public sewers on all sides of the site except the north side. There is a United Utilities plc sewage works to the north of the site.

3. ASSESSMENT OF FLOOD RISK

3.1 BACKGROUND

The following risk assessment has been carried out in accordance with the National Planning Policy Framework[1] and its Planning Practice Guidance[2] on Flood Risk. The broad aim of the guidance is to reduce the number of people and properties within the natural and built environment at risk of flooding. To achieve this aim, planning authorities are required to ensure that flood risk is properly assessed during the initial planning stages.

Responsibility for this assessment lies with the developers and they must demonstrate:

- Whether the proposed development is likely to be affected by flooding.
- Whether the proposed development will increase flood risk in other parts of the hydrological catchment.
- That the measures proposed to deal with any flood risk are sustainable.

The developer must prove to the Local Planning Authority and the Environment Agency that the existing flood risk or the flood risk associated with the proposed development can be satisfactorily managed.

3.2 FLOOD RISK TERMINOLOGY

Flood risk considers both the probability and consequence of flooding.

Flood events are often described in terms of their probability of recurrence or probability of occurring in any one year. The threshold between a medium flood and a large flood is often regarded as the 1 in 100-year event. This is an event which statistical analysis suggests will occur on average once every hundred years. However, this does not mean that such an event will not occur more than once every hundred years. Table 3.1 shows the event return periods expressed in years and annual exceedance probabilities as a fraction and a percentage.

For example, a 1 in 100-year event has a 1% probability of occurring in any one year, i.e. a 1 in 100 probability. A 1000-year event has a 0.1% probability of occurring in any one year, i.e. a 1 in 1000 probability.

Table 3.1 Flood return periods & exceedance probabilities

Return Period (years)	Annual Exceedance Probability (AEP)	
	Fraction	Percentage
2	0.5	50%
10	0.1	10%
25	0.04	4%
50	0.02	2%
100	0.01	1%
200	0.005	0.5%
500	0.002	0.2%
1000	0.001	0.1%

3.3 DATA COLLECTION

The following information was referred to for the Flood Risk Assessment:

- Environment Agency Flood Map for Planning.
- Environment Agency Surface Water Flood Risk Map.
- Environment Agency Reservoir Flood Risk Map.
- Environment Agency Historic Flood Map.
- Environment Agency flood model output.
- SLDC Strategic Flood Risk Assessment.
- Topographic survey.

3.4 STRATEGIC FLOOD RISK ASSESSMENT

In August 2017, Copeland Borough Council published a Strategic Flood Risk Assessment (SFRA)[6] This provides flood risk maps for several towns and villages across the Copeland Borough area. An extract from the flood risk map in the vicinity of the site is shown in Figure 3.1, this shows that the site was not considered to be at risk of tidal flooding in 2017. The following paragraphs are from the CBC SFRA:

'Millom is situated on the Duddon Estuary at an elevation of approximately 7 mAOD. Parts of the town and much of the periphery are located within Zone 3a High Probability. Defences are present, however the EA has suggested that these defences are not up to standard. Most of the defences consist of earth embankments. Coastal erosion is threatening the railway embankment which acts as a defence to some parts of Millom'.

'At Salthouse Bridge, flooding has been known to occur as a result of failure of the floodgates. At two locations within Zone 1 Low Probability there have been reports of flooding, these are Buttermere Drive and Millom Fire Station. There have been reports of flooding on Devonshire Road which is partially located within the higher risk flood zones'.

'The only formal raised defences within the Borough of Copeland are at Haverigg and Millom, providing protection against tidal flooding. Flood defences are typically raised structures that alter natural flow patterns and prevent floodwater from entering property in times of flooding'.

'There is always a residual risk that these defences may fail, as a result of either overtopping and/or breach failure. The latter could result in rapid inundation into overbank areas behind the defence, posing a potential risk to residents, pedestrians and property that may be in the path of the floodwaters'.

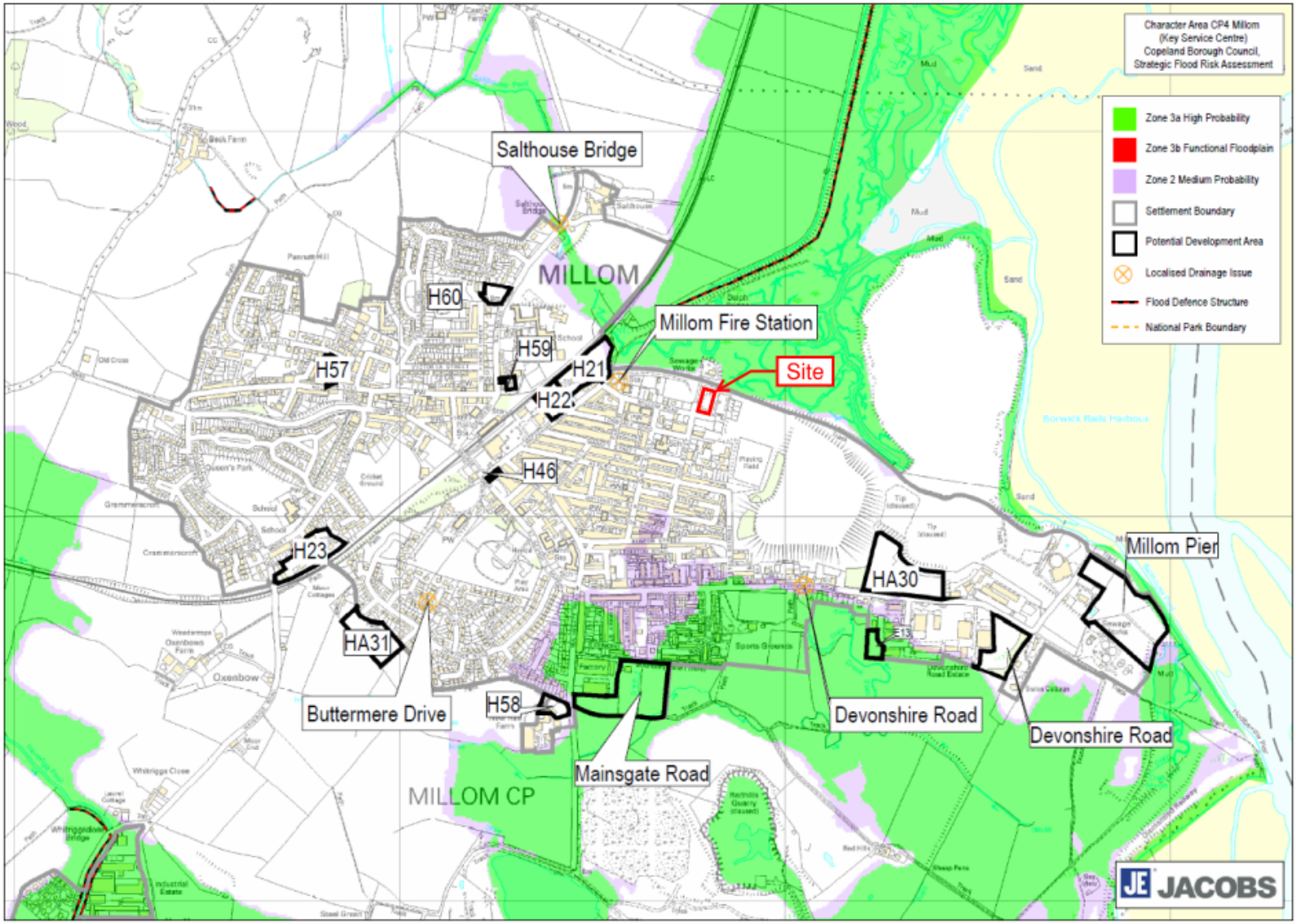


Figure 3.1 CBC strategic flood risk assessment map[6].

'A qualitative assessment of the potential risk to life within defended areas was undertaken. The raised defences at Millom typically exceed 1 m in height. Given that this is the case, should (in a worst-case scenario) a catastrophic structural failure of the raised defences occur during high tide levels, then a wave of flood water will rapidly inundate the area immediately behind the location of the breach. This may pose a risk to life to those who happen to be standing immediately behind the defence at the time of failure. Following the initial 'burst' of water through the defences the flood water has the potential to remain for a long duration and this also poses a risk to life'.

'The structural integrity of the existing flood defences is absolutely integral to the sustainability of both existing and future development in both Haverigg and Millom. Without the raised defences, the severity and frequency of flooding in these areas will increase. It is essential that the detailed site-based Flood Risk Assessment for all potential future development in defended areas of the Borough considers both the likelihood and consequence of defence failure in the vicinity of the site'.

Since 2017, the understanding of flood mechanisms and risks in Millom has developed, and the EA has carried out new modelling to define flood risks. The SFRA maps are therefore regarded as superseded by new EA Flood Map for Planning.

3.5 ENVIRONMENT AGENCY FLOOD MAP FOR PLANNING

Figure 3.2 is an extract from the EA's Flood Map for Planning[7] This map identifies the extent of Flood Zones 2 and 3. Flood Zone 3 (darker blue) is the area that could be affected by flooding up to and including a river flow rate with an annual exceedance probability of 1% or an area that could be affected by flooding from the sea with an annual exceedance probability of 0.5%. Flood Zone 2 (lighter blue) is the area that would be affected by more extreme events with an AEP of 0.1%. Areas which are not coloured are Flood Zone 1, i.e. areas where flooding is highly unlikely. The Flood Map for Planning shows that the site is located within Flood Zone 3. The area in which the site is located is protected against small to medium floods by a flood defence embankment. However, if these defences were overtopped by a large flood event or the defences failed structurally, the site and much of Millom would be flooded.

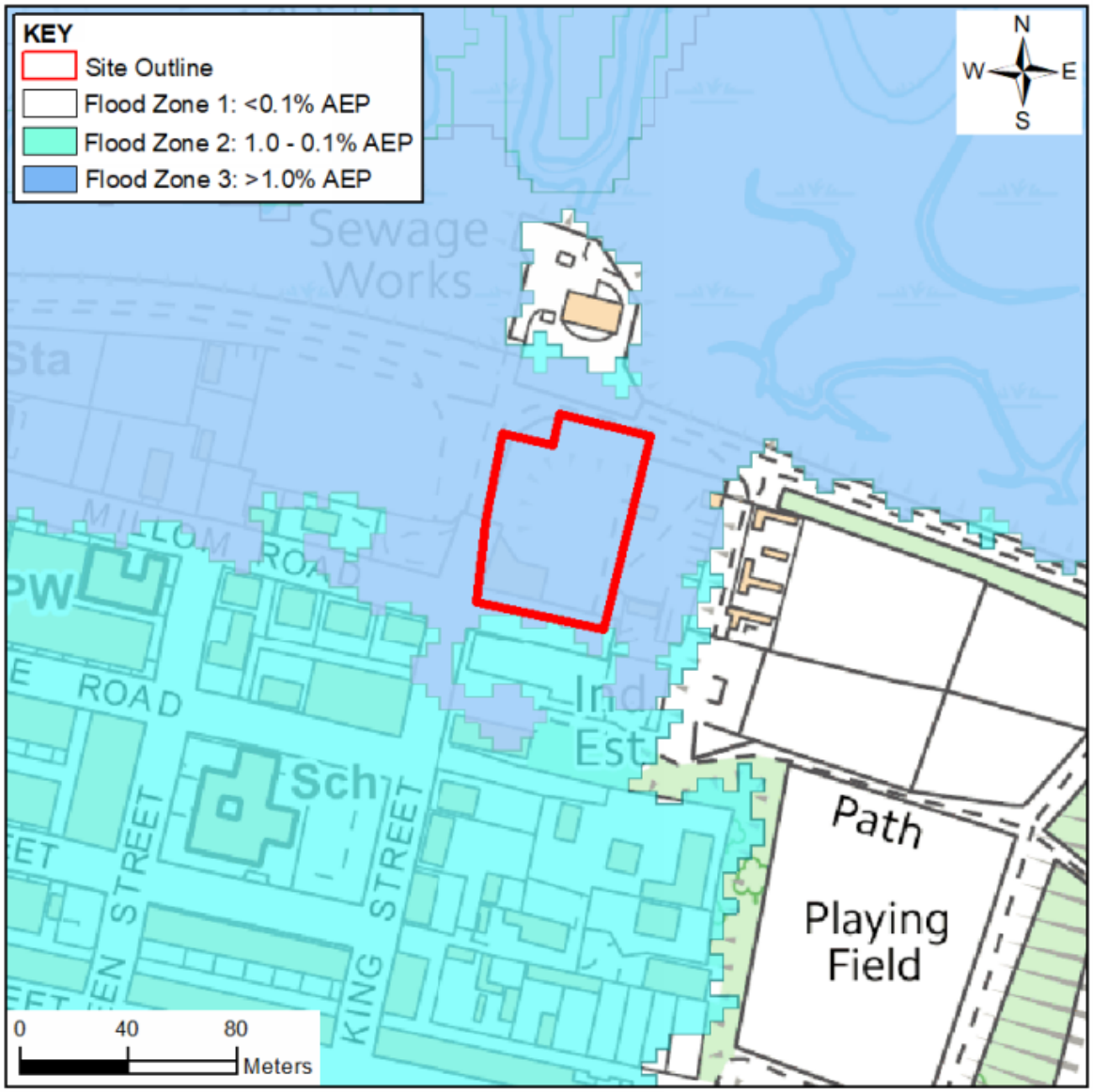


Figure 3.2 Environment Agency flood map for planning.

3.6 TIDAL FLOOD RISK – ENVIRONMENT AGENCY MODELLING

The EA Flood Map for Planning indicates the site is at risk of flooding from the sea. Tidal flooding would most likely occur due to a combination of spring tides with a tidal surge caused by a low-pressure weather system.

The town of Millom is however partially protected against tidal flooding by a railway ballast embankment which forms a de-facto flood defence. Modelling undertaken by JBA Consulting[8] on behalf of the Environment Agency was completed in 2013. Figure 3.3 shows the model-predicted extents of a 0.5% AEP flood and a climate change influenced 0.5% AEP flood taking the current flood defences into account. Figure 3.4 shows the equivalent map but not taking the defences into account. These figures indicate that if the defences are maintained to their current condition, the site is not at risk of flooding for tidal events up to and including the 0.5% AEP event. However, events larger than the 0.5% AEP event would overtop the embankment. In addition, climate change will also cause future 0.5% AEP events to overtop the embankment.

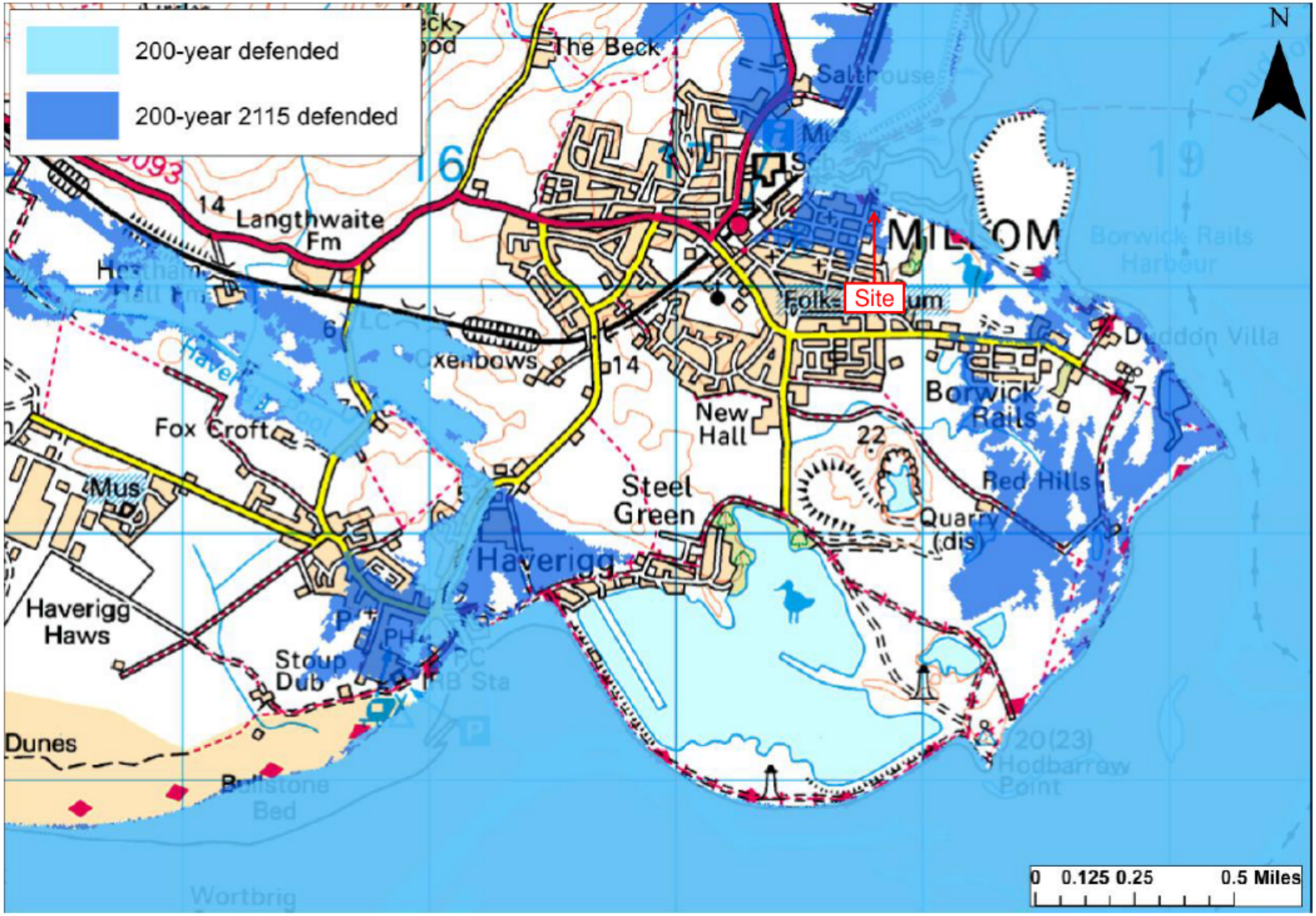


Figure 3.3 Defended 0.5% AEP flood and defended climate change 0.5% AEP flood map[8]

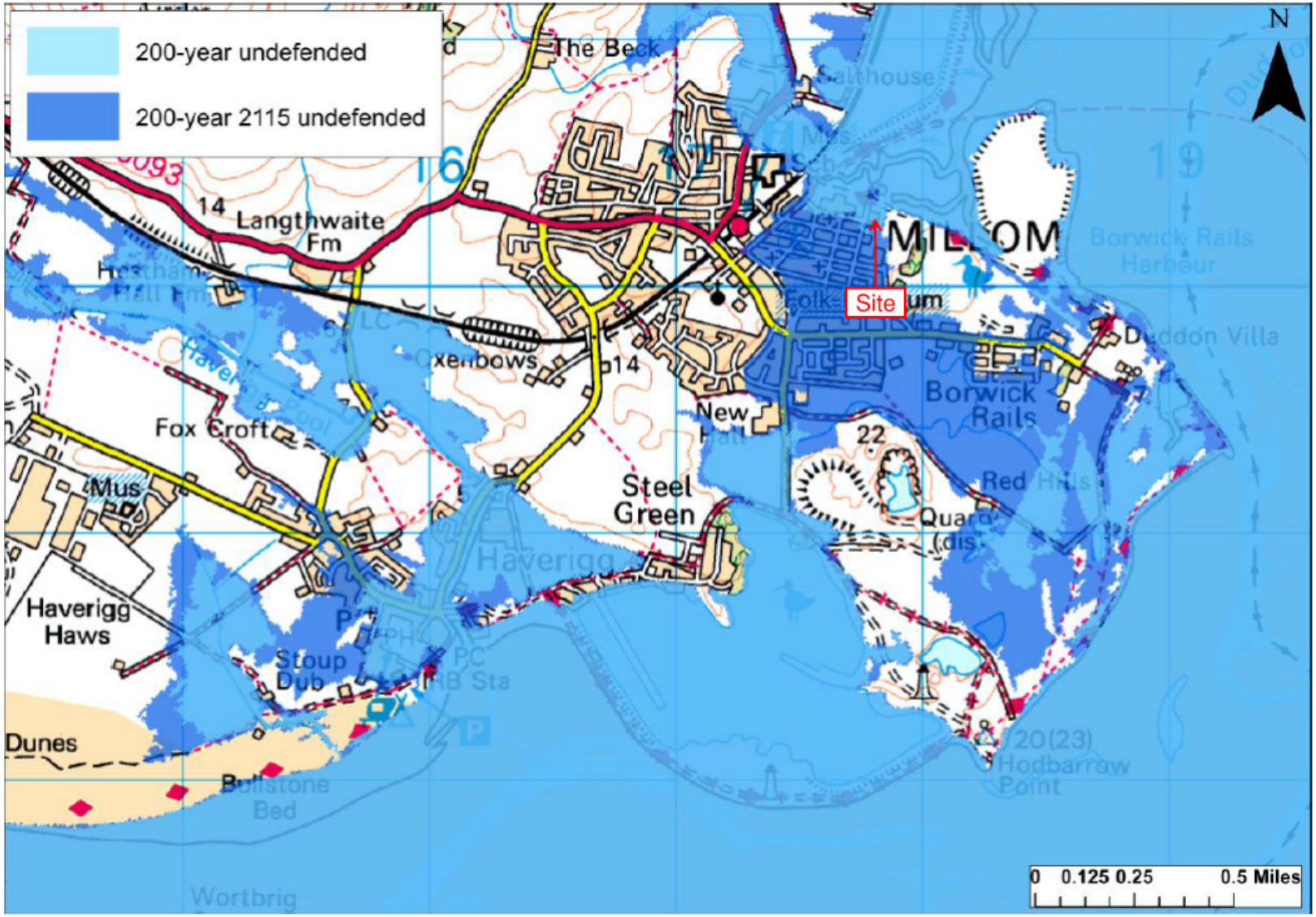


Figure 3.4 Undefended 0.5% AEP flood and undefended climate change 0.5% AEP flood map[8]

The JBA report also highlighted that in Millom there is a large difference between Flood Zone 2 and 3. In Flood Zone 3, there are also some buildings flooded along Millom Road. In Flood Zone 2, there is far more inundation of residential properties in Millom from Millom Road southwards to Nelson Street, more residential and industrial property is also inundated along Oxford Street and Devonshire Road in the southern part of Millom. Flood depths on Millom Road reach 0.2 m and 1 m in the 200-year and 1,000-year scenarios respectively.

3.7 RECENT ENVIRONMENT AGENCY INFORMATION

The most up to date information available was requested from the Environment Agency. The EA has provided the following information:

- Flood map for planning identifying flood zones 1, 2 and 3.
- Defended modelled tidal extent.
- Defences removed modelled tidal extent.
- Defended climate change modelled tidal extent.
- Defences removed climate change modelled tidal extent.
- Defended modelled tidal extent and height.
- Defences removed modelled tidal extent and height.
- Defended climate change modelled tidal extent and height.
- Defences removed climate change modelled tidal extent and height.

The EA Flood Map for Planning confirms that the site is in Flood Zone 3 and that it benefits from defences (see Figure 3.5).

The defended modelled tidal extent (Figure 3.6) shows that the defences provide a very high standard of protection so that the site would not be flooded by a 0.1% AEP event.

When the model is run without the defences in place (Figure 3.7), this shows that the site would be flooded by a 0.5% AEP event and larger events. In this scenario, for a 0.5% AEP event, the flood water depth would be around 0.10 m and the height would be 4.79 mAOD. For a 0.1% AEP event, the depth would be around 1.11 m and the height would be 5.79 mAOD. In all of the flood events, there would be some variation in the depth of the flood water owing to variations in ground level but the water height or level would be relatively constant.

When climate change is included (Figure 3.8), the site would be flooded by a 0.5% AEP event even with the defences in place. This illustrates how climate change will reduce the effectiveness of defences. In this scenario (defences 0.5% AEP + 600 mm to allow for climate change), the depth would be 0.86 m and the height would be 5.57 mAOD.

The model shows that without the defences and allowing for climate change (Figure 3.9), the site would be flooded by a 0.5% AEP event but flooding would be deeper and more extensive. In this scenario (no defences 0.5% AEP + 600 mm to allow for climate change), the depth would be 2.26 m and the height would be 6.95 mAOD.

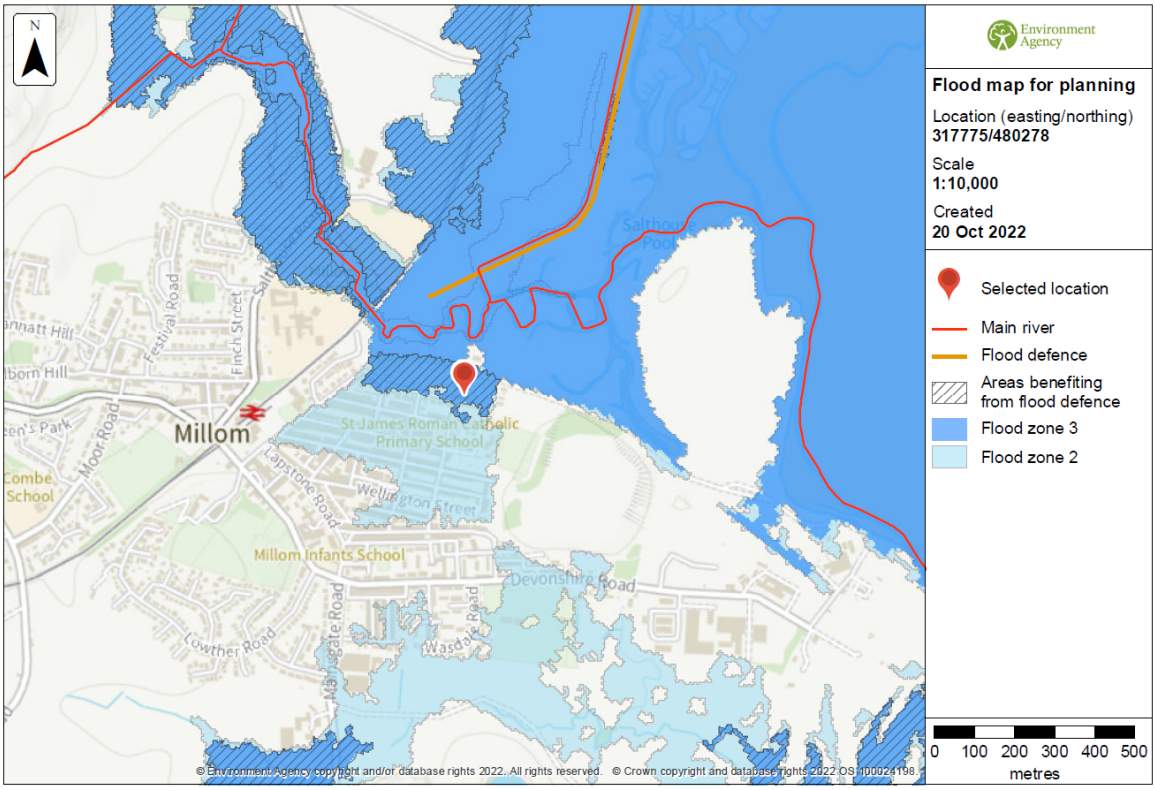


Figure 3.5 Flood map for planning.

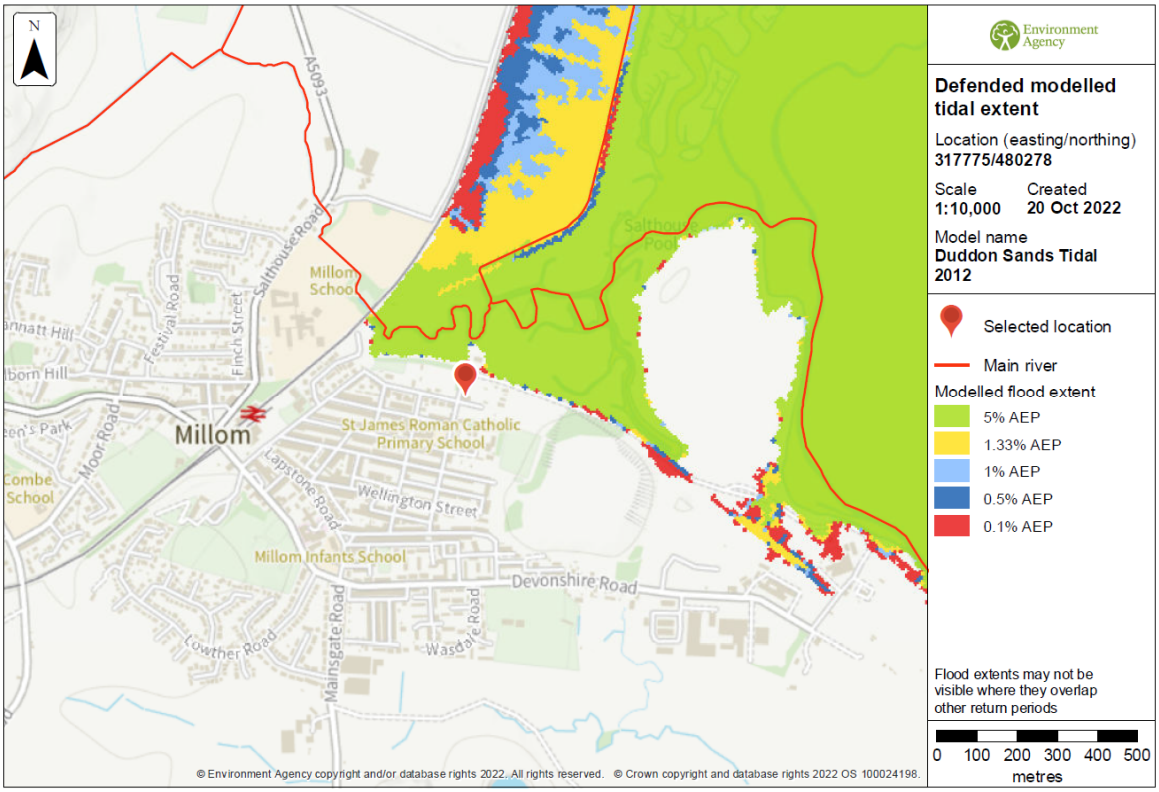


Figure 3.6 Defended modelled tidal extent.

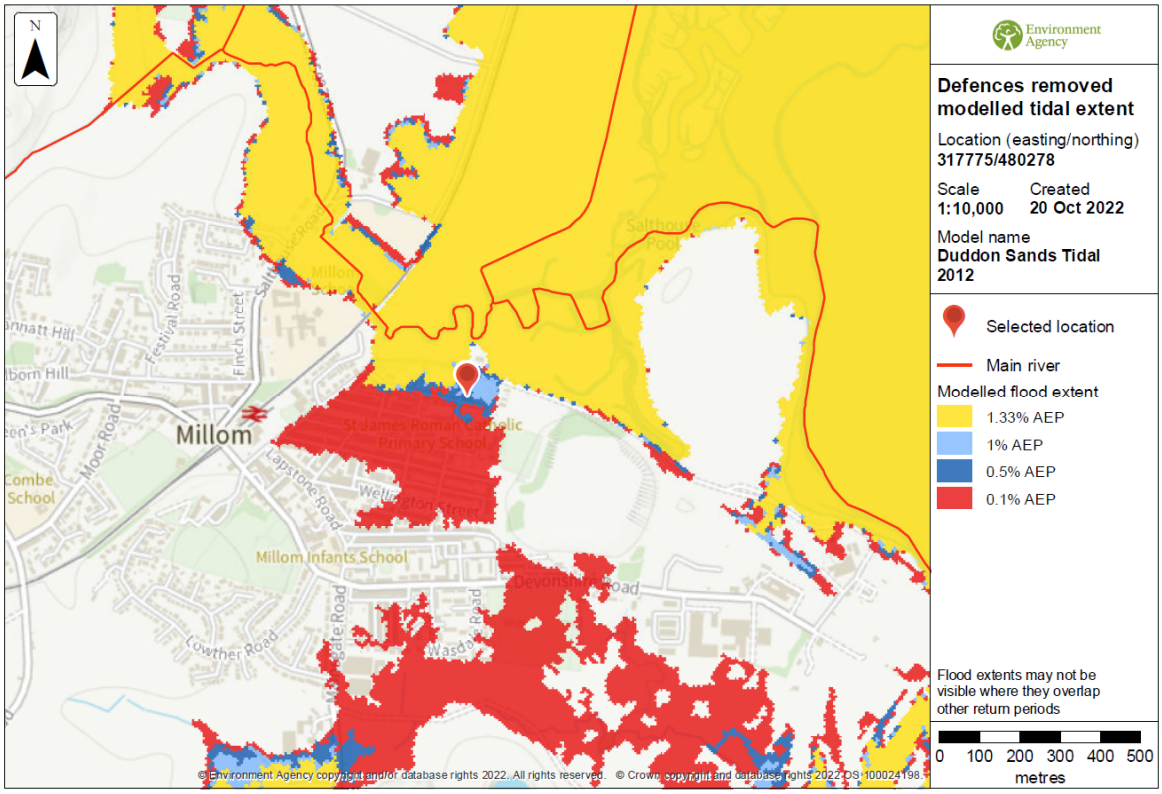


Figure 3.7 Defences removed modelled tidal extent.

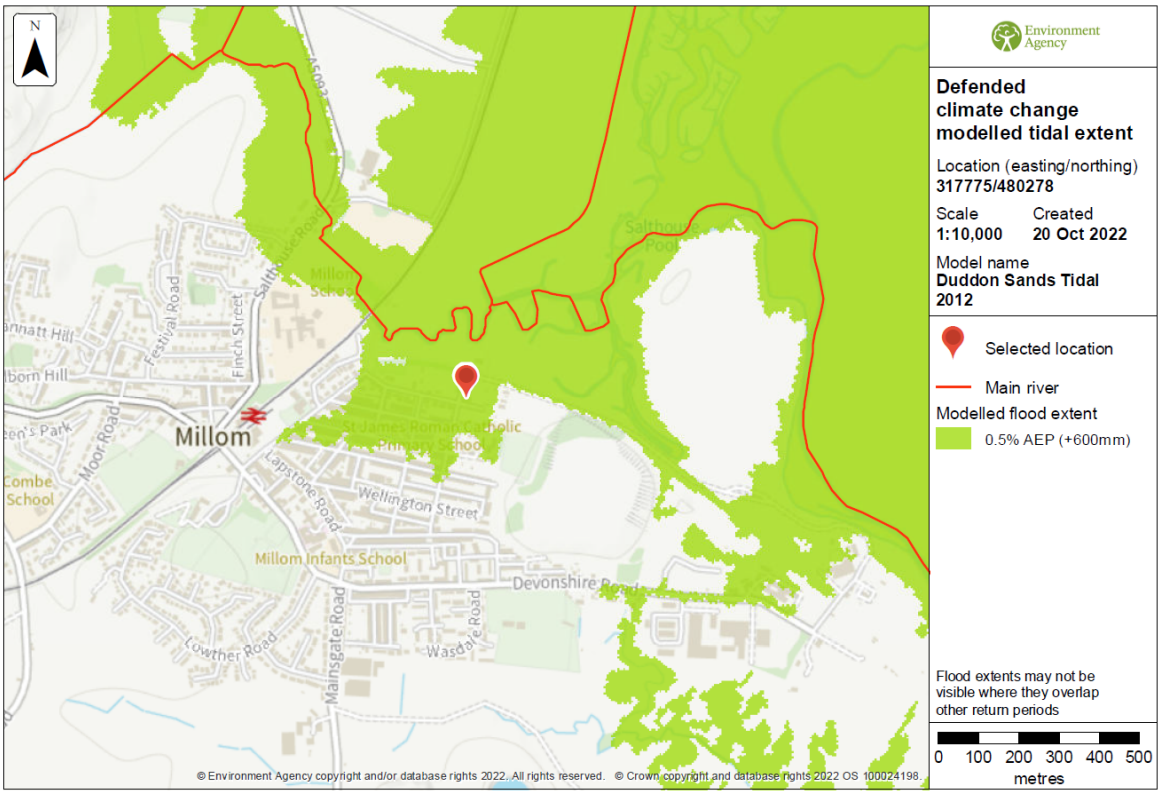


Figure 3.8 Defended climate change modelled tidal extent.

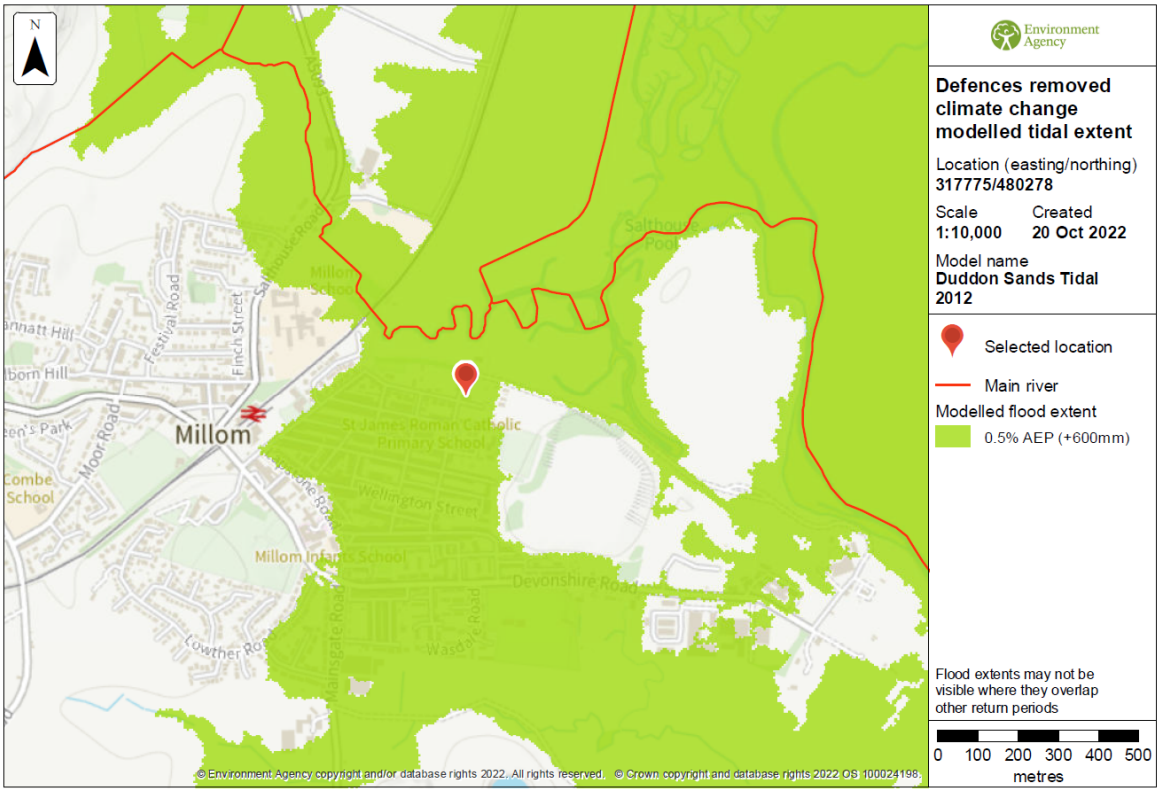


Figure 3.9 Defences removed climate change modelled tidal extent.

3.8 SURFACE WATER FLOOD RISK

Surface water flooding is that which results from extreme rainfall rather than overflowing rivers. This type of flooding typically occurs when extreme rainfall causes water to run down slopes and collect in depressions in the landscape or where runoff is focussed into an area where drainage is insufficient. It can also cause erosion resulting in the partial or complete blockage of drains or culverts.

Figure 3.10 shows an extract from the EA surface water flood risk map[7] This has four risk classifications from very low probability (<0.1% AEP) to high probability (>3.3% AEP). The EA's surface water flood risk map also shows that part of the site is at risk from surface water flooding.

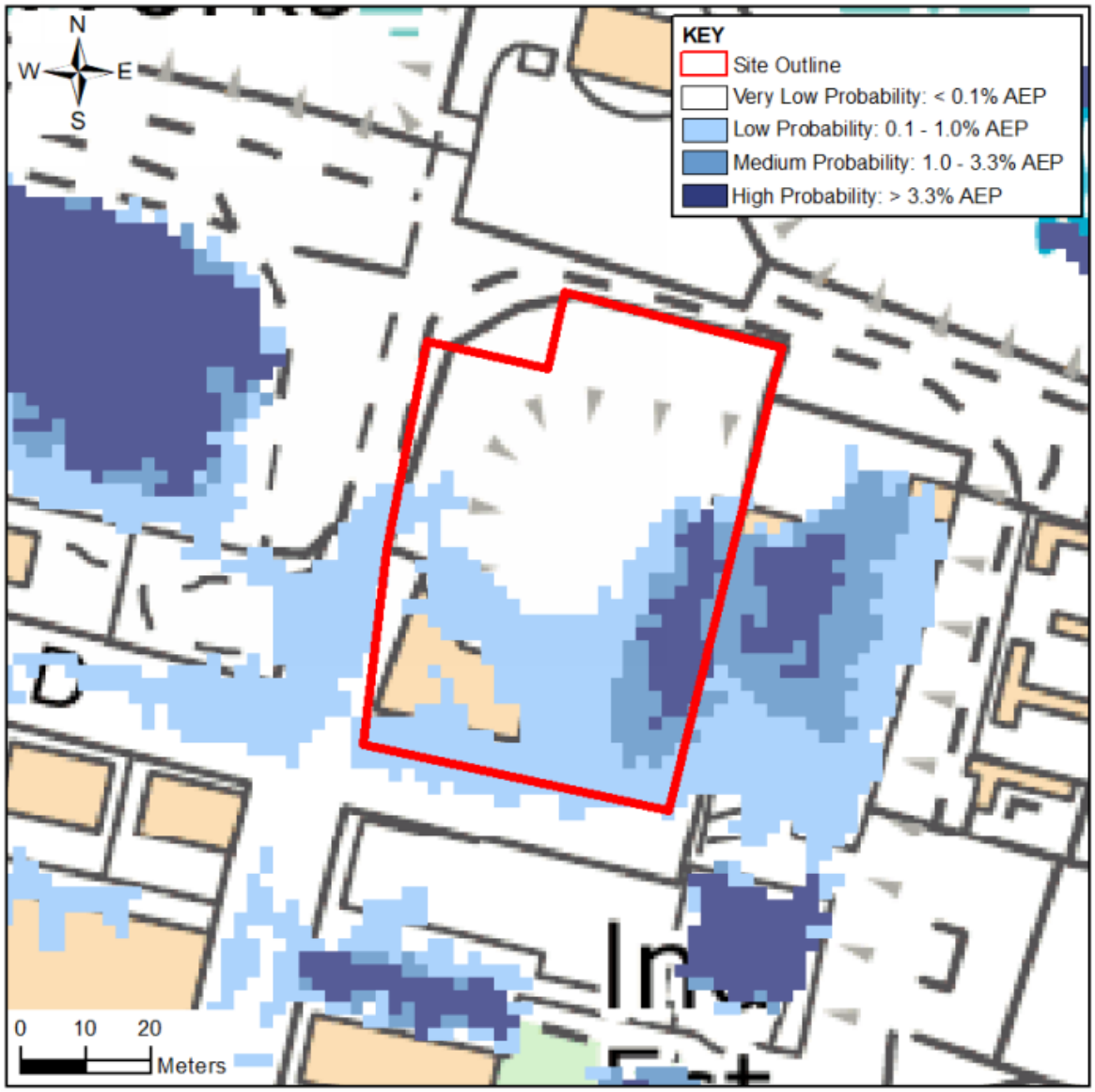


Figure 3.10 Environment Agency surface water flood map.

Figure 3.11 shows the predicted depths of surface water flooding. This shows that water depths could be between 300 mm and 600 mm in parts of the southern side of the site.

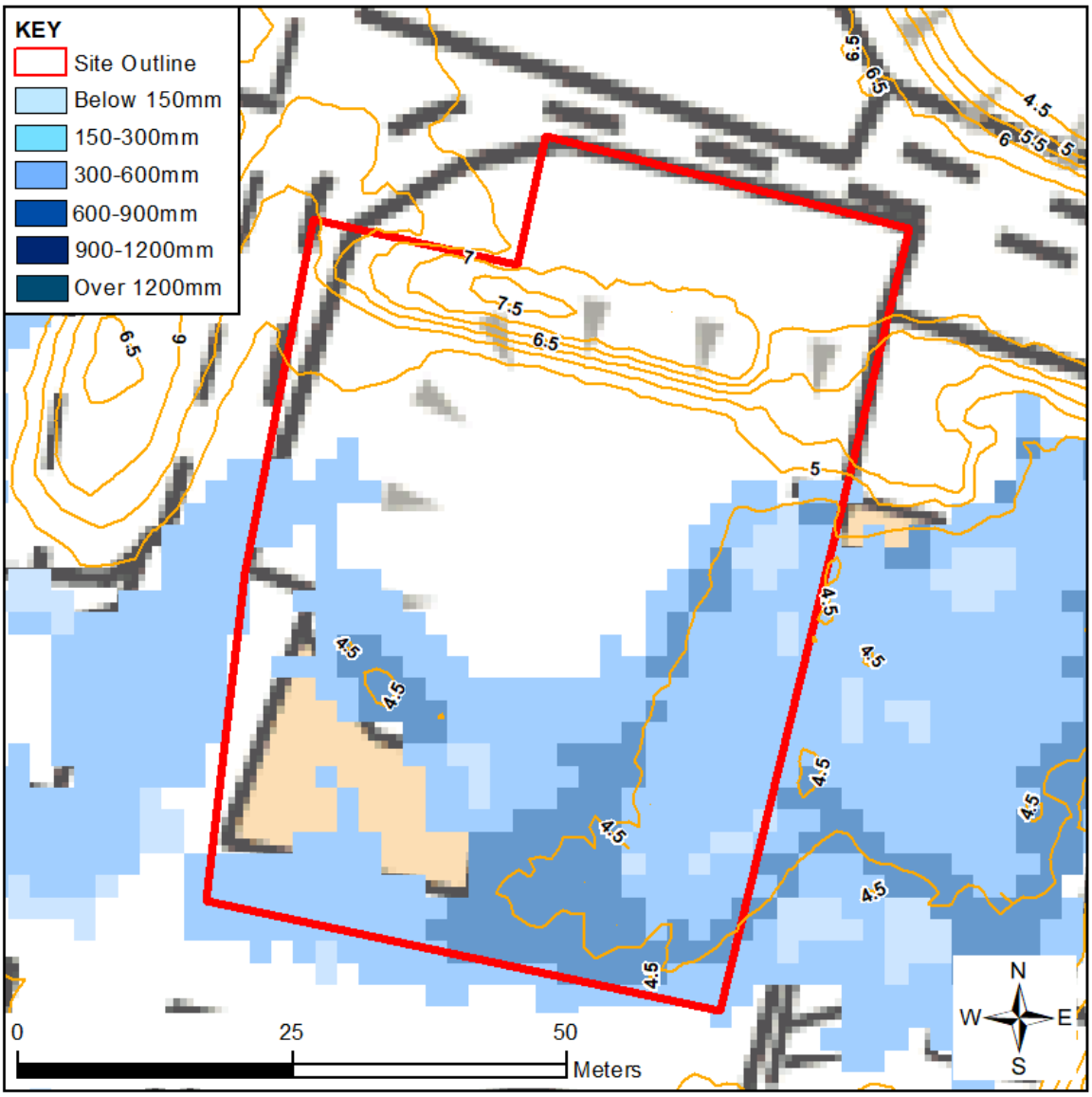


Figure 3.11 Depths of surface water flooding

3.9 GROUNDWATER FLOOD RISK

Groundwater flooding occurs when water levels in the ground rise above the ground surface level. It is most likely to occur in low lying areas underlain by permeable drift and rocks.

Figure 3.12 shows the groundwater flood risk map for the site and surrounding area based on BGS data. This shows that the site is outside the area of groundwater flood risk.

Owing to the proximity of the site to the Millom saltmarshes and the Duddon Estuary, it is likely that there is groundwater close to the surface. Therefore, should the proposals include excavation below ground level, it will be important to consider the possibility of shallow groundwater.

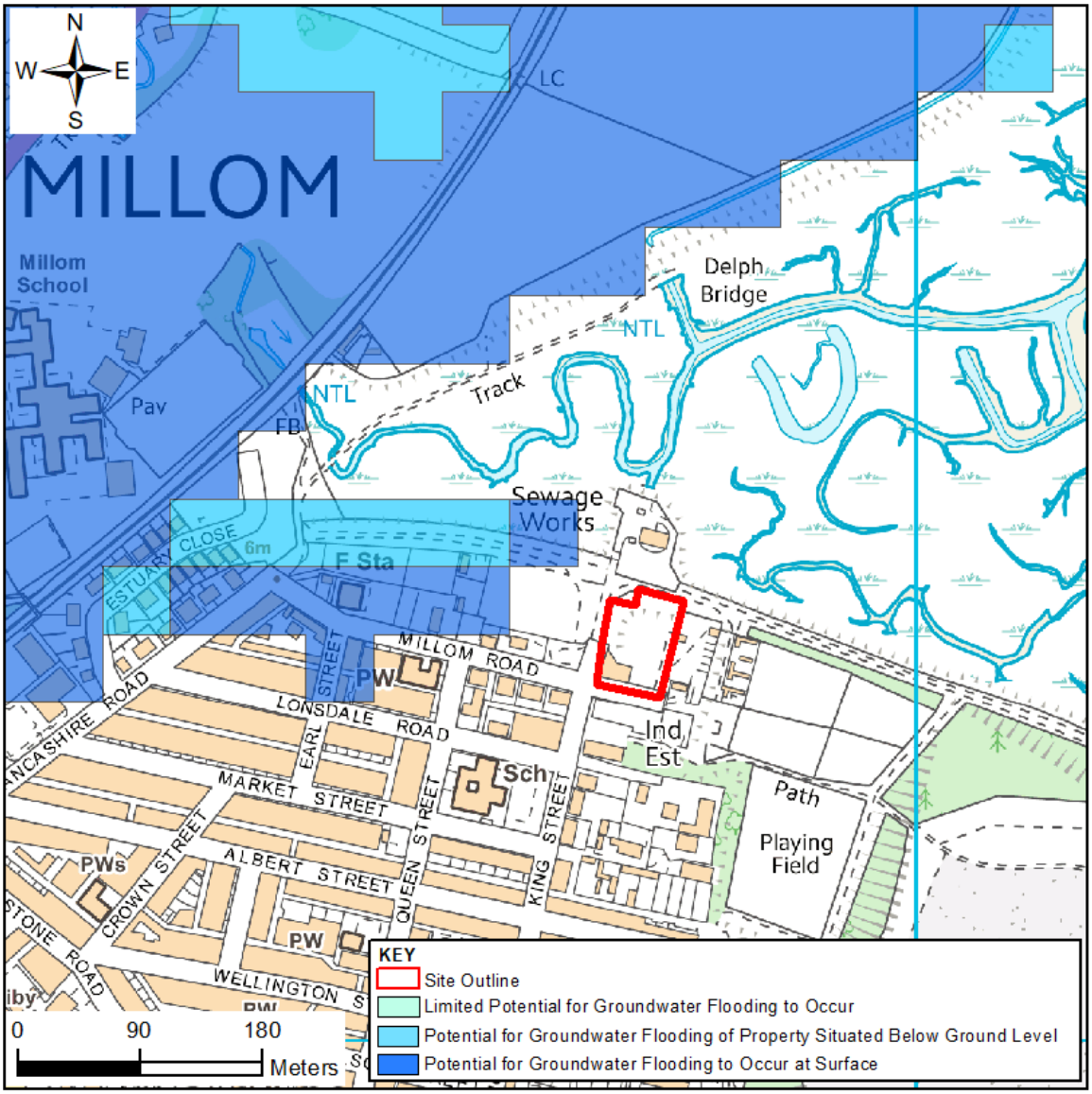


Figure 3.12 Groundwater flood risk

3.10 FLOODING FROM RESERVOIRS, CANALS OR OTHER ARTIFICIAL SOURCES

There are no reservoirs, canals or other artificial water sources in the surface water catchment in which the site is located. There is therefore no risk of flooding from such sources.

3.11 FLOODING FROM SEWERS

There are sewers and a sewerage treatment works in the vicinity of the site. It is therefore concluded that the site is at risk of flooding from these sources, especially during high-tide conditions when sewers may surcharge.

3.12 HISTORIC FLOODING

There have been two recent instances of flooding in Millon. These were in September 2017 and August 2021. Each of these were examples of surface water flooding caused by intense rainfall.

On 30th September 2017 an intense rainfall event occurred over Millom and Haverigg. The rainfall overwhelmed the drainage systems, flooding an estimated 255 residential properties including commercial[9]. Figure 3.13 shows the locations recorded as flooded on 30th September 2017

The LLFA has suggested that the existing combined sewer system throughout Millom may be designed for a smaller event than the 1 in 30-year event. The event experienced on 30th September 2017 is believed to be beyond a 1 in 30-year event and overwhelmed the system[9].

LLFA listed flooding in the following areas:

- Settle Street / Finch Street – October 2012 – internal flooding of 1 property caused by surface water runoff from fields at the rear of the property.
- Mainsgate Road / Bowness Road – 4th October 2012 – several properties affected with both internal and external flooding – surface water runoff appears to have been the cause and some clearing of the downstream watercourse was carried out following the flooding.

Parts of Millom and Haverigg also experienced flooding on 5th August 2021 after heavy rainfall. Copeland Borough Council distributed sandbags and expanding water barriers to the affected areas[10].

After the August 2021 flooding, it was suggested that the town's flood management was not adequate and that the King Street pumping station was unable to cope with substantial rainfall[11]. It was also suggested that runoff was mixed with wastewater in the combined sewer drainage system.

Tidal flooding influenced by strong winds affected parts of the Cumbria coast on 1st February 2014[12]. Floodwater and debris covered some coastal routes and a number of flood warnings were issued. The A5087 between Barrow and Ulverston and Ocean Road on Walney Island were among roads closed by flooding. Northern Rail said trains had been affected between Barrow and Millom and from Workington to Carlisle. However, records of flooding in Millom on this date could not be found suggesting that the defences were effective in this case.

During November 1977, the whole of the Lancashire and Cumbria coastline was affected by extremely high and rough sea conditions, with a massive surge of water along the North West coast[13]. In addition to the surge, high winds generated waves that became increasingly severe as the tide rose. The Institute of Oceanographic Sciences has since indicated that the tide levels experienced in the North West on 11th November 1977 exceeded the 1 in 100-year tide level[13]. Not surprisingly damage was caused to sea defences in the area, which the previous year had successfully withstood 1 in 50-year tide levels[13]. Before this flood the only records of conditions approaching a similar scale of devastation are from 1898, 1907 and 1927[13].

Figure 3.13 Environment Agency records of areas flooded on 30th September 2017.

4. FLOOD MITIGATION

4.1 SUMMARY OF FLOOD RISK

The risk of flooding from fluvial sources, groundwater and reservoirs/canals is considered low and therefore it is recommended that mitigation measures are not necessary in this respect for the proposed development. The site however is identified as being at risk of tidal flooding, surface water flooding and sewer flooding. A summary of the predicted flood risk is outlined in Table 4.1.

Table 4.1 Flood risk summary

Source of Flood Risk	Interpreted Risk Classification	Justification
Fluvial	Very Low	As predicted by EA model
Tidal	Low to Medium	As predicted by EA model
Surface Water	Medium	Flood history and EA model
Groundwater	Low	Indicated by BGS susceptibility maps
Artificial Sources	Very Low	As identified by the EA
Sewer	Medium	Flood history

4.2 PERMITTED DEVELOPMENT

In terms of development within Flood Zone 3, the proposed less vulnerable use of the land is appropriate, as set out in Table 3 of NPPF Planning Practice Guidance[2], reproduced in Table 4.2.

Table 4.2 Flood risk vulnerability & flood zones compatibility

Flood Zones	Flood Risk Vulnerability Classification				
	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test Required	✓	✓	✓
Zone 3a	Exception Test Required	×	Exception Test Required	✓	✓
Zone 3b	Exception Test Required	×	×	×	✓
Key: ✓ Development is Appropriate; × Development should not be permitted					

4.3 CLIMATE CHANGE ALLOWANCES

Projections of future climate change indicate that more frequent short-duration, high intensity rainfall and more frequent periods of long-duration rainfall are likely to occur over the next few decades in the UK. Sea levels are also predicted to continue to rise. These future changes will have implications for tidal flooding and these factors will lead to increased and new risks of flooding within the lifetime of planned developments.

Recommendations provided in the Planning Practice Guidance[2] and Table 3 of the EA's Climate Change Guidance[11] have been used in conjunction with the EA's tidal model to identify the predicted sea level rise for the lifetime of the development.

Table 4.3 shows the Higher and Upper End values associated with the North West district, up to 100 years, while Table 4.4 shows the current and predicted climate change tidal levels at the site.

Table 4.3 Sea level allowances in north west district (use 1981 to 2000 baseline)

Allowance	2000-2035 (mm)	2036-2065 (mm)	2066-2095 (mm)	2096-2125 (mm)	Cumulative Rise 2000-2125 (m)
Higher Central	4.5 (158)	7.3 (219)	10 (300)	11.2 (336)	1.01
Upper End	5.7 (200)	9.9 (297)	14.2 (426)	16.3 (489)	1.41
Note: Shown in mm per year, per epoch. The total sea level rise for each epoch is shown in brackets.					

Table 4.4 Current and predicted climate change modelled tidal flood levels for a 0.5% AEP event

Annual Exceedance Probability (%)	Flood Level 2020 Undefended (mAOD)	Flood Level 2125 Undefended (mAOD) Higher Central	Flood Level 2125 Undefended (mAOD) Upper End
0.5 (1 in 200 year)	4.79	5.80	6.20

Based on the predominant existing ground level of 5.00 mAOD, it is projected that in future the site could flood to a maximum depth of 0.8 m in the 0.5% AEP higher central undefended scenario and 1.20 m in the upper end undefended scenario.

4.4 FLOOD RESISTANCE AND RESILIENCE

As the proposed development is an extension to an existing motor body workshop, the practical approach to managing flood risk is for the new facilities to include flood resistance and resilience features. Such features will allow the facility to cope with a flood by minimising damage allowing it to recover quickly following a flood.

Depending on predicted flood depth, the EA have specified various criteria that should be met as outlined below:

Water depth up to 0.3 m

Design your building or development to keep water out as much as possible. Do this by using materials that have low permeability (i.e. materials that water cannot pass through, such as impermeable concrete).

Water depth from 0.3 m to 0.6 m.

Design your building or development to keep water out (unless there are structural concerns) by:

- using materials with low permeability to at least 0.3 m.

- using flood resilient materials and design (e.g. raised electrical sockets).
- making sure there is access to all spaces to enable drying and cleaning.

Water depth above 0.6 m.

Design your building or development to allow water to pass through the property to avoid structural damage by:

- using materials with low permeability to at least 0.3 m.
- making it easy for water to drain away after flooding.
- making sure there's access to all spaces to enable drying and cleaning.

4.5 FLOOD HAZARD

Flood Hazard describes the flood conditions in which people are likely to be swept over or drown in a flood, and is a combination of flood depth, velocity, and the presence of debris.

Adults are unable to stand in 'still' floodwater with a depth of about 1.50 m or greater, although this is obviously affected by the height of the person. The depth of 'flowing' floodwater where people are unable to stand is much less. For example, some people will be at risk when water depth is only 0.50 m if the velocity is 1 m/s. If the velocity increases to 2 m/s, some people will be unable to stand in a depth in a depth of water of only 0.30 m. Most people are unable to stand when the velocity is 2 m/s, and the depth is 0.60 m.

The methodology to quantify flood hazard was developed and outlined in report FD2321[15] which has provided the framework for the assessment below. Following the development of this methodology, a more precautionary approach was adopted for the purpose of planning policy as outlined in report FD2320[16]. Flood hazard classification boundaries were redefined and for the purpose of simplifying the calculations, a worst-case 'urban' scenario is assumed for the debris factor. The differences in methodology are outlined in Table 4.5.

Table 4.5 Summary of differences in hazard classification methodology

Threshold for Flood Hazard Rating H = d x (v + 0.5) + DF		Degree of Flood Hazard	Description
FD2321	FD2320		
<0.75	<0.75	Low	**Caution** - "Flood zone with shallow flowing water of deep standing water"
0.75-1.25	0.75-1.25	Moderate	**Dangerous for some (i.e. children)** - "Danger: Flood Zone with deep or fast flowing water"
1.25-2.5	1.25-2.5	Significant	**Dangerous for most people** - "Danger: flood zone with deep, fast flowing water"
>2.5	>2.5	Extreme	**Dangerous for all** - "Extreme danger: flood zone with deep, fast flowing water".

Guidance on the depths and velocities of floodwater that cause risks to people as outlined in FD2320 is shown in Figure 4.1. A map of flood risk in and around the site is shown in Figure 4.2. The range of flood hazard values given by the map for the site is 1-1.25 which is classed as 'Danger for Some'.

HR	Depth of flooding - d (m)												
	DF = 0.5				DF = 1								
Velocity - v (m/s)	0.05	0.10	0.20	0.25	0.30	0.40	0.50	0.60	0.80	1.00	1.50	2.00	2.50
0.0	0.03 + 0.5 = 0.53	0.05 + 0.5 = 0.55	0.10 + 0.5 = 0.60	0.13 + 0.5 = 0.63	0.15 + 1.0 = 1.15	0.20 + 1.0 = 1.20	0.25 + 1.0 = 1.25	0.30 + 1.0 = 1.30	0.40 + 1.0 = 1.40	0.50 + 1.0 = 1.50	0.75 + 1.0 = 1.75	1.00 + 1.0 = 2.00	1.25 + 1.0 = 2.25
0.1	0.03 + 0.5 = 0.53	0.06 + 0.5 = 0.56	0.12 + 0.5 = 0.62	0.15 + 0.5 = 0.65	0.18 + 1.0 = 1.18	0.24 + 1.0 = 1.24	0.30 + 1.0 = 1.30	0.36 + 1.0 = 1.36	0.48 + 1.0 = 1.48	0.60 + 1.0 = 1.60	0.90 + 1.0 = 1.90	1.20 + 1.0 = 2.20	1.50 + 1.0 = 2.55
0.3	0.04 + 0.5 = 0.54	0.08 + 0.5 = 0.58	0.15 + 0.5 = 0.65	0.19 + 0.5 = 0.69	0.23 + 1.0 = 1.23	0.30 + 1.0 = 1.30	0.38 + 1.0 = 1.38	0.45 + 1.0 = 1.45	0.60 + 1.0 = 1.60	0.75 + 1.0 = 1.75	1.13 + 1.0 = 2.13	1.50 + 1.0 = 2.50	1.88 + 1.0 = 2.88
0.5	0.05 + 0.5 = 0.55	0.10 + 0.5 = 0.60	0.20 + 0.5 = 0.70	0.25 + 0.5 = 0.75	0.30 + 1.0 = 1.30	0.40 + 1.0 = 1.40	0.50 + 1.0 = 1.50	0.60 + 1.0 = 1.60	0.80 + 1.0 = 1.80	1.00 + 1.0 = 2.00	1.50 + 1.0 = 2.50	2.00 + 1.0 = 3.00	2.50 + 1.0 = 3.50
1.0	0.08 + 0.5 = 0.58	0.15 + 0.5 = 0.65	0.30 + 0.5 = 0.80	0.38 + 0.5 = 0.88	0.45 + 1.0 = 1.45	0.60 + 1.0 = 1.60	0.75 + 1.0 = 1.75	0.90 + 1.0 = 1.90	1.20 + 1.0 = 2.20	1.50 + 1.0 = 2.50	2.25 + 1.0 = 3.25	3.00 + 1.0 = 4.00	3.75 + 1.0 = 4.75
1.5	0.10 + 0.5 = 0.60	0.20 + 0.5 = 0.70	0.40 + 0.5 = 0.90	0.50 + 0.5 = 1.00	0.60 + 1.0 = 1.60	0.80 + 1.0 = 1.80	1.00 + 1.0 = 2.00	1.20 + 1.0 = 2.20	1.60 + 1.0 = 2.60	2.00 + 1.0 = 3.00	3.00 + 1.0 = 4.00	4.00 + 1.0 = 5.00	5.00 + 1.0 = 6.00
2.0	0.13 + 0.5 = 0.63	0.25 + 0.5 = 0.75	0.50 + 0.5 = 1.00	0.63 + 0.5 = 1.13	0.75 + 1.0 = 1.75	1.00 + 1.0 = 2.00	1.25 + 1.0 = 2.25	1.50 + 1.0 = 2.50	2.00 + 1.0 = 3.00	3.50	4.75	6.00	7.25
2.5	0.15 + 0.5 = 0.65	0.30 + 0.5 = 0.80	0.60 + 0.5 = 1.10	0.75 + 0.5 = 1.25	0.90 + 1.0 = 1.90	1.20 + 1.0 = 2.20	1.50 + 1.0 = 2.50	1.80 + 1.0 = 2.80	3.40	4.00	5.50	7.00	8.50
3.0	0.18 + 0.5 = 0.68	0.35 + 0.5 = 0.85	0.70 + 0.5 = 1.20	0.88 + 0.5 = 1.38	1.05 + 1.0 = 2.05	1.40 + 1.0 = 2.40	1.75 + 1.0 = 2.75	3.10	3.80	4.50	6.25	8.00	9.75
3.5	0.20 + 0.5 = 0.70	0.40 + 0.5 = 0.90	0.80 + 0.5 = 1.30	1.00 + 0.5 = 1.50	1.20 + 1.0 = 2.20	1.60 + 1.0 = 2.60	3.00	3.40	4.20	5.00	7.00	9.00	11.00
4.0	0.23 + 0.5 = 0.73	0.45 + 0.5 = 0.95	0.90 + 0.5 = 1.40	1.13 + 0.5 = 1.63	1.35 + 1.0 = 2.35	1.80 + 1.0 = 2.80	3.25	3.70	4.60	5.50	7.75	10.00	12.25
4.5	0.25 + 0.5 = 0.75	0.50 + 0.5 = 1.00	1.00 + 0.5 = 1.50	1.25 + 0.5 = 1.75	1.50 + 1.0 = 2.50	2.00 + 1.0 = 3.00	3.50	4.00	5.00	6.00	8.50	11.00	13.50
5.0	0.28 + 0.5 = 0.78	0.60 + 0.5 = 1.10	1.10 + 0.5 = 1.60	1.38 + 0.5 = 1.88	1.65 + 1.0 = 2.65	3.20	3.75	4.30	5.40	6.50	9.25	12.00	14.75

Flood Hazard Rating (HR)	Colour Code	Hazard to People Classification
Less than 0.75		Very low hazard - Caution
0.75 to 1.25		Danger for some – includes children, the elderly and the infirm
1.25 to 2.0		Danger for most – includes the general public
More than 2.0		Danger for all – includes the emergency services

Figure 4.1 Combination of flood depth and velocity

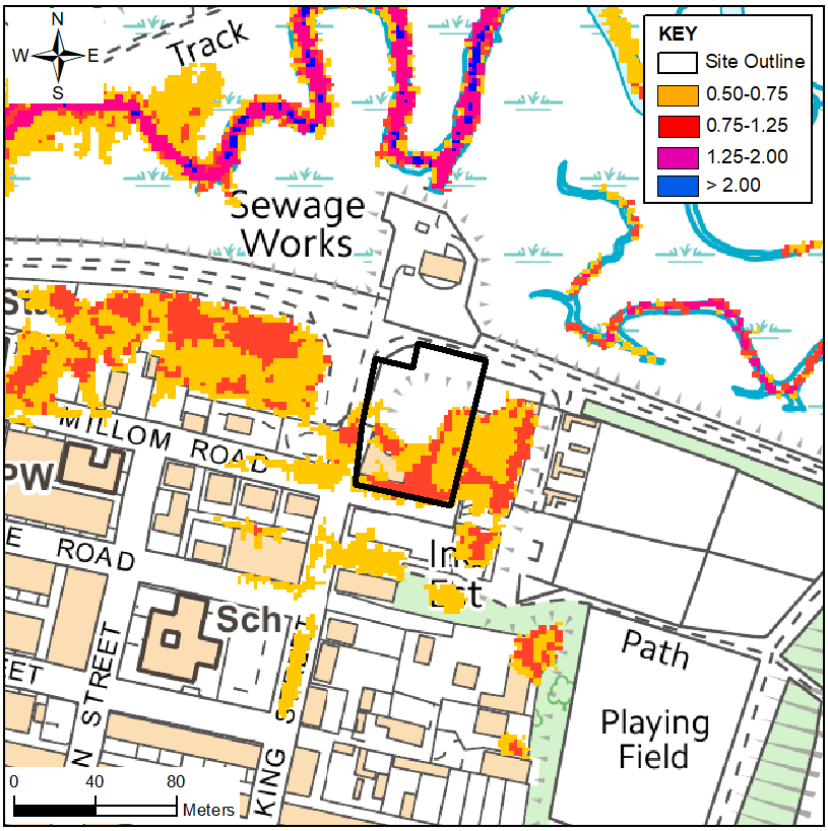


Figure 4.2 Flood hazard map

4.6 FLOOD ALERTS AND WARNINGS

The Environment Agency is the lead organisation for flood forecasting and flood warning in England and Wales. The EA currently offers a 3-stage warning service to properties at risk of flooding shown in Table 4.6. The site is within both a Flood Alert area and a Flood Warning area as shown in Figure 4.3 and Figure 4.4.

Table 4.6 Proposed response to EA flood warnings

Flood Warning State (see website)	Description of Flooding	Action to be taken
All clear	Flooding is unlikely	Use building as normal.
 Flood Alert	Flooding may be possible within two hours for fluvial flooding, six for tidal locations	Check weather forecast and EA floodline (**0345 988 1188**) for advice. Any external private defences such as flood guards on doorways to be erected.
 Flood Warning	Flooding is likely.	Occupants to vacate the site
 Severe Flood Warning	High risk to life and property. Flooding of the development site and highway is possible.	Occupants to vacate the site if they have not done so already

The EA offers a free flood warning service, Floodline Warnings Direct, where registered property owners and businesses can receive flood warning and severe flood warning, plus messages to advise on when these warning are no longer in force. This service is available to the proposed development site and it is advised the owners/occupiers sign up to this free service as part of a flood plan. Registration can be made at https://www.fws.environment-agency.gov.uk/app/olr/register

In the event of a possible flood, a warning would be issued by the EA, with the aim of providing as much lead time as possible, a minimum of 6 hours for tidal locations, this would provide adequate time to evacuate the premises.

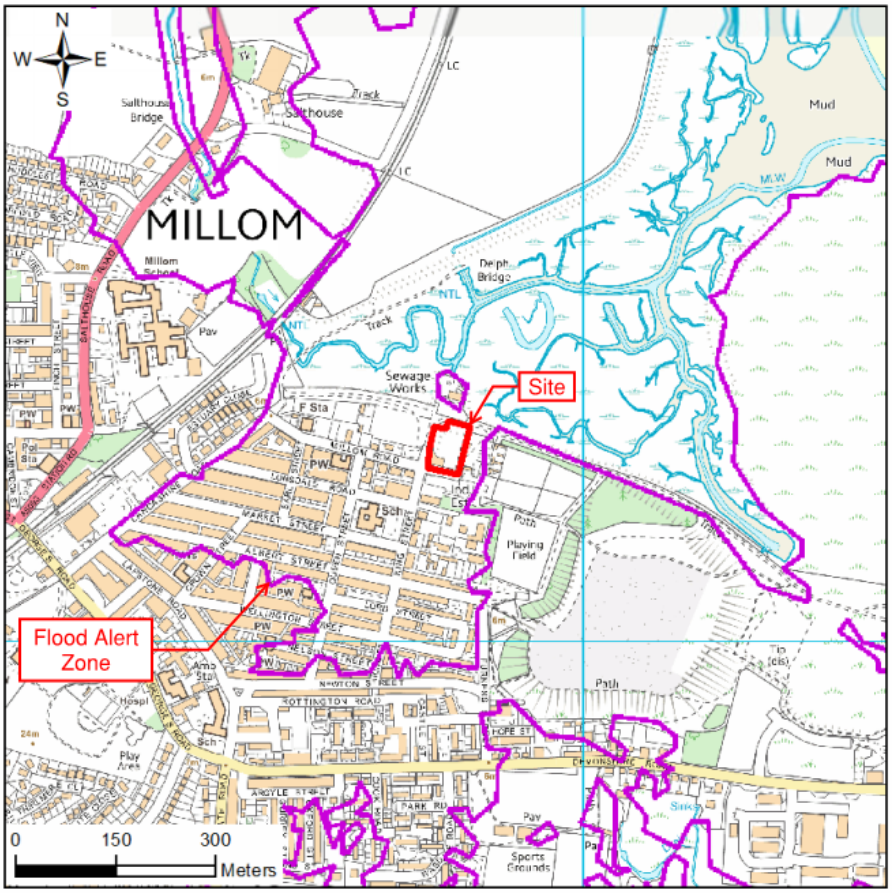


Figure 4.3 Environment Agency flood alert areas

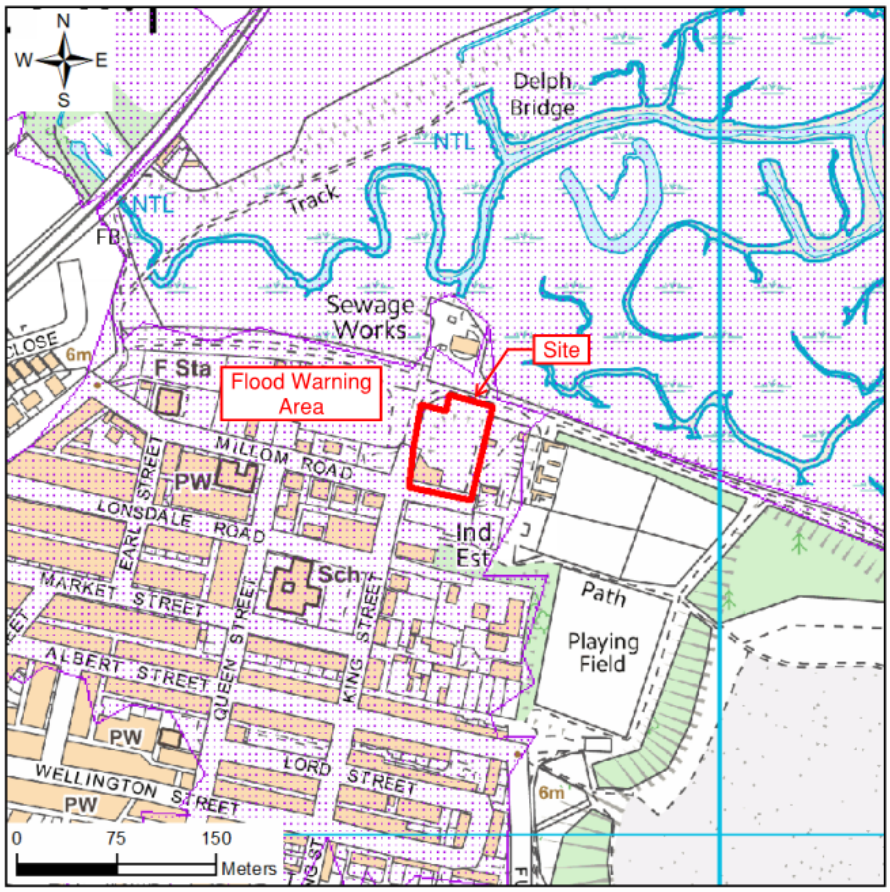


Figure 4.4 Environment Agency flood warnings areas

4.7 ACCESS AND EGRESS

Owing to the predictable nature of tidal flooding, ample warning can be provided to allow evacuation of the site as outlined in Section 4.6. This can be done either through Millom or if this is already flooded, there is an alternative route to playing fields a short distance south east of the site.

Surface water flooding is also a risk but it is predicted that should this occur, it would only affect the southern half of the site and therefore, site users will be able to take refuge in the northern half of the site.

5. CONCLUSIONS AND RECOMMENDATIONS

In consideration of the Flood Risk Assessment for the site, the following conclusions and recommendations are made:

- The EA Flood Map for Planning shows the site lies within defended Flood Zone 3 and predicts it is at risk of surface water flooding and tidal flooding. National guidance states that the development of sites for 'less vulnerable' development is acceptable in Flood Zone 3a.
- Millom has experienced surface water flooding several times in recent years. Surface water flooding depths are predicted to be between 300 mm and 600 mm in parts of the southern side of the site.
- Modelling has shown that flood defences protect Millom and the site against large tidal flood events of the order of 0.1% AEP. However, modelling has also shown that climate change will progressively reduce the effectiveness of this defence in the future.
- Because coastal flooding events can be reliably predicted, the flood hazard is less than for river flooding. The hazard can therefore be reduced by taking appropriate action well in advance of a predicted flood event.
- The site is not at risk from groundwater flooding. However, it is likely that groundwater is present close to the surface and therefore the excavation of vehicle inspection pits should be avoided if possible.
- The site is not at risk from flooding from reservoirs or canals.
- There is a risk of flooding from sewers as these are in close proximity to the site. The sewer flooding risk is related to the surface water flooding risk as the sewers in Millom are a combined system where surface water runoff is directed into the sewers. Sewer flooding has occurred in Millom in recent years.
- The site is within the area identified by the Environment Agency for the receipt of flood alerts and warnings. The site users will be able to register for this service.
- If a tidal flood event is forecast, it will be possible to leave the site either through Millom or via an alternative route to playing fields, which are predicted not to flood, a short distance south east of the site. As surface water flooding is predicted to only affect the southern half of the site, site users will be able to take refuge in the northern half of the site.
- The practical approach to managing flood risk is for the new facilities to include flood resistance and resilience features. Such features will allow the facility to cope with a flood by minimising damage, allowing it to recover quickly following a flood. If possible, building features should aim to prevent the ingress of surface water flooding and to position vulnerable equipment and facilities such as electrical systems above possible flood water levels. Consideration should be given to using flood resilient materials and design and making sure there is access to all spaces to enable drying and cleaning.

6. REFERENCES

[1] Ministry of Housing, Communities and Local Government, National Planning Policy Framework, July 2018.

[2] Ministry of Housing, Communities and Local Government, Planning Practice Guidance to the National Planning Policy Framework, October 2020

[3] Defra/Environment Agency, The Town and Country Planning Order 2015, 2015 No.595, April 2015.

[4] British Geological Survey, 2020. Geoindex. http://mapapps2.bgs.ac.uk/geoindex/home.html

[5] Land Information System (LANDIS)- Soilscapes viewer, Accessed January 2016. http://www.landis.org.uk/soilscapes

[6] Jacobs, 2017. Copeland Borough Council Strategic Flood Risk Assessment.

[7] Environment Agency Spatial Data Catalogue, WMS Links, January 2016. http://environment.data.gov.uk/ds/catalogue/#/catalogue

[8] JBA, Environment Agency, North West Region- Cumbrian Tidal Areas Benefiting from Defences Revisited, Summary Report, July 2013.

[9] Cumbria County Council, 2018. Millom and Haverigg Flood Investigation Report 30th September 2017.

[10] The Mail, 2021. Widespread flooding affects Millom and Haverigg residents. https://www.nwemail.co.uk/news/19497048.widespread-flooding-affects-millom-haverigg-residents/

[11] Whitehaven News, 2019. Millom fears another flood this winter. https://www.whitehavennews.co.uk/news/18023859.millom-fears-another-flood-winter/

[12] BBC News, 2014. Strong winds and high tides flood Cumbria coast. https://www.bbc.co.uk/news/uk-england-cumbria-25998692

[13] Environment Agency, 1977. Coastal flooding in the North West. http://ea-lit.freshwaterlife.org/archive/ealit:521

[14] Environment Agency, Flood Risk Assessments: Climate Change Allowances, July 2020.

[15] Defra/Environment Agency, Flood and Coastal Defence R & D Programme- Flood Risks to People Phase 2, FD2321/TR2, March 2006.

[16] Defra/Environment Agency, Flood and Coastal Defence R & D Programme- Flood Risk Assessment Guidance for New Development Phase 2, FD2320/TR2, October 2005.

APPENDIX A

EA Data

Flood risk assessment data

Location of site: 317775 / 480278 (shown as easting and northing coordinates)
Document created on: 20 October 2022
This information was previously known as a product 4.
Customer reference number: YJBWEBMB4XMR

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

How to use this information

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

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

Included in this document

In this document you'll find:

- how to find information about surface water and other sources of flooding
- information on the models used
- definitions for the terminology used throughout
- flood map for planning (rivers and the sea)
- areas benefiting from defences
- modelled data
- climate change modelled data
- information about strategic flood risk assessments
- information about this data
- information about flood risk activity permits
- help and advice

Not included in this document

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

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

Include a site location map in your request.

Information that's unavailable

This document **does not** contain:

- historic flooding
- flood defences and attributes

We do not have historic flooding data for this location.

Please note that:

- 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 floodng from rivers or the sea

You can 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.

We aren't able to display flood defence locations and attributes. There are coastal defences managed by Copeland Borough Council at this location that we don't hold the information on, you will be able to contact them to obtain the information.

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: Duddon Sands_Tidal 2012
Scenario(s): Defended tidal, defences removed tidal, defended climate change tidal, defences removed climate change tidal
Date: 1 July 2013

This model contains 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

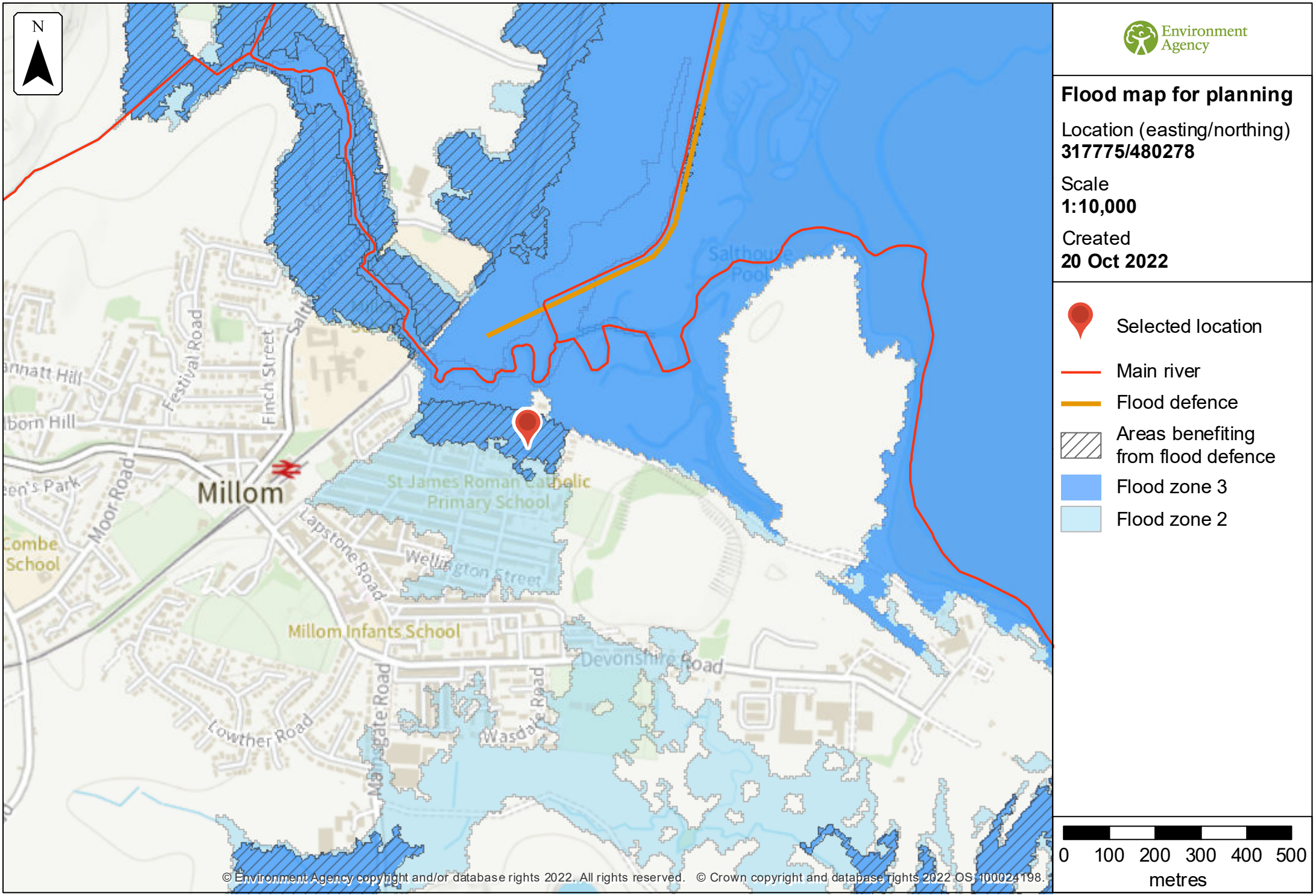
This data is updated on a quarterly basis as better data becomes available.

Areas benefiting from defences

This map shows the areas benefiting from defences for 2 possible events:

- fluvial (river flooding) event that has a 1% annual exceedance probability (AEP), this means a 1% chance of occurring in any one year
- tidal or coastal event that has a 0.5% annual exceedance probability (AEP), this means a 0.5% chance of occurring in any one year

Download the GIS dataset for areas benefiting from defences


N
Millom
Festival Road
Finch Street
Moor Road
Lapstone Road
Millom Infants School
St James Roman Catholic Primary School
Devonshire Road
Wasdale Road
Lowther Road
Combe School
Environment Agency
Flood map for planning
Location (easting/northing)
317775/480278
Scale
1:10,000
Created
20 Oct 2022
Selected location
Main river
Flood defence
Areas benefiting from flood defence
Flood zone 3
Flood zone 2
0 100 200 300 400 500
metres
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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
- 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

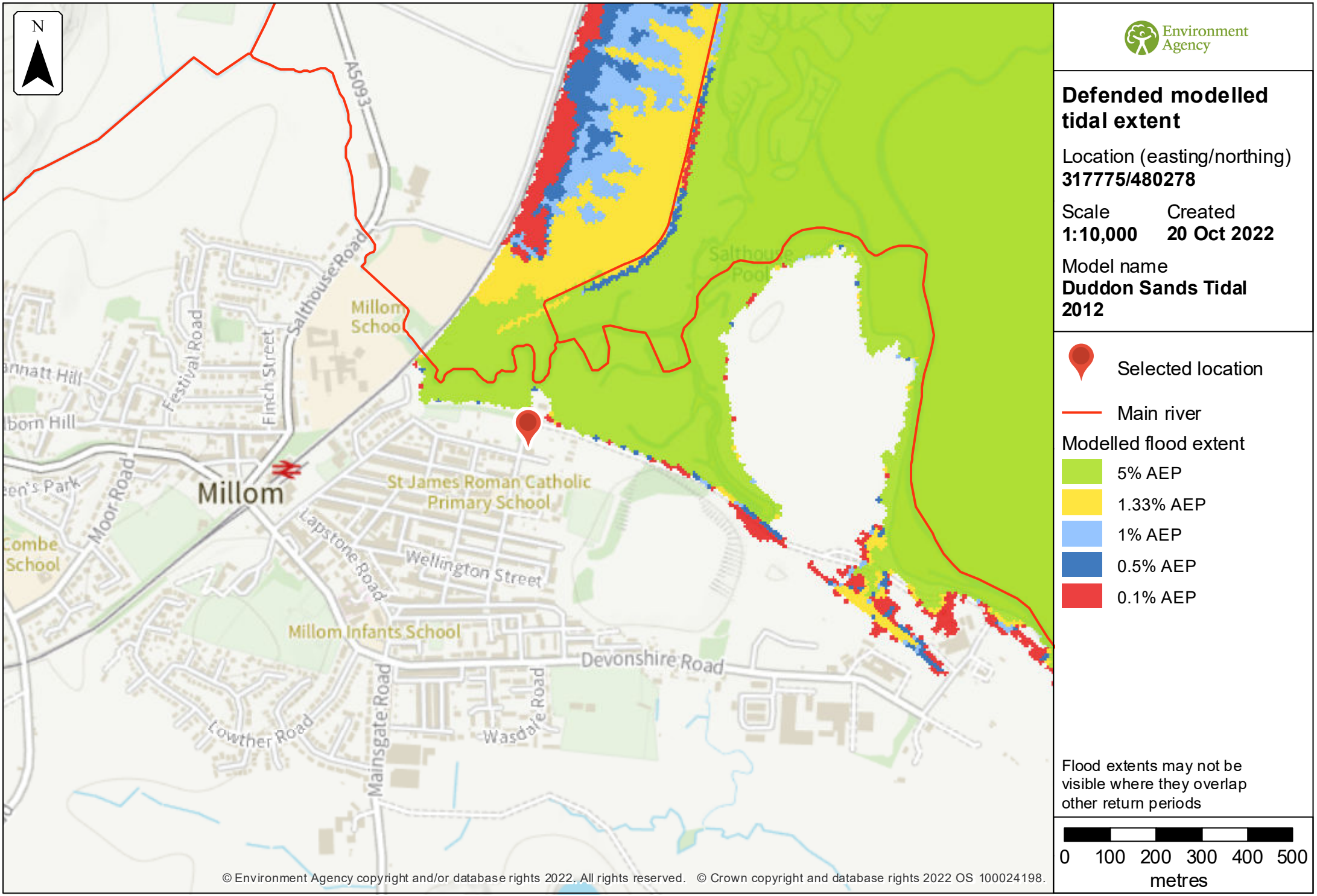
The climate change data included in the models may not include the latest flood risk assessment climate change allowances. Where the new allowances are not available you will need to consider this data and factor in the new allowances to demonstrate the development will be safe from flooding.

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 tidal: risk of flooding from the sea where there are flood defences
- Defences removed modelled tidal: risk of flooding from the sea where flood defences have been removed
- Defended climate change modelled tidal: risk of flooding from the sea where there are flood defences, including estimated impact of climate change
- Defences removed climate change modelled tidal: risk of flooding from the sea where flood defences have been removed, including estimated impact of climate change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A5093
Salthouse Road
Millom School
Festival Road
Finch Street
Millom
St James Roman Catholic Primary School
Moor Road
Lapstone Road
Wellington Street
Millom Infants School
Devonshire Road
Mainsgate Road
Wasdale Road
Lowther Road
Combe School
Environment Agency
Defended modelled tidal extent
Location (easting/northing)
317775/480278
Scale
1:10,000
Created
20 Oct 2022
Model name
Duddon Sands Tidal 2012
Selected location
Main river
Modelled flood extent
5% 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
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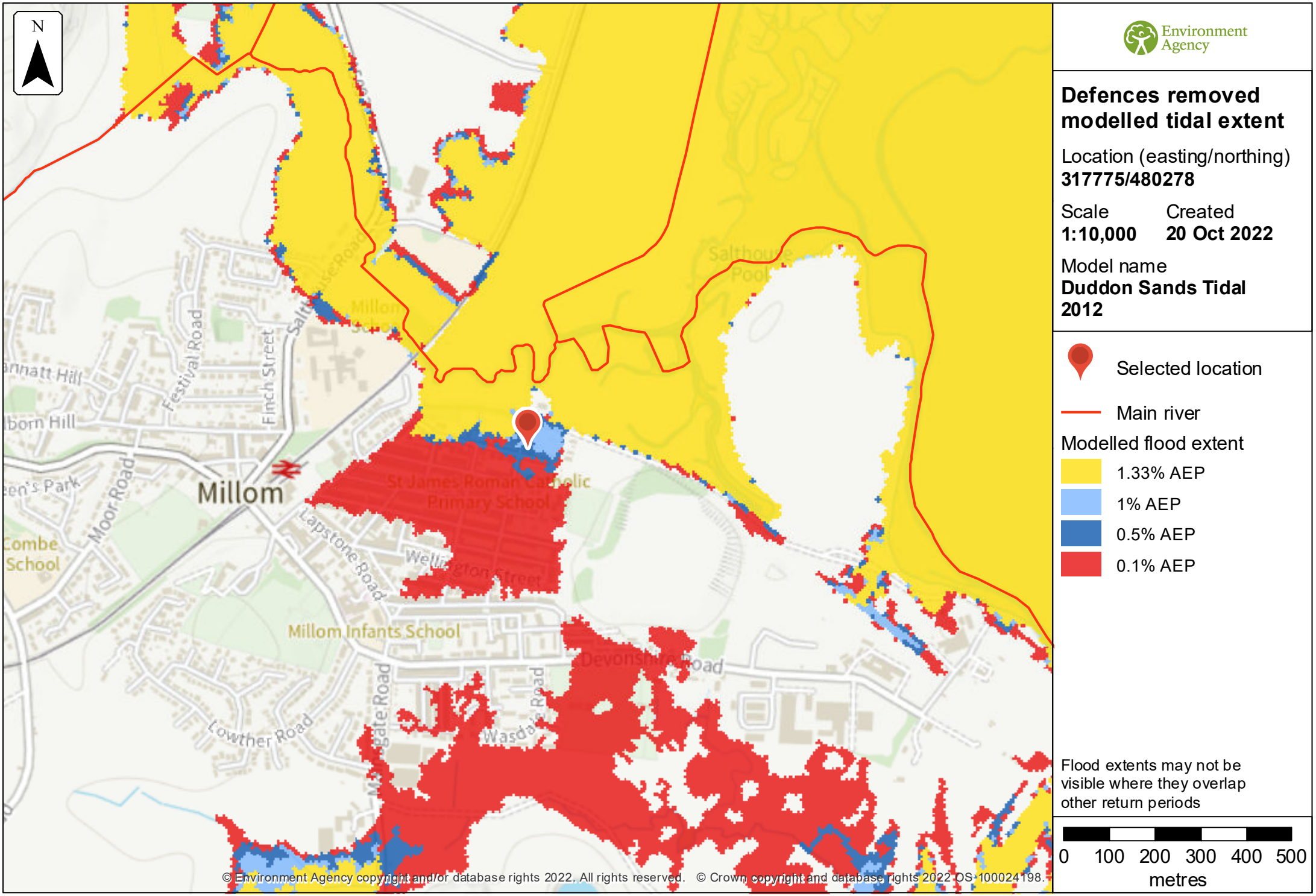
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Millom
Millom Infants School
St James Roman Catholic Primary School
Lapstone Road
Moor Road
Festival Road
Finch Street
Lowther Road
Wellington Street
Devonshire Road
Wasdale Road
Salthouse Pool
Environment Agency
Defences removed modelled tidal extent
Location (easting/northing)
317775/480278
Scale
1:10,000
Created
20 Oct 2022
Model name
Duddon Sands Tidal 2012
Selected location
Main river
Modelled flood extent
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
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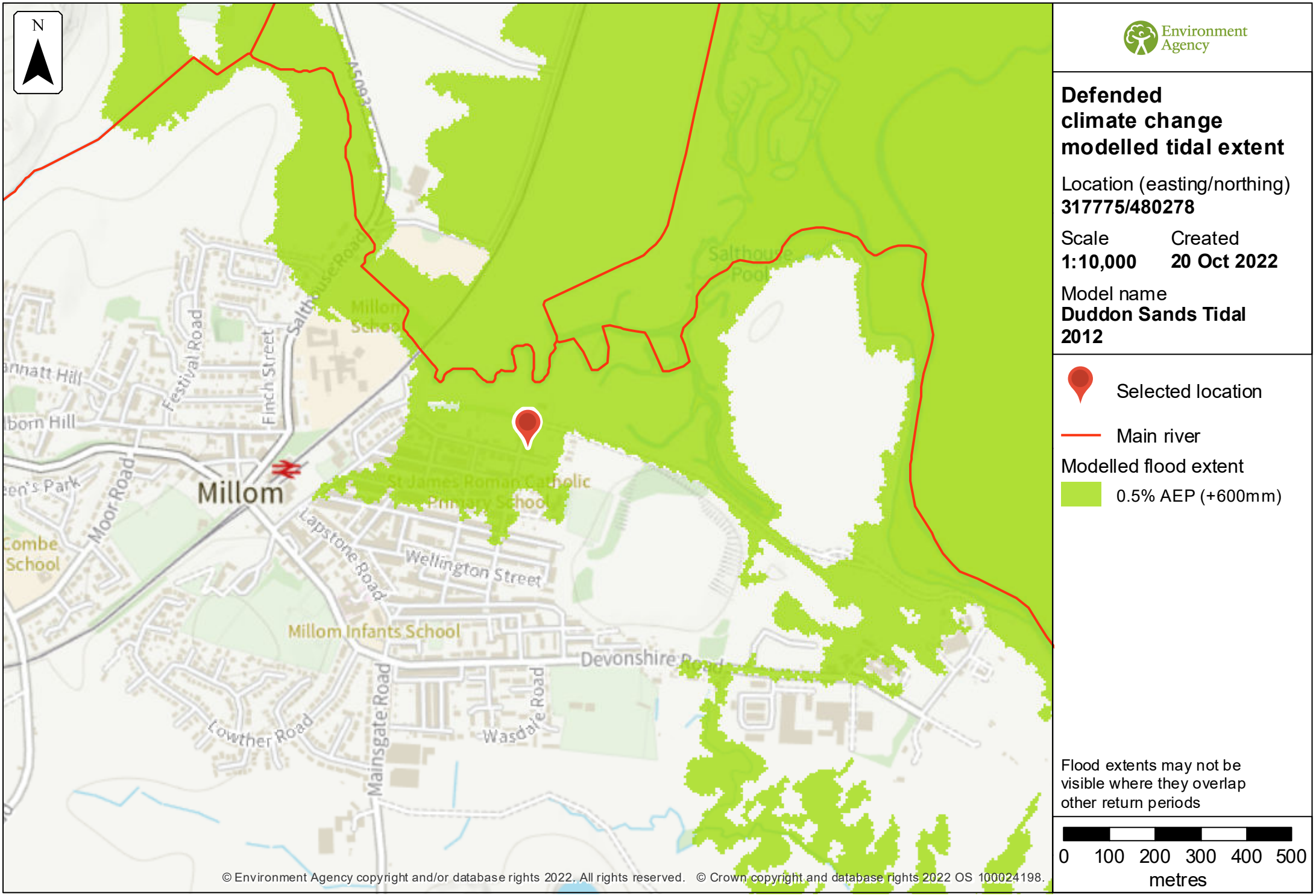
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Millom
Festival Road
Finch Street
Moor Road
Lapstone Road
Wellington Street
Millom Infants School
Devonshire Road
Mainsgate Road
Wasdale Road
Lowther Road
Millom School
St James Roman Catholic Primary School
Salthouse Pool
Combe School
Environment Agency
Defended climate change modelled tidal extent
Location (easting/northing)
317775/480278
Scale
1:10,000
Created
20 Oct 2022
Model name
Duddon Sands Tidal 2012
Selected location
Main river
Modelled flood extent
0.5% AEP (+600mm)
Flood extents may not be visible where they overlap other return periods
0 100 200 300 400 500
metres
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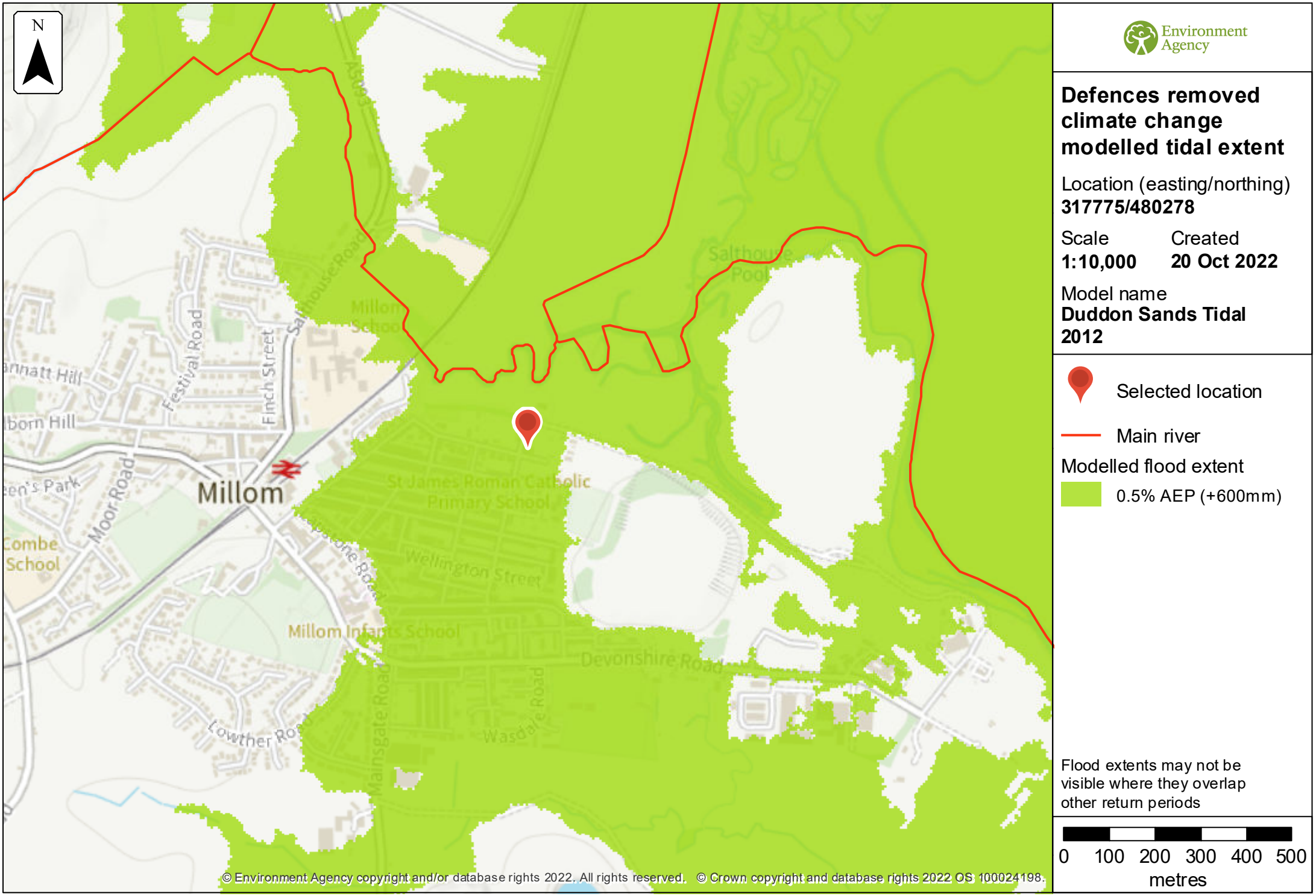
N
Millom
Festival Road
Finch Street
Moor Road
Millom School
St James Roman Catholic Primary School
Wellington Street
Millom Infants School
Devonshire Road
Wasdale Road
Mainsgate Road
Lowther Road
Salthouse Road
Salthouse Pool
Environment Agency
Defences removed climate change modelled tidal extent
Location (easting/northing)
317775/480278
Scale
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Flood extents may not be visible where they overlap other return periods
0 100 200 300 400 500
metres
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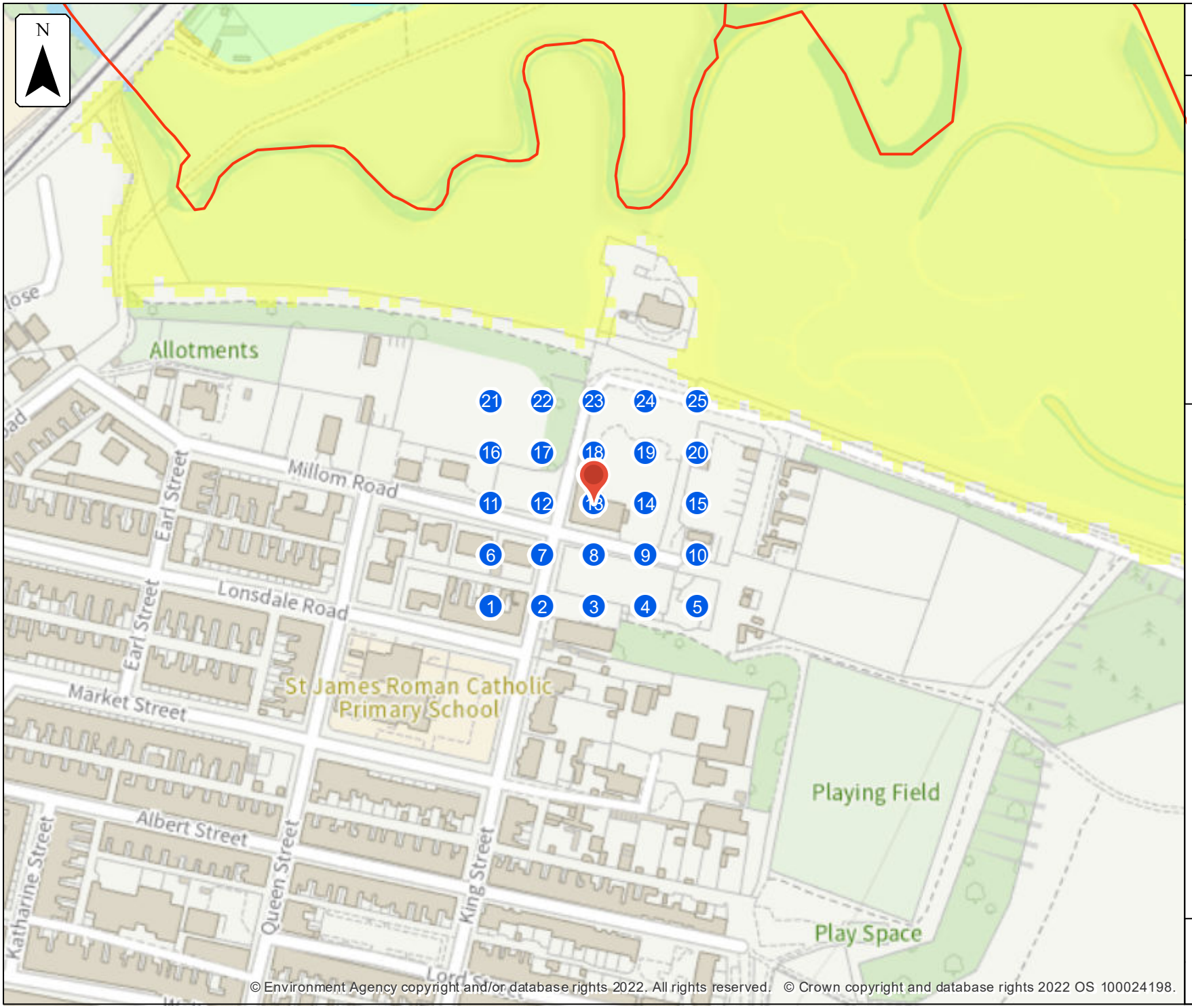


Environment Agency

Defended modelled tidal extent and height

Location (easting/northing)
317775/480278

Scale
1:2,500

Created
20 Oct 2022

Model name
Duddon Sands Tidal 2012

Selected location

Main river

Modelled 2D grid
Water level in mAOD

- 0 - 6.0
- 6.0 - 6.125
- 6.125 - 6.25
- 6.25 - 6.375
- 6.375 - 6.5
- 6.5 - 6.625
- 6.625 - 6.75
- 6.75 - 6.875
- 6.875 - 7.0

This map shows the 0.1% AEP height data

0 25 50 75 100
metres

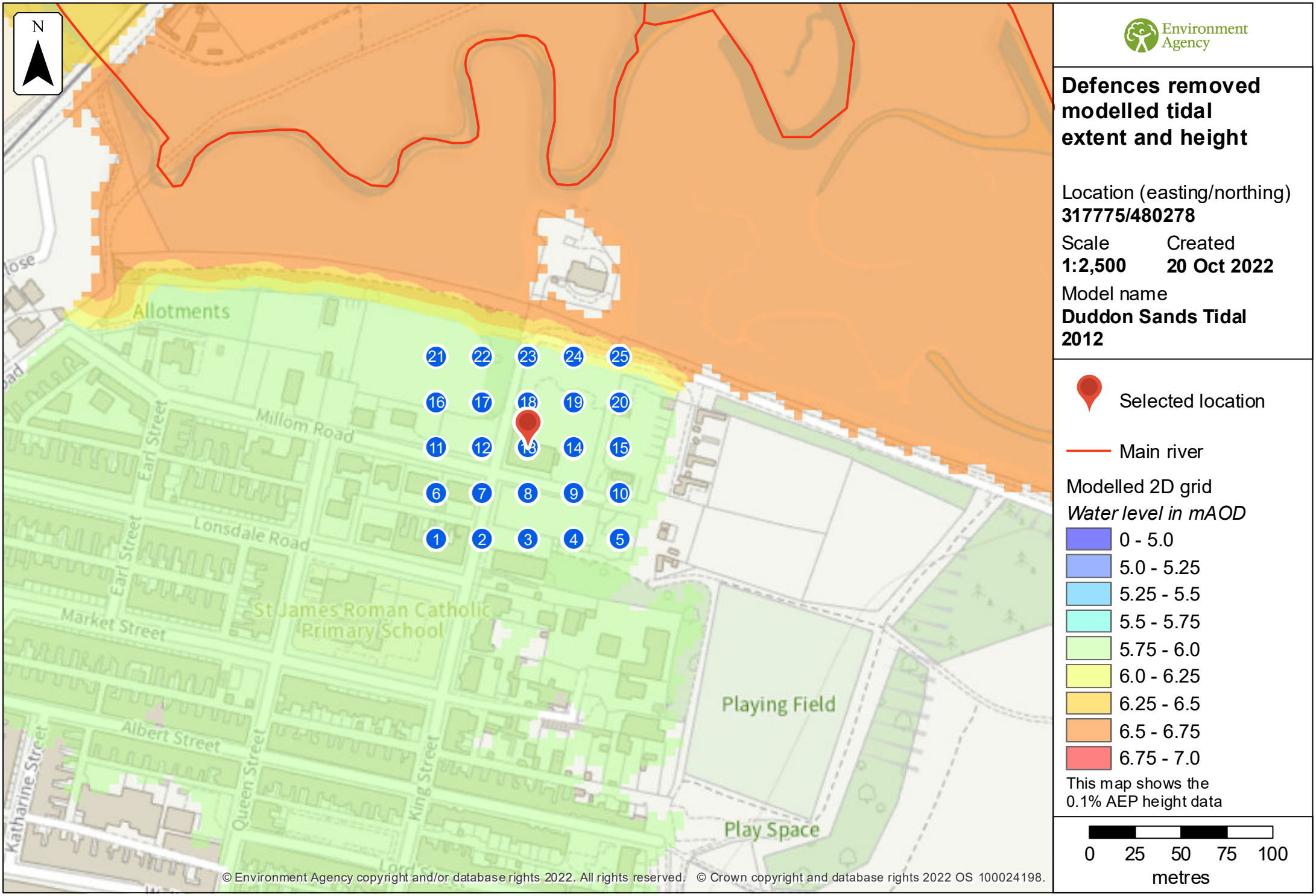
Sample point data

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	317725	480228	NoData	NoData			NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
2	317750	480228	NoData	NoData			NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
3	317775	480228	NoData	NoData			NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
4	317800	480228	NoData	NoData			NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
5	317825	480228	NoData	NoData			NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
6	317725	480253	NoData	NoData			NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
7	317750	480253	NoData	NoData			NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
8	317775	480253	NoData	NoData			NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
9	317800	480253	NoData	NoData			NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
10	317825	480253	NoData	NoData			NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
11	317725	480278	NoData	NoData			NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
12	317750	480278	NoData	NoData			NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
13	317775	480278	NoData	NoData			NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
14	317800	480278	NoData	NoData			NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
15	317825	480278	NoData	NoData			NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
16	317725	480303	NoData	NoData			NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData

Label	Easting	Northing	5% AEP		2% AEP		1.33% AEP		1% AEP		0.5% AEP		0.1% AEP	
			Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height
17	317750	480303	NoData	NoData			NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
18	317775	480303	NoData	NoData			NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
19	317800	480303	NoData	NoData			NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
20	317825	480303	NoData	NoData			NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
21	317725	480328	NoData	NoData			NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
22	317750	480328	NoData	NoData			NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
23	317775	480328	NoData	NoData			NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
24	317800	480328	NoData	NoData			NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
25	317825	480328	NoData	NoData			NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData

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



Environment Agency

Defences removed modelled tidal extent and height

Location (easting/northing)
317775/480278

Scale
1:2,500

Created
20 Oct 2022

Model name
Duddon Sands Tidal 2012

Selected location

Main river

Modelled 2D grid
Water level in mAOD

- 0 - 5.0
- 5.0 - 5.25
- 5.25 - 5.5
- 5.5 - 5.75
- 5.75 - 6.0
- 6.0 - 6.25
- 6.25 - 6.5
- 6.5 - 6.75
- 6.75 - 7.0

This map shows the 0.1% AEP height data

0 25 50 75 100
metres

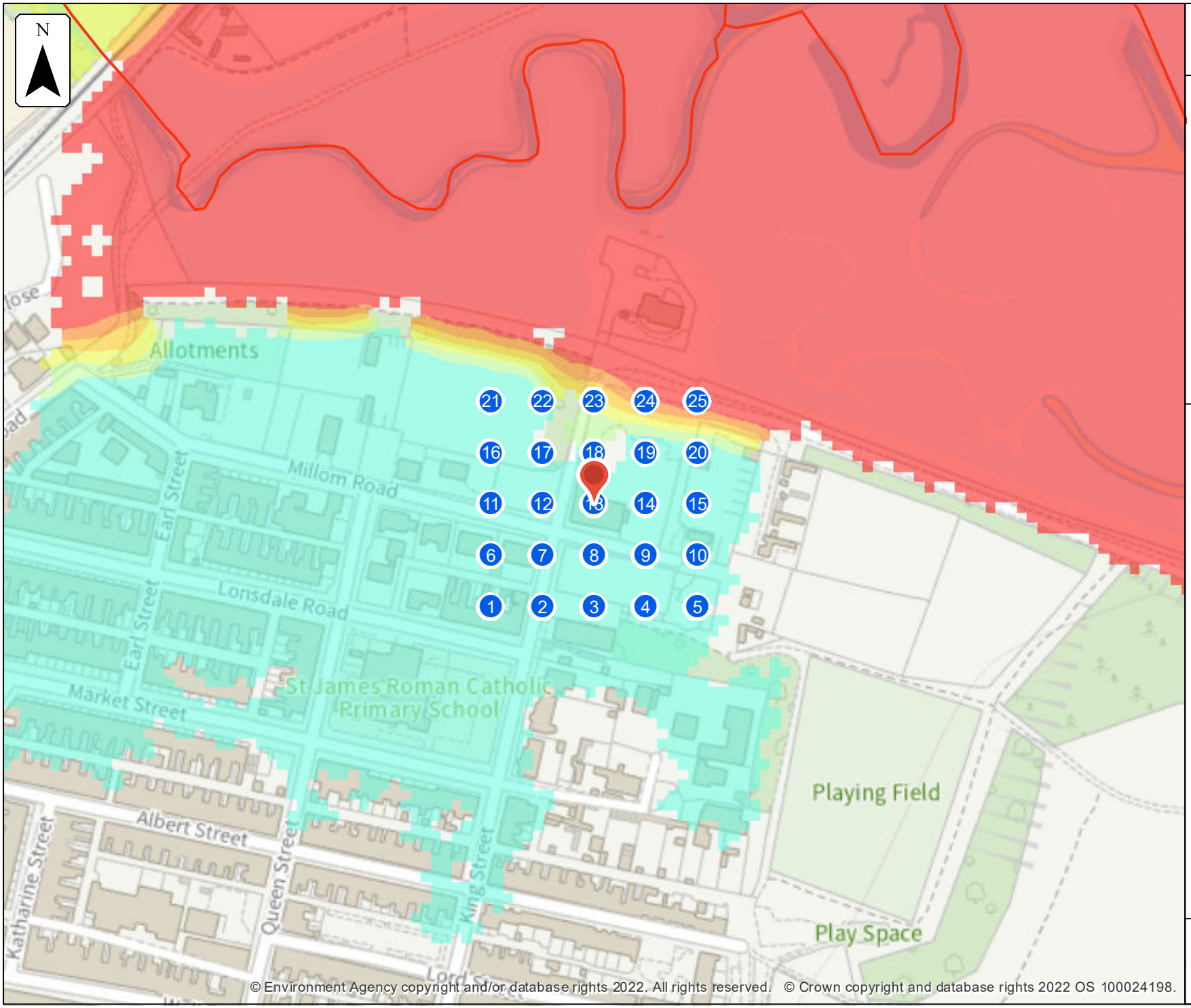
Sample point data

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	317725	480228					NoData	NoData	NoData	NoData	NoData	NoData	0.97	5.79
2	317750	480228					NoData	NoData	NoData	NoData	NoData	NoData	1.05	5.79
3	317775	480228					NoData	NoData	NoData	NoData	0.16	4.79	1.16	5.79
4	317800	480228					NoData	NoData	NoData	NoData	NoData	NoData	0.87	5.79
5	317825	480228					NoData	NoData	NoData	NoData	0.07	4.69	1.16	5.79
6	317725	480253					NoData	NoData	NoData	NoData	NoData	NoData	0.88	5.79
7	317750	480253					NoData	NoData	NoData	NoData	NoData	NoData	1.03	5.79
8	317775	480253					NoData	NoData	NoData	NoData	NoData	NoData	1.05	5.79
9	317800	480253					NoData	NoData	NoData	NoData	NoData	NoData	1.04	5.79
10	317825	480253					NoData	NoData	NoData	NoData	0.19	4.77	1.21	5.79
11	317725	480278					NoData	NoData	NoData	NoData	0.08	4.79	1.07	5.79
12	317750	480278					NoData	NoData	NoData	NoData	0.14	4.79	1.14	5.79
13	317775	480278					NoData	NoData	NoData	NoData	0.10	4.79	1.11	5.79
14	317800	480278					NoData	NoData	0.14	4.45	0.47	4.79	1.47	5.79
15	317825	480278					NoData	NoData	0.09	4.45	0.42	4.79	1.43	5.79
16	317725	480303					0.01	4.55	0.03	4.63	0.17	4.79	1.17	5.79

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	317750	480303					NoData	NoData	0.03	4.63	0.12	4.79	1.12	5.79
18	317775	480303					NoData	NoData	NoData	NoData	0.14	4.79	1.15	5.79
19	317800	480303					NoData	NoData	0.15	4.45	0.49	4.79	1.49	5.79
20	317825	480303					NoData	NoData	0.13	4.45	0.47	4.79	1.47	5.79
21	317725	480328					0.23	4.55	0.31	4.63	0.47	4.80	1.47	5.79
22	317750	480328					0.15	4.55	0.22	4.63	0.38	4.79	1.38	5.79
23	317775	480328					NoData	NoData	0.07	4.60	0.23	4.81	1.18	5.80
24	317800	480328					NoData	NoData	0.03	4.45	0.14	5.26	0.47	6.01
25	317825	480328					NoData	NoData	NoData	NoData	0.00	5.67	0.05	6.23

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



Environment Agency

Defended climate change modelled tidal extent and height

Location (easting/northing)
317775/480278

Scale
1:2,500

Created
20 Oct 2022

Model name
Duddon Sands Tidal 2012

Selected location

Main river

Modelled 2D grid
Water level in mAOD

- 0 - 5.0
- 5.0 - 5.25
- 5.25 - 5.5
- 5.5 - 5.75
- 5.75 - 6.0
- 6.0 - 6.25
- 6.25 - 6.5
- 6.5 - 6.75
- 6.75 - 7.0

This map shows the 0.5% AEP +600mm height data

0 25 50 75 100
metres

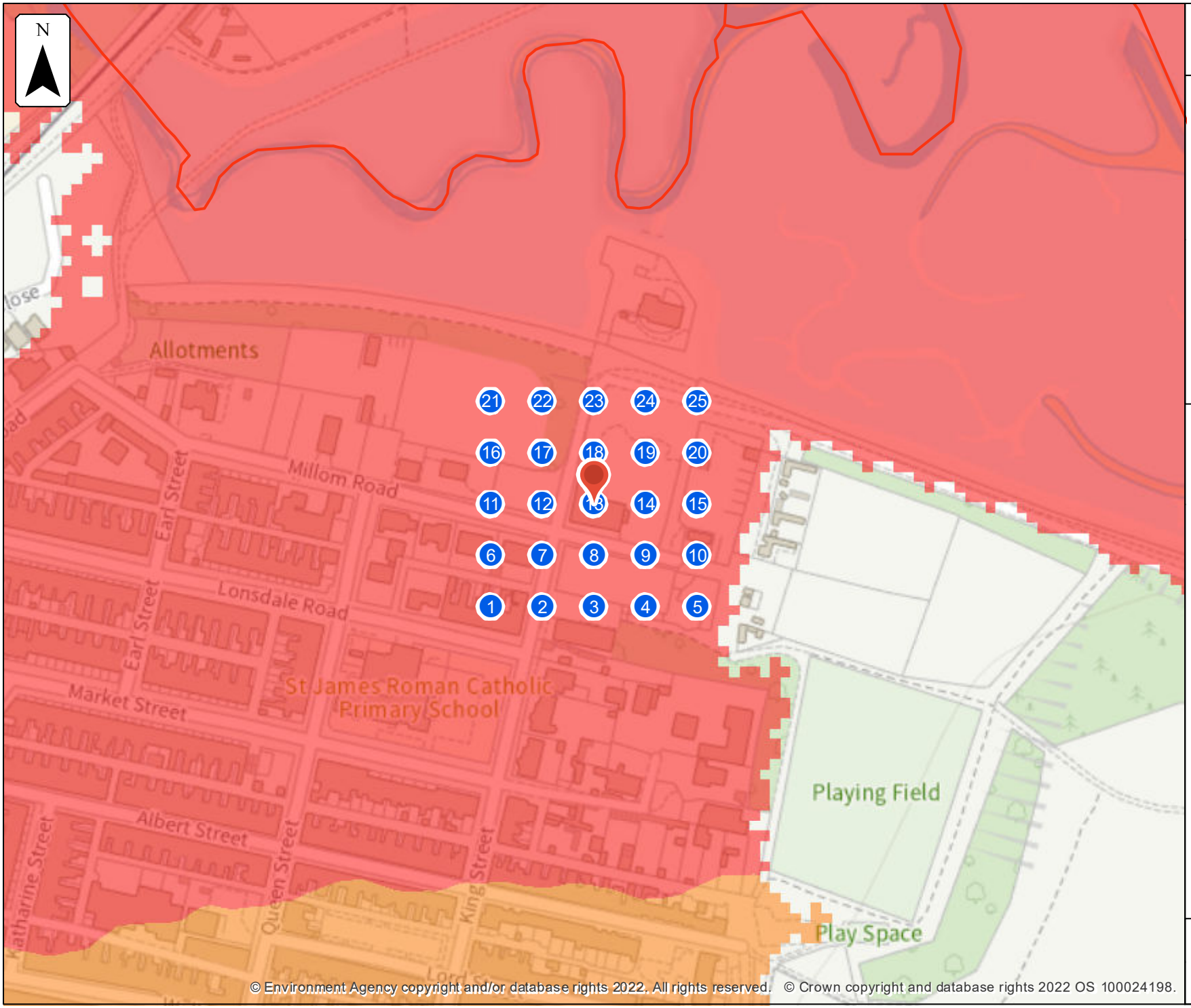
Sample point data

Defended climate change

Label	Easting	Northing	0.5% AEP (+600mm)	
			Depth	Height
1	317725	480228	0.75	5.57
2	317750	480228	0.83	5.57
3	317775	480228	0.94	5.57
4	317800	480228	0.65	5.57
5	317825	480228	0.94	5.57
6	317725	480253	0.66	5.57
7	317750	480253	0.80	5.57
8	317775	480253	0.83	5.57
9	317800	480253	0.82	5.57
10	317825	480253	0.99	5.57
11	317725	480278	0.85	5.57
12	317750	480278	0.92	5.57
13	317775	480278	0.86	5.57
14	317800	480278	1.25	5.57
15	317825	480278	1.21	5.57
16	317725	480303	0.95	5.57

Label	Easting	Northing	0.5% AEP (+600mm)	
			Depth	Height
17	317750	480303	0.43	5.57
18	317775	480303	0.21	5.71
19	317800	480303	1.01	5.57
20	317825	480303	0.69	5.61
21	317725	480328	1.25	5.57
22	317750	480328	0.98	5.67
23	317775	480328	0.56	6.05
24	317800	480328	0.12	6.59
25	317825	480328	0.17	6.89

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



Environment Agency

Defences removed climate change modelled tidal extent and height

Location (easting/northing)
317775/480278

Scale
1:2,500

Created
20 Oct 2022

Model name
Duddon Sands Tidal 2012

Selected location

Main river

Modelled 2D grid
Water level in mAOD

- 0 - 6.0
- 6.0 - 6.125
- 6.125 - 6.25
- 6.25 - 6.375
- 6.375 - 6.5
- 6.5 - 6.625
- 6.625 - 6.75
- 6.75 - 6.875
- 6.875 - 7.0

This map shows the 0.5% AEP +600mm height data

0 25 50 75 100
metres

Sample point data

Defences removed climate change

Label	Easting	Northing	0.5% AEP (+600mm)	
			Depth	Height
1	317725	480228	2.12	6.94
2	317750	480228	2.20	6.94
3	317775	480228	2.31	6.94
4	317800	480228	2.02	6.94
5	317825	480228	2.31	6.94
6	317725	480253	2.03	6.94
7	317750	480253	2.18	6.94
8	317775	480253	2.20	6.94
9	317800	480253	2.20	6.94
10	317825	480253	2.37	6.95
11	317725	480278	2.23	6.95
12	317750	480278	2.30	6.95
13	317775	480278	2.26	6.95
14	317800	480278	2.63	6.95
15	317825	480278	2.58	6.95
16	317725	480303	2.33	6.95

Label	Easting	Northing	0.5% AEP (+600mm)	
			Depth	Height
17	317750	480303	2.28	6.95
18	317775	480303	2.31	6.95
19	317800	480303	2.65	6.95
20	317825	480303	2.63	6.95
21	317725	480328	2.63	6.95
22	317750	480328	2.54	6.95
23	317775	480328	2.31	6.95
24	317800	480328	1.31	6.95
25	317825	480328	0.66	6.95

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

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