



## Appendix A: GeoPDF User Guide

Please tick the boxes next to the dataset titles in the map legend to display data. If data does not display, it means it is not present in that particular area.

Legend	Description	Reference
<u>Authority Information</u> <ul style="list-style-type: none"> <li>District Boundaries</li> <li>Watercourses</li> </ul>	<ul style="list-style-type: none"> <li>District Boundaries are the legal border lines that separate the study districts from other districts.</li> <li>Watercourses include freshwater rivers, tidal estuaries and canals, from the Ordnance Survey (OS) Open Rivers open-source mapping dataset.</li> </ul>	<b>Section 1.5</b> SFRA study area <b>Figure 1-1</b> <b>Figure 1-3</b>
<u>Historic</u> <ul style="list-style-type: none"> <li>Historic Flood Map (EA)</li> <li>Recorded Flood Outlines (EA)</li> <li>Cayton Flood Extent</li> </ul>	<ul style="list-style-type: none"> <li>The Environment Agency (EA) Historic Flood Map shows areas of land that have been previously subject to fluvial flooding in the area. This includes flooding from rivers, the sea and groundwater springs but excludes surface water.</li> <li>EA Recorded Flood Outlines show all records of historic flooding from rivers, the sea, groundwater and surface water. This may not include all LA/ LLFA flood incidents or records.</li> <li>The Cayton Flood outline was generated from an existing flood risk in Cayton map (adapted from the Cayton Flood Alleviation Assessment 2004).</li> </ul> <p>If an area is not covered by the Historic Flood Map/Recorded Flood Outlines, it does not mean that it has never flooded, only that currently there are no records of flooding in this area from the EA records. Other historic information is supplemented in the Level 1 report (section 5.1).</p>	<b>Section 5.1</b> Historical Flooding <b>Figure 5-1</b> <b>Appendix E</b>
<u>EA FMfP Flood Zones</u> <ul style="list-style-type: none"> <li>EA FZ3</li> <li>EA FZ2</li> </ul>	<p>The EA's Flood Map for Planning (FMfP) is an online mapping portal which shows the Flood Zones in England. They are formed from older national 2D generalised (broad-scale) modelling and updated periodically every year with detailed modelling outputs. In most places they should therefore reflect latest modelling where available, but not always, for example in this case, the River Esk which was completed only this year. The Flood Zones are for use in development planning and flood risk assessments.</p> <ul style="list-style-type: none"> <li>Flood Zone 3a – High probability: greater or equal to a 1% chance of river flooding in any given year or greater than a 0.5% chance of sea flooding in any given year. (Excludes Flood Zone 3b, which is derived as part of the SFRA).</li> <li>Flood Zone 2 – Medium probability: between a 1% and 0.1% chance of river flooding in any given year or 0.5% and 0.1% chance of sea flooding in any given year. This also includes the Historic Flood Map.</li> </ul>	<b>Section 3.2.1</b> The Flood Zones



Legend	Description	Reference
<p><u>Flood Zones (Modelled)</u></p> <ul style="list-style-type: none"> <li>Indicative Flood Zone 3b</li> <li>Flood Zone 3b</li> <li>Flood Zone 3a</li> <li>Flood Zone 2</li> </ul>	<p>These Flood Zones refer to where modelled outputs have been used.</p> <ul style="list-style-type: none"> <li>Flood Zone 3b – Functional Floodplain: This zone comprises land where water has to flow or be stored in times of flood. Flood Zone 3b is identified as land which would flood with an annual probability of 1 in 20 years, where detailed hydraulic modelling exists.</li> <li>Indicative Flood Zone 3b – as above, but where no detailed modelled 20-year flood extent exists, then Flood Zone 3a has been used as a proxy – this is hatched to show the difference. This is conservative and developers would need to refine in a detailed site assessment.</li> <li>Flood Zone 3a – High probability: greater or equal to a 1% chance of river flooding in any given year or greater than a 0.5% chance of sea flooding in any given year. This is likely to be the same as the EA’s FMfP FZ3a, but if there are newer models not yet incorporated into the FMfP, then it will present the undefended 1% AEP event from the latest model.</li> <li>Flood Zone 2 – Medium probability: between a 1% and 0.1% chance of river flooding in any given year or 0.5% and 0.1% chance of sea flooding in any given year. This is likely to be the same as the EA’s FMfP FZ2, but if there are newer models not yet incorporated into the FMfP, then it will present the undefended 0.1% AEP (Annual Exceedance Probability) event from the latest model, combined with the Historic Flood Map.</li> </ul>	<p><b>Section 3.2.1</b> The Flood Zones (amber box)</p>
<p><u>Tidal Esk Flood Zones (Modelled)</u></p> <ul style="list-style-type: none"> <li>Tidal Esk Flood Zone 3b</li> <li>Tidal Esk Flood Zone 3a</li> <li>Tidal Esk Flood Zone 2</li> </ul>	<p>These are the latest tidal modelling outputs representing the Flood Zone events from the EA’s ‘River Esk and Tributaries Flood Risk Mapping’ study 2016-2020, which are not yet incorporated into the EA’s Flood Map for Planning.</p>	<p><b>Section 3.2.1</b> The Flood Zones (amber box)</p>
<p><u>Climate Change Extent (Modelled)</u></p> <ul style="list-style-type: none"> <li>Climate Change Central</li> <li>Climate Change Higher Central</li> <li>Climate Change Upper End</li> </ul>	<p>These extents are from existing hydraulic models, where the 1% AEP (100-year flow) is upscaled by the EA’s climate change allowances for the 2080s epoch for the relevant river basin.</p> <p>In the absence of modelled climate change outputs, Flood Zone 2 can be used as a proxy, until detailed modelling is undertaken at site-specific FRA stage.</p>	<p><b>Section 4</b> Impact of Climate Change</p>



Legend	Description	Reference
<p><u>Coastal (Modelled)</u></p> <ul style="list-style-type: none"> <li>• PD (95%) 0.5% AEP</li> <li>• PD (95%) 0.1% AEP</li> <li>• Coastal Higher Central</li> <li>• Coastal Upper End</li> </ul>	<ul style="list-style-type: none"> <li>• PD (Present Day)</li> <li>• 0.5% - each year the area has a 1 in 200 chance of flooding</li> <li>• 0.1% - each year the area has a 1 in 1000 chance of flooding</li> <li>• There are a range of allowances for sea level rise based on percentiles. A percentile describes the proportion of possible scenarios that fall below an allowance level.</li> </ul> <p>The <b>higher central</b> climate change allowance is based on the 70th percentile and <b>upper end</b> climate change allowance is based on the 95th percentile. There is little change between the 70<sup>th</sup> and 95<sup>th</sup> percentiles in the mapping, hence only the 95<sup>th</sup> has been shown for present day.</p>	<p><b>Section 4.4</b> Representing climate change in the Level 1 SFRA</p>
<p><u>Risk of Flooding from Rivers and Sea (EA)</u></p> <ul style="list-style-type: none"> <li>• Very low</li> <li>• Low</li> <li>• Medium</li> <li>• High</li> </ul>	<p>The Risk of Flooding from Rivers and Sea maps have been generated from the EA's National Flood Risk Assessment (NaFRA) and National Receptor Dataset (NRD).</p> <ul style="list-style-type: none"> <li>• Very low risk: each year there is a chance of flooding of less than 1 in 1000 (0.1%)</li> <li>• Low risk: each year there is a chance of flooding of between 1 in 1000 (0.1%) and 1 in 100 (1%).</li> <li>• Medium risk: each year there is a chance of flooding of between 1 in 100 (1%) and 1 in 30 (3.3%).</li> <li>• High risk: each year there is a chance of flooding of greater than 1 in 30 (3.3%).</li> </ul>	<p><b>Section 5.4</b> Fluvial flood risk <b>Appendix E</b></p>
<p><u>Risk of Flooding from Surface Water (EA)</u></p> <ul style="list-style-type: none"> <li>• RoFSW 3.3% AEP</li> <li>• RoFSW 1% AEP</li> <li>• RoFSW 0.1% AEP</li> </ul>	<p>The EA's Risk of Flooding from Surface Water (RoFfSW) flood maps give an indication of the broad areas likely to be at risk of surface water flooding. This includes flooding that takes place from the surface runoff generated by rainwater.</p> <ul style="list-style-type: none"> <li>• 3.3% - each year the area has a 1 in 30 chance of flooding</li> <li>• 1% - each year the area has a 1 in 100 chance of flooding</li> <li>• 0.1% - each year the area has a 1 in 1000 chance of flooding</li> </ul>	<p><b>Section 5.6</b> Surface water flooding <b>Appendix E</b></p>
<p><u>EA Flood Alert and Warning Areas</u></p> <ul style="list-style-type: none"> <li>• Flood Warning</li> <li>• Flood Alert</li> </ul>	<ul style="list-style-type: none"> <li>• Flood Warnings are issued to designated Flood Warning Areas when a river level hits a certain threshold, heavy rainfall or high tides and strong winds are forecast. "Flooding is expected, immediate action is required".</li> <li>• Flood Alerts are issued when there is water out of bank for the first time <i>anywhere in the catchment</i> and when forecasts indicate flooding may be possible. "Flooding is possible, be prepared".</li> <li>• Both of these datasets are a polygon GIS shapefile where the above are issued; they are not flood extents.</li> </ul>	<p><b>Section 5.10</b> Flood Alert and Flood Warnings <b>Appendix D</b> Flood Alert and Flood Warnings</p>



Legend	Description	Reference
<p><u>Defences</u></p> <ul style="list-style-type: none"> <li>• Embankment</li> <li>• Wall</li> <li>• Foss FSA</li> <li>• Filey FAS</li> </ul>	<p>EA Asset Information Management System (AIMS) spatial Flood Defence dataset, shows flood defences currently owned, managed or inspected by the EA. A defence is any asset that provides flood defence or coastal protection functions. This layer has been categorised to show only formal embankments and walls where defences are known to be present.</p> <p>The outline of the following two Flood Alleviation Schemes has been digitised from data provided by the Councils for inclusion in the mapping:</p> <ul style="list-style-type: none"> <li>- Foss FSA (Flood Storage Area) aims to reduce peak flows in the river and reduce risk of flooding downstream.</li> <li>- Filey FAS (Flood Alleviation Scheme) involves construction of flood defences, flood water storage areas and drainage channels and culverts to redirect floodwater flows around various sites in Filey.</li> </ul>	<p><b>Table 6-2</b> Locations shown in the 'EA AIMS' dataset</p> <p><b>Section 6.5</b> Existing and future flood alleviation schemes</p>
<p><u>Groundwater Levels Risk Mapping (JBA)</u></p> <ul style="list-style-type: none"> <li>• Less than 0.025m below surface</li> <li>• Between 0.025-0.5m below surface</li> <li>• Between 0.5-5m below surface</li> <li>• At least 5m below surface</li> <li>• No risk</li> </ul>	<p>JBA's Groundwater Flood Risk map shows the level of groundwater below the surface, at a resolution of 5m. Flood risk could increase when groundwater is already high or emerged, causing additional overland flow paths or areas of still ponding.</p>	<p><b>Section 5.8</b> Groundwater flooding</p> <p><b>Appendix E</b></p>
<p><u>Susceptibility to Groundwater Flooding (EA)</u></p> <ul style="list-style-type: none"> <li>• &lt;25%</li> <li>• ≥25%&lt;50%</li> <li>• ≥50%&lt;75%</li> <li>• ≥75%</li> </ul>	<p>The EA's groundwater flooding susceptibility data shows the degree to which areas of England, Scotland and Wales are susceptible to groundwater flooding on the basis of geological and hydrogeological conditions. This is shown at a resolution of 50m. It does not show the likelihood of groundwater flooding occurring, i.e. it is a hazard not risk-based dataset.</p>	<p><b>Section 5.8</b> Groundwater flooding</p> <p><b>Appendix E</b></p>

## Appendix B - Data sources used in the SFRA

### 1 Historical Flooding

North Yorkshire County Council provided Section 19 reports in the area and information of historical flooding events across the area of Scarborough Borough. The Environment Agency's Historic Flood Map is also presented in Appendix A: GeoPDF Mapping. Section 5.1 documents historic flooding records obtained.

### 2 Fluvial flooding

#### 2.1 Flood Zones 2 and 3a

Flood Zones 2 and 3a, as shown in the Appendix A mapping, show the same extent as the online Environment Agency's Flood Map for Planning (which incorporates latest modelled data), where available, except for the following areas where the modelled data was not fully incorporated into the EA Flood Zones:

- River Esk at Whitby
- Vale of Pickering
- River Derwent from Old Malton to Buttercrambe
- Sea-Cut (Scalby Beck) south of West Ayton

Figure B-1 shows the coverage of these models. The extents for these areas have been replaced with the modelled outputs.

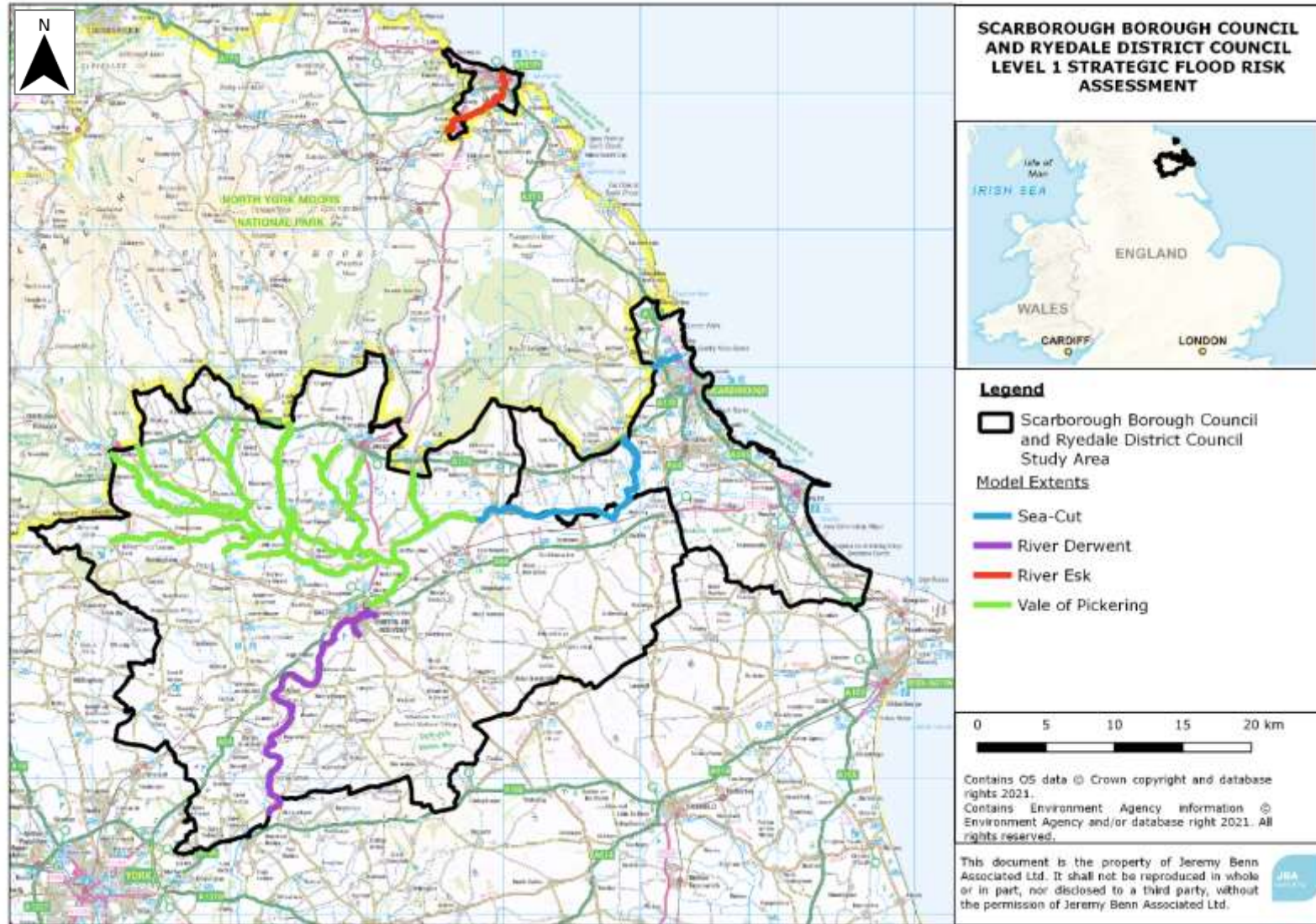
Over time, the online mapping is likely to be updated more often than the SFRA, so SFRA users should check there are no major changes in their area.

#### 2.2 Flood Zone 3b (the Functional Floodplain)

Flood Zone 3b, as shown in Appendix A mapping, has been compiled for the study area as part of this SFRA and is based on the 5% AEP (1 in 20-year chance of flooding in any given year) or 4% AEP (1 in 25-year chance of flooding in any given year) extents produced from Environment Agency detailed hydraulic models where outputs were available (see Figure B-1 for model coverage).

For areas not covered by detailed EA models, a precautionary approach should be adopted for Flood Zone 3b with the assumption that the extent of Flood Zone 3b would be equal to Flood Zone 3a. If development is shown to be in Flood Zone 3a (or Flood Zone 3b derived from 2D generalised modelling), further work should be undertaken as part of a detailed site-specific Flood Risk Assessment to define the extent of Flood Zone 3b.

If the area of interest is in an area that has seen some major changes to the extent of the Flood Zones, having checked the online mapping, developers will also need to remap Flood Zone 3b as part of a detailed site-specific Flood Risk Assessment.



**Figure B-1: Existing hydraulic modelling coverage**

### 3 Climate change

Detailed Environment Agency hydraulic models were obtained. For the Sea Cut model the 100-year flows were upscaled by the Derwent Humber Management Catchment 2080's scenarios (+22% and +33%) under the new Environment Agency guidance released in 2021. For most of the other models, 100-year flows upscaled by the previous guidance for the Humber basin's 2080s scenarios (+20% and +30%) were available which were deemed suitable to use following discussion with the EA. For the River Derwent model just the 20% climate change allowance was available, however, this model was not re-run for the Level 1 SFRA as this model is due to be updated for the Level 2 SFRA. Where there were no detailed models available, Flood Zone 2 has been used as an indication of climate change. Figure B-1 shows the existing EA model coverage, where climate change outputs were either already available or were run as part of this SFRA (Sea-Cut – see section 3.1).

Please refer to Chapter 4 for information on the approach to climate change in this SFRA.

#### 3.1 Sea-Cut (Scalby Beck) model

The Sea-Cut (Scalby Beck) through Scarborough Borough and Ryedale is represented by the Environment Agency's Sea-Cut 1D-2D HEC-RAS hydraulic model (2018). This model was re-run with updated climate change guidance released by the Environment Agency in July 2021 (+22% and +33% for the Derwent Humber Management Catchment). The baseline scenario has been used to inform FZ3b and climate change extents.

### 4 Coastal flooding

Coastal projection modelling was run for the present day (2021) along the east coast of Scarborough Borough. The present-day water levels were uplifted using the UKCP18 climate projections for 2121 for both the higher central and upper end allowances for extreme still water levels.

The tidal section of the River Esk is also represented by the Environment Agency's Tidal Esk 1D-2D ESTRY-TUFLOW hydraulic model (2020).

Coastal flood risk was also assessed using the Tyne to Flamborough Head Shoreline Management Plan and the national coastal erosion risk mapping (2018-2021) which is published online by the Environment Agency. These datasets provide information regarding the short, medium and long-term coastal management strategies to understand potential areas of coastal erosion.

Section 5.5 of the Main Report explains coastal flooding.

### 5 Surface water flooding

Mapping of surface water flood risk in the study area has been taken primarily from the Risk of Flooding from Surface Water (RoFfSW) maps published online by the Environment Agency. These maps are intended to provide a consistent standard of assessment for surface water flood risk across England and Wales in order to help LLFAs, the Environment Agency and any potential developers to focus their management of surface water flood risk.



The RoFfSW is derived primarily from identifying topographical flow paths of existing watercourses or dry valleys that contain some isolated ponding locations in low lying areas. They provide a map which displays different levels of surface water flood risk depending on the annual probability of the land in question being inundated by surface water (Table B-1).

**Table B-1: RoFfSW risk categories**

Category	Definition
High	Flooding occurring as a result of rainfall with a greater than 1 in 30 chance in any given year (annual probability of flooding 3.3%)
Medium	Flooding occurring as a result of rainfall of between 1 in 100 (1%) and 1 in 30 (3.3%) chance in any given year.
Low	Flooding occurring as a result of rainfall of between 1 in 1,000 (0.1%) and 1 in 100 (1%) chance in any given year.

A detailed surface water model for Scarborough was provided by North Yorkshire County Council. Here the RoFfSW mapping was replaced with the model outputs. Figure B-2 shows the extent of the Scarborough surface water model.

Although the RoFfSW offers improvement on previously available datasets, the results should not be used to understand flood risk for individual properties. The results should be used for high level assessments such as SFRA for local authorities. If a site is indicated in the Environment Agency mapping to be at risk from surface water flooding, a more detailed assessment should be considered to more accurately illustrate the flood risk at a site-specific scale.

## 6 Groundwater

Mapping of groundwater flood risk has been based on the Areas Susceptible to Groundwater Flooding 2010 (AStGWF) dataset and the JBA Groundwater Flood Risk map.

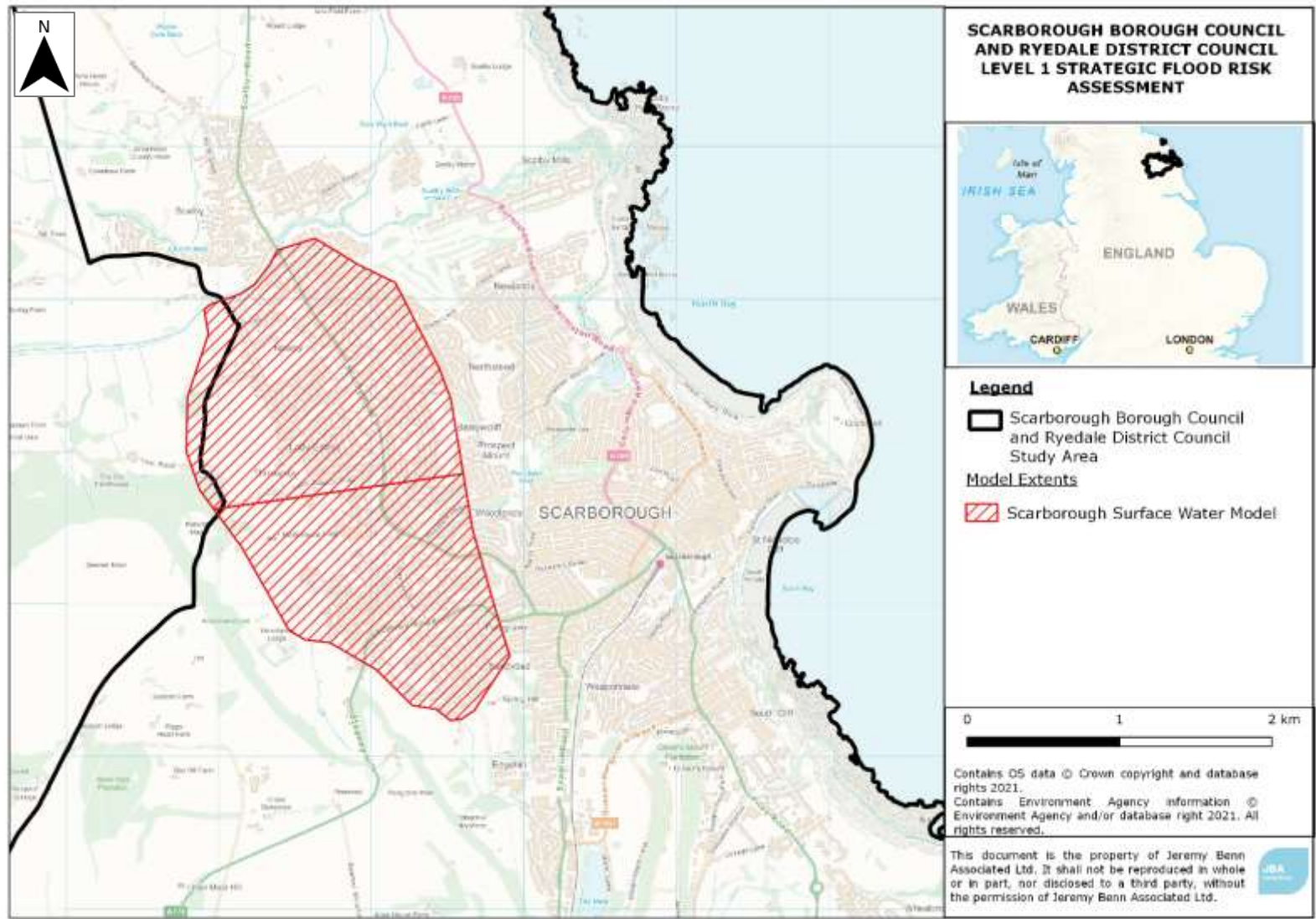
The AStGWF dataset is a strategic-scale map showing groundwater flood areas on a 1km square grid. It shows the proportion of each 1km grid square, where geological and hydrogeological conditions indicate that groundwater might emerge. It does not show the likelihood of groundwater flooding occurring and does not take account of the chance of flooding from groundwater rebound (e.g. following cessation of mining or industrial activity). This dataset covers a large area of land, and only isolated locations within the overall susceptible area are likely to suffer the consequences of groundwater flooding.

The AStGWF data should be used only in combination with other information, for example local data or historical data. It should not be used as sole evidence for any specific flood risk management, land use planning or other decisions at any scale. However, the data can help to identify areas for assessment at a local scale.

The JBA Groundwater Flood Risk map shows groundwater flood risk on a 5m square grid. For each grid cell, a depth range is given for modelled groundwater levels in the 100-year return period flood event. It takes into account factors including topography, groundwater recharge volumes and spatial variations in aquifer storage and transmission properties.

Section 5.8 of the Main Report explains groundwater flooding.





**Figure B-2: Scarborough surface water model extent**



## 7 Sewers

Historical incidents of flooding are detailed by Yorkshire Water through their Hydraulic Flood Risk Register (HFRR). The HFRR database records incidents of flooding relating to public foul, combined or surface water sewers and displays which properties suffered flooding.

Section 5.7 of the Main Report presents this data.

## 8 Reservoirs

The risk of inundation because of reservoir breach or failure of reservoirs within the area has been mapped using the outlines produced as part of the National Inundation Reservoir Mapping (NIRIM) study, and are shown online on the Long-Term Risk of Flooding website at the time of publication. Section 5.9 of the Main Report presents the reservoirs affecting Scarborough Borough and Ryedale.

## 9 Flood Defences

The Environment Agency supplied the location of all flood defences within the district in their AIMS database, including information relating to the type of flood defence and their standard of protection. The Areas Benefitting from Defences shapefile was also considered. Chapter 6 of the Main Report provides information on flood defences and schemes.

## 10 Overview of supplied data

Overview of supplied data for the Scarborough Borough and Ryedale SFRA from stakeholders is as follows:

Source of flood risk	Data used to inform the assessment	Data supplied by
Historic (all sources)	Historic Flood Map Recorded Flood Outlines Hydraulic Modelling Reports	Environment Agency
	Section 19 Reports	North Yorkshire County Council
	Historic Flooding Incidents for Scarborough Borough	North Yorkshire County Council
Fluvial (including climate change)	Sea-Cut (Scalby Beck) (2018) 1D-2D HEC-RAS Hydraulic Model River Derwent (2009) 1D-2D ISIS-TUFLOW Hydraulic Model Vale of Pickering (2019) Hydraulic Model River Esk (2020) (1D-2D) ESTRY-TUFLOW Hydraulic Model	Environment Agency
	Flood Map for Planning Flood Zones	Environment Agency
	Coastal	Projection modelling
Coastal Strategy Reports		Scarborough Borough Council
Shoreline Management Plan		Environment Agency
National coastal erosion risk mapping (2018-2021)		Environment Agency



Surface Water	Risk of Flooding from Surface Water dataset	Environment Agency
	Scarborough Local Model	North Yorkshire County Council
Sewers	Hydraulic Flooding Risk Register (HFRR)	Yorkshire Water
Groundwater	Areas Susceptible to Groundwater Flooding dataset Bedrock geology/superficial deposits datasets (online dataset)	Environment Agency
	Groundwater Flood Risk Map	JBA
Reservoir	National Inundation Reservoir Mapping (Long term flood risk map)	Environment Agency
Flood Defences	Location and description of flood defences	Environment Agency
Cross-boundary impacts	Neighbouring authority sites and Local Plan information, to help assess cross-boundary impacts and the cumulative impact assessment	City of York Council East Riding of Yorkshire Council Hambleton District Council North Yorkshire Moors National Park Authority Redcar and Cleveland Borough Council
Other datasets	Partner Data Catalogue: <ul style="list-style-type: none"> <li>- Source Protection Zones</li> <li>- Aquifer Designation Maps</li> <li>- Areas Susceptible to Groundwater Flooding</li> <li>- Detailed River Network</li> <li>- Flood Alert Areas</li> <li>- Flood Warning Areas</li> <li>- Flood Maps for Planning</li> <li>- Groundwater Vulnerability</li> <li>- Historic Flood Map</li> <li>- Risk of Flooding from Rivers and Sea</li> </ul>	Environment Agency (via SBC and RDC)

Flood risk source / information source	Relevant sections of this SFRA	Result	Level of concern	Recommendations	Sequential and Exception Tests
Fluvial / Coastal (Flood Zones)	5 - Understanding flood risk in Scarborough and Ryedale	Significant proportion (e.g. greater than 50%) of site in Flood Zones (2 and 3)	High	Residential development on a site in this zone is unlikely to be appropriate unless the site is in an area benefitting from defence and can be made safe for the intended lifespan.	Sites in these categories should be explicitly addressed in a Sequential Test and may require preparation of further evidence to substantiate that Exception Test can be satisfied. Evidence from a Level 2 SFRA is required to demonstrate that the principle of development is supported.
		A proportion (e.g. less than 50%) of site in Flood Zones (2 and 3)	Medium	Residential development may be appropriate, sequential approach should be applied to avoid developing in flood zones as far as reasonable. Parts of the site within flood zone 1 should also be reviewed against the criteria described below.	
		Site located in Flood Zone 1	Medium	Residential development is probably appropriate in this zone, however catchments <3km <sup>2</sup> in area are not covered by the Environment Agency Flood Zones and there may be a risk of flooding from small watercourses and/or other sources. These should be considered in conjunction with the DRN data and data on other sources of flooding. The surface water data in particular often highlights areas at risk of flooding from these smaller watercourses.	
Fluvial / Coastal - Climate change	4 - Impacts of climate change 5 - Understanding flood risk in Scarborough Borough and Ryedale	Significant proportion (e.g. greater than 50%) of site at risk of flooding from the future 1% AEP event (future 0.5% AEP event for coastal)	High	Residential development is unlikely to be appropriate unless the site is in an area benefitting from defence. Consideration should be given to the Standard of Protection of existing defences in relation to future climate change and any other measures necessary to provide appropriate standards of protection to proposed development.	Sites in these categories should be explicitly addressed in a Sequential Test and may require preparation of further evidence to substantiate that Exception Test can be satisfied. Evidence from a Level 2 SFRA is required to demonstrate that the principle of development is supported.
		A proportion (e.g. less than 50%) of site at risk of flooding from the future 1% AEP event (future 0.5% AEP event for coastal)	Medium	Residential development may be appropriate, sequential approach should be applied to avoid developing in the areas at risk of flooding as much as reasonable. Consideration should be given to the Standard of Protection of any defences in relation to future climate change and the commitment to deliver the required standards.	
		Site not at risk of flooding from the future 1% AEP event (future 0.5% AEP event for coastal)	Medium	Residential development is probably appropriate in this risk area, however this will depend on the present-day fluvial risk - refer to fluvial flood zone recommendations	

Flood risk source/ information source	Relevant sections of this SFRA	Result	Level of concern	Recommendations	Sequential and Exception Tests
Fluvial - Climate change proxy	4 - Impacts of climate change 5 - Understanding flood risk in Scarborough Borough and Ryedale	Significant proportion (e.g. greater than 50%) of site at risk of flooding from the 0.1% AEP event when used as a proxy for climate change	High	Residential development is unlikely to be appropriate unless the site is in an area benefitting from defence. Consideration should be given to the Standard of Protection of existing defences in relation to future climate change and any other measures necessary to provide appropriate standards of protection to proposed development.	Sites in these categories should be explicitly addressed in a Sequential Test and may require preparation of further evidence to substantiate that Exception Test can be satisfied. Evidence from a Level 2 SFRA (including detailed modelling of the impact of climate change) is required to demonstrate that the principle of development is supported.
		A proportion (e.g. less than 50%) of site at risk of flooding from the 0.1% AEP event when used as a proxy for climate change	Medium	Residential development may be appropriate, sequential approach should be applied to avoid developing in the areas at risk of flooding as much as reasonable. Consideration should be given to the Standard of Protection of any defences in relation to future climate change and the commitment to deliver the required standards.	
		Site not at risk of flooding from the 0.1% AEP event when used as a proxy for climate change	Low	Residential development is likely to be appropriate based on this criterion.	
Surface Water	5 - Understanding flood risk in Scarborough Borough and Ryedale	Significant proportion (e.g. >50%) of site is affected by surface water flooding (across all three surface water events)	High	Development on a site in this risk area is unlikely to be appropriate unless measures (including drainage) are in place to control overland flow.	Evidence may be required from a Level 2 SFRA to demonstrate that the principle of development is supported
		A proportion (e.g. <50%) of site is affected by surface water flooding (across all three surface water events)	Medium	Development may be appropriate and consultations should be held with the Lead Local Flood Authority.	
		No risk of surface water flooding	Low	Development is likely to be appropriate based on this criterion.	

Flood risk source/ information source	Relevant sections of this SFRA	Result	Level of concern	Recommendations	Sequential and Exception Tests
Surface Water - Climate change	4 - Impacts of climate change 5 - Understanding flood risk in Scarborough Borough and Ryedale	Significant proportion (e.g. greater than 50%) of site at risk of surface water flooding from the future 1% AEP event	High	Development on a site in this risk area is unlikely to be appropriate unless measures (including drainage) are in place to control overland flow.	Evidence may be required from a Level 2 SFRA to demonstrate that the principle of development is supported
		A proportion (e.g. less than 50%) of site at risk of surface water flooding from the future 1% AEP event	Medium	Development may be appropriate and consultations should be held with the Lead Local Flood Authority.	
		Site not at risk of surface water flooding from the future 1% AEP event	Low	Development may be appropriate in this risk area, however this will depend on the present-day flood risk - refer to surface water recommendations.	
Surface Water - Climate change proxy	4 - Impacts of climate change 5 - Understanding flood risk in Scarborough and Ryedale	Significant proportion (e.g. greater than 50%) of site at risk of surface water flooding from the 0.1% AEP event when used as a proxy for climate change	High	Development on a site in this risk area is unlikely to be appropriate unless measures (including drainage) are in place to control overland flow.	Evidence may be required from a Level 2 SFRA (including detailed modelling of the risk from climate change) to demonstrate that the principle of development is supported
		A proportion (e.g. less than 50%) of site at risk of surface water flooding from the 0.1% AEP event when used as a proxy for climate change	Medium	Development may be appropriate and consultations should be held with the Lead Local Flood Authority.	
		Site not at risk of surface water flooding from the 0.1% AEP event when used as a proxy for climate change	Low	Development is likely to be appropriate in this risk area.	
Groundwater	5 - Understanding flood risk in Scarborough Borough and Ryedale	Historic records of groundwater flooding within or near a site	Medium	The effect of this will depend on the location and historic evidence of known problems - a site-specific FRA should consider overland flow paths once groundwater has emerged. It is unlikely that infiltration SuDS will be appropriate and groundwater monitoring should be recommended.	
		Risk of flooding from groundwater is not negligible	Medium	Development might be appropriate but a site-specific FRA should consider groundwater risk. A high likelihood may mean infiltration SuDS are not appropriate and groundwater monitoring should be recommended.	
		Negligible risk of flooding from groundwater	Low	Development is likely to be appropriate in this risk area, however as groundwater datasets are generally produced nationally it is recommended that ground investigations are carried out and reported on within a site-specific FRA where this is required (known to be a problem locally).	
Reservoir inundation	5 - Understanding flood risk in Scarborough Borough and Ryedale	Maximum risk of flooding from reservoir inundation (is greater than 2m depth or 2m/s velocity)	High	Development on a site in this risk area might not be appropriate - this will be heavily dependent on the state of repair of the dam and the long term commitment to its management and maintenance. If development is considered, the local authority Emergency Planning team should be consulted to confirm that proposals can be safely implemented.	Level 2 SFRA required to provide evidence that the principle of development is supported
		Maximum risk of flooding from reservoir inundation (is less than 2 m depth or 2 m/s velocity)	Medium	Risk of flooding from reservoirs should not rule out development as the likelihood of reservoir breach is low, however risk should still be considered by the developer at site-specific FRA stage and an emergency plan is likely to be required. The local authority Emergency Planning team should be consulted.	
		No risk of reservoir inundation	Low	Development is likely to be appropriate in this risk area.	

Flood risk source/ information source	Relevant sections of this SFRA	Result	Level of concern	Recommendations	Sequential and Exception Tests
Historic flood map	5 - Understanding flood risk in Scarborough Borough and Ryedale	Any part of site within historic flood extents	Medium	Sites located in areas that have historically flooded might be appropriate for development; however, further investigation will be required regarding the severity and frequency of the historic flooding and accuracy of the historic flood extent. This should be used alongside other information in the Level 1 SFRA to decide whether the site is appropriate for allocation. Technical work will be required to inform this at the site-specific FRA stage.	
		No risk of historic flooding	Low	Development is likely to be appropriate based on this criterion.	
Detailed River Network	Appendix A - Interactive Flood Risk Mapping	Any part of site within 20m of a watercourse (from the Detailed River Network dataset)	Medium	Sites located within 20m of the DRN line might be appropriate for development. Where the DRN goes through or adjacent to a site, the Flood Zones and surface water map should also be considered to further determine the effect on development. Where the DRN is located away from a site and land slopes down towards the site, development may be less appropriate than a site where land slopes down towards the watercourse and away from the site.	
		Site not within 20m of a watercourse (from the Detailed River Network dataset)	Low / Medium	Development is likely to be appropriate in this risk area, however not all watercourses are mapped on the Detailed River Network dataset, smaller drains may not be mapped and may need to be considered along with flood risk from other sources.	
Areas benefitting from defence	6 - Flood alleviation schemes and assets	Any part of the site is within an area benefiting from defence	Advisory	Development in this risk area is normally appropriate in principle, however, the performance of formal defences and residual flood risk will need to be considered and consideration given to the commitment and contributions required to maintain the appropriate standard of protection.	Level 2 SFRA required to provide evidence that the principle of development is supported
		The site is not in an area benefiting from defence	Low	Development is likely to be appropriate in this risk area if there is no risk of flooding from other sources on the site. See other recommendations if there is any risk of flooding.	

Flood risk source/ information source	Relevant sections of this SFRA	Result	Level of concern	Recommendations	Sequential and Exception Tests
Cumulative impacts	7 - Cumulative impact of development and strategic solutions	High - Any part of the site is within a High Cumulative Impact Zone	Medium	Development could be considered as appropriate, however, specific planning policy recommendations may need to be formulated. Drainage and flood risk reduction opportunities will probably need to be considered further within these catchments that may have financial and/or land take implications for the site and allay concerns of existing communities potentially at risk.	Level 2 SFRA may be required to provide evidence that the principle of development is supported
		Medium - Any part of the site is within a Medium Cumulative Impact Zone (unless the site is also within a High Zone)	Low / Medium	Development is likely to be appropriate in these risk areas, however if a Medium score has been identified based on a high amount of development then specific planning policy recommendations may need to be formulated. Drainage and flood risk reduction opportunities may need to be considered further within these catchments that may have financial and/or land take implications for the site.	
		Low - Any site not partially or fully within either High or Medium Cumulative Impact Zones	Low	Development is likely to be appropriate in this risk area.	





## Appendix D - Flood Alert and Flood Warnings

### 1.1 Flood Alert Areas

Flood Alert Code	Flood Alert Name	Watercourse/s	Coverage
122WAC952	North Sea coast from Staithes to Whitby including tidal River Esk	North Sea	The North Sea coast from Staithes to Whitby including Sandsend and tidal River Esk
122WAC953	North Sea coast from Whitby to Filey	North Sea	The North Sea coast from Whitby to Filey, including Scarborough
122WAF935	River Esk catchment	River Esk	Low lying land in the Esk Valley and some minor roads
122WAF938	River Wiske and tributaries	River Wiske, Brompton Beck, Cod Beck, North Beck, Willow Beck, Sun Beck, Winton Beck	The River Wiske, Brompton Beck, Cod Beck, North Beck, Willow Beck, Sun Beck, Winton Beck
122WAF945	River Foss catchment	River Foss, Tang Hall Beck, Osbaldwick Beck, Tanghall Beck	Land adjacent to the river Foss from Stillington to the River Ouse in York, including the Huntington Road area in York
122WAF948	River Riccal catchment	River Riccal	Land around the River Riccal and its tributaries including Bonfield Gill, Bogmire Gill, Ellerker Beck, Keld Spring Beck, Walmouth Beck, including properties to the West of Mill Street in Harome and properties along Howldale Land in Beadlam
122WAF949	Upper River Derwent	River Derwent, Sea Cut, River Hertford, Burniston Beck	The Upper Derwent and Scarborough areas, including land around The Sea Cut at Scalby, Throxenby Beck, Old Malton, and Priorpot Beck in Norton
122WAF950	Lower River Derwent	River Derwent	Local roads and low-lying land around Stamford Bridge, Pocklington, Wressle, Wilberfoss and Elvington
122WAF970	Gypsy Race and the Wolds	Gypsy Race	Gypsy Race from Wold Newton to Bridlington
122WAF979	Thornton Beck catchment	Thornton Beck	Land around Thornton Beck and its tributaries, including Thornton-le-Dale



122WAF980	River Seven catchment	River Seven	Land around the River Seven and its tributaries including Northdale Beck, Hartoft Beck, Ings Beck, Lastingham Beck, Sutherland Beck, Cropton Beck, Catter Beck, including properties in Sinnington and to the East of Normanby
122WAF981	Holbeck catchment	Holbeck	Land around Holbeck and its tributaries Including, Thorpe Beck, Marrs Beck, including properties to the West of Station Road at Gilling East
122WAF982	River Rye catchment	River Rye	Land around the River Rye and its tributaries, including Ralsdale Beck, River Seph, Ledge Beck, Fangdale Beck, Prodale Beck, Ladhill Beck, Etton Gill, Borough Beck, Spittle Beck, including properties of Salton, Nunnington and Helmsley
122WAF983	River Dove catchment	River Dove	Land around the River Dove and its tributaries, including Fish Beck, Bloworth Slack, Hodge Beck, Ouse Gill, including properties of Kirkby Mills, Keldholme and Kirkbymoorside
122WAF984	Pickering Beck and Costa Beck catchments	Pickering Beck, Costa Beck	Land around Pickering Beck and its tributaries including Raindale Beck, Levisham Beck, Gundale Beck, Costa Beck, including properties of Kirby Misperton and Pickering

## 1.2 Flood Warning Areas

Flood Warning Code	Flood Warning Name	Watercourse/s	Coverage
122FWC009	North Sea at Scarborough – North Bay	North Sea	Properties adjacent to Peasholm Gap and along Royal Albert Drive
122FWC036	North Sea at Sandsend	North Sea	The sea front (A174) and properties adjacent to the road
122FWC038	Tidal River Esk from Ruswarp weir downstream to Whitby Bridge (A171)	North Sea	Properties located on the River Esk from Ruswarp weir downstream to A171 Whitby Bridge including Mill Court, Ruswarp Fields, Sneaton Lane and Riverside Walk



Flood Warning Code	Flood Warning Name	Watercourse/s	Coverage
122FWC040	North Sea at Whitby Harbour	North Sea	Whitby harbour area including Abrahams Quay, Pier Road, New Quay Road, Church Street, Campion Dock and Bagdale Road
122FWC045	North Sea at Scarborough - Sandside	North Sea	Properties on Sandside around the Old Harbour
122FWC048	North Sea at Scarborough - Foreshore Road	North Sea	Properties on Foreshore Road from the roundabout to West Pier
122FWC050	North Sea at Scarborough - Spa Complex	North Sea	Scarborough Spa and Bandstand at Cleveland Way
122FWF620	Pickering Beck riverside properties at Pickering	Pickering Beck	Pickering Beck riverside properties at Beck Isle, Hungate and Visis Lane
122FWF621	Pickering Beck at Pickering	Pickering Beck	Properties at Newbridge downstream to Mill Lane in Pickering, including Undercliffe, Park Street, Market Place, Train Lane, Southgate, Recreation Road, Visis Lane, Millfield Close and Mill Lane
122FWF627	River Seven at Sinnington	River Seven	Properties along Main Street in the village of Sinnington
122FWF628	Hovingham Beck at Hovingham	Hovingham Beck	Properties around Hall Farm, Brookside and Church Street
122FWF629	Thornton Beck at Thornton-le-Dale	Thornton Beck	Properties along Malton Gate and Chestnut Avenue, including Brook Lane
122FWF630	Mill Beck at Welham Road, Norton	River Derwent	Properties on Welham Road, Norton
122FWF648	River Derwent at Norton	River Derwent	Properties in Scarborough Road, Church Street, St Nicholas Street, Welham Road and the Railway Land at Norton
122FWF649	River Derwent at Old Malton	River Derwent	Old Malton, including Town Street (B1257), Westgate, Lascelles Lane
122FWF650	River Derwent at Buttercrambe Mill	River Derwent	Buttercrambe Mill at Buttercrambe Bridge



Flood Warning Code	Flood Warning Name	Watercourse/s	Coverage
122FWF652	River Derwent at Stamford Bridge - The Weir Caravan Park and Kexby Bridge	River Derwent	The Weir Caravan Park at Stamford Bridge and properties at Kexby Bridge
122FWF653	River Derwent at Stamford Bridge - riverside properties	River Derwent	Riverside properties in Stamford Bridge including Buttercrambe Road and The Square
122FWF684	Sea Cut at Mowthorpe, Scalby and Newby including Newby Beck	Sea Cut, Newby Beck	Properties in Mowthorpe and Scalby at risk from Sea Cut and in Newby from Newby Beck and Sea Cut
122FWF692	River Derwent at Malton	River Derwent	Properties in Sheepfoot and Castlegate
122FWF777	River Foss upstream of Yearsley Baths to Strensall - riverside properties only	River Foss	Riverside and low-lying homes and businesses close to the River Foss from Strensall to Yearsley Baths
122FWF805	River Esk from Briggswath to Ruswarp	River Esk	The River Esk from Briggswath (Sleights Bridge) downstream to A171 at Whitby
122FWF807	River Rye at Nunnington	River Rye	Properties in the village of Nunnington including Low Street and surrounding farmland
122FWF809	River Dove at Kirkby Mills and Keldholme	River Dove	Properties on Dove Way, Kirkby Mills, and Keldholme
122FWF810	Costa Beck at Costa Mills	Costa Beck	Properties in the village of Costa Mills
122FWF811	River Dove at Salton	River Dove	Properties in the village of Salton
122FWF812	River Rye at Brawby	River Rye	Properties in Brawby village and on Brawby Lane
122FWF814	River Derwent at Yedingham	River Derwent	Properties in the village of Yedingham
122FWF816	River Seven at Normanby	River Seven	Properties in the village of Normanby including Malton Road and Barugh Lane
122FWF818	River Seven at Marton	River Seven	Properties in the village of Marton including Marton Road and Back Lane
122FWF819	River Seven at Great Barugh	River Seven	Properties in the village of Great Barugh



## Appendix E – Summary of flood risk in Scarborough Borough and Ryedale District

The table below summarises the areas where there are notable flood risks within the districts.

Area	Fluvial flood risk	Existing defences	Coastal flood risk	Surface water flood risk	Susceptibility to Groundwater flood risk				Reservoir inundation risks	Historic, recorded flood events
					<25%	>=25% <50%	>=50% <75%	>=75%		
Upstream reaches of the Vale of Pickering (upstream of River Rye and River Seven confluence)	<p>The Vale of Pickering consists of relatively low-lying land, with Flood Zones 2 and 3 showing similar extents across a relatively wide floodplain.</p> <p>The Holbeck enters the area in the west and flows east until it joins the Rye. In its upper reaches the Holbeck and its tributary Thorpe Beck are confined to a relatively narrow floodplain due to the steep topography but still provide a risk to infrastructure and properties, with some properties along Mill Lane located in Flood Zone 3. The floodplain widens as the topography flattens further downstream, with several properties in Gilling East located in Flood Zones 2 and 3. Downstream, the floodplain becomes more rural, with only a couple of roads at flood risk until Hovingham, where several roads and properties in the north are located within Flood Zones 2 and 3. Wath Beck, a tributary of the Holbeck, also flows west to east within the area. The floodplain of Wath Beck is predominantly rural and Flood Zones 2 and 3 are confined to a narrow channel; however, there are a few properties in Wath, Fryton and the northern edge of Slingsby which are located within Flood Zone 3. Downstream the floodplain widens where Wath Beck joins the Holbeck, which then joins the Rye; however, this area is predominantly rural and flood risk is limited to a couple of isolated farmhouses.</p> <p>The River Riccal and River Rye enter the area from the northwest and flow east, with their flood zones largely indistinguishable from one another, due to the wide, low-lying floodplains, until the River Riccal joins the River Rye downstream at High Waterholmes. The Rye enters the area to the south of Helmsley, where there are a couple of properties located in Flood Zone 3 and several more located within Flood Zone 2. The Riccal enters the area north of the Rye and causes a flood risk to</p>	<p>The EA AIMS dataset shows the following defences:</p> <ul style="list-style-type: none"> <li>• Embankment along the eastern bank and part of the western bank of Wath Beck from Little Farm to where it joins the Holbeck</li> <li>• Embankment along both sides of the Holbeck from High Waterholmes to where it joins the River Rye</li> <li>• Embankment along both banks of the River Dove from Wythe Farm to where it joins the River Rye. This embankment includes the eastern bank of Howkeld Beck</li> <li>• Embankment along both sides of the River Rye for most of its length from High Waterholmes to where it joins the River Derwent. The embankment along its northern bank extends further upstream to Low Woods. There is also an isolated section of embankment on the northern bank of the</li> </ul>	None	<p>Surface water in the area follows the topography, flowing downhill from the surrounding slopes and pooling across the low-lying topography of the Vale of Pickering. Surface water flows predominantly follow the paths of the watercourses in the area. The Vale of Pickering is predominantly rural with relatively few assets at flood risk; however, there are also a number of built up areas where there is a flood risk to properties and infrastructure:</p> <ul style="list-style-type: none"> <li>• Gilling East – there is a low to high risk flow path heading south along Main Street and several properties are at low risk of flooding.</li> <li>• Hovingham – there are a couple of properties affected by localised areas of low risk surface water pooling.</li> <li>• Slingsby – medium risk flow paths along the High Street and Railway Streets. Flow paths are mainly confined to the roads but there are shown to be small areas of low risk around some properties.</li> <li>• Helmsley – the area to the southeast of the A170 falls within the study area. There are low to medium risk flow paths along several of the roads in this area and a large area of low to high risk pooling to the east of Ashdale Road affecting several properties.</li> <li>• Harome – there are low to high risk flow paths along Owmen Field Lane and Main Street, however, most of the flow is confined to the roads with only a couple of small areas of pooling around properties.</li> <li>• Nunnington – there is a large area of surface water pooling between the River Rye and Low Street affecting several properties, with low risk flow paths extending down Church Street and Rectory Lane.</li> <li>• Beadlam and Nawton – there is a high-risk flow path heading in a south-easterly direction towards Beadlam and Nawton with several properties at a high risk of flooding both to the north and south of the A170.</li> </ul>	✓	✓	✓	✓	<p>Gilling Lower Fish Pond – predominantly follows the flow path of Holbeck with some flow heading south and following the path of Spring Beck and Marrs Beck before entering Holbeck and eventually entering the River Rye just upstream of Butterwick.</p> <p>Elleron Lake – follows the flow path of Sutherland Beck to the west and then flows south following the path of Cropton Beck into the River Seven.</p>	<p><b>From the EA's Recorded Flood Outlines Shapefile:</b></p> <ul style="list-style-type: none"> <li>• February 1991 – fluvial flooding due to overtopping of defences along the Holbeck, the River Dove, the River Riccal, the River Rye and the River Seven</li> <li>• March 1999 – overtopping of defences along the Holbeck, the River Dove, the River Riccal, the River Rye and the River Seven</li> <li>• June 2005 – fluvial flooding due to the River Rye exceeding its capacity upstream of Great Habton</li> <li>• Autumn 2000 – fluvial flooding due to overtopping of defences along the River Riccal, the River Dove and the River Rye</li> <li>• December 2015 – fluvial flooding due to overtopping of the River Rye at Butterwick</li> <li>• February 2020 (Storm Dennis) – fluvial flooding due to many watercourses across the area exceeding their capacity</li> </ul>



	<p>infrastructure and a couple of isolated properties. At Harome, the flood extents from the two rivers become largely indistinguishable. The flood extent covers a largely rural area with the main flood risk to several isolated farm properties located within Flood Zone 3. Built up areas affected are the west of Harome where there are a number of properties located partially within Flood Zone 3 and the north of Nunnington where there are a number of properties located within Flood Zone 3.</p> <p>Syke Cut enters the area to the north of the River Riccal and there are several properties between Beadlam and Nawton located within Flood Zone 3. Further downstream this watercourse becomes Keld Spring Beck and Walmouth Beck. The floodplain widens but is rural and unoccupied.</p> <p>The River Dove flows north to south until it joins the River Rye. The flood risk from Hodge Beck is confined to a narrow floodplain. Howkeld Beck has a much wider floodplain, with several isolated properties and farm buildings located within Flood Zones 2 and 3. North of Kirkby Mills, the Flood Zones for the River Dove are confined to a narrow floodplain. Just north of the A170 there are several properties located within Flood Zone 3 at Kirkby Mills and Keldhlme, and further properties located within Flood Zone 2. South of the A170 properties along Dove Way are mostly located within Flood Zone 3. Downstream there are several roads and isolated properties located within Flood Zone 3. In Salton, located just upstream, of the Dove and Rye confluence, the majority of properties are located in Flood Zone 3, with further properties located within Flood Zone 2.</p> <p>The River Seven flows north to south through the area. The low-lying land means the flood risk is spread across a wide floodplain. The Seven enters the area at Sinnington where several properties along the Main Street are located within Flood Zone 3, with further properties located within Flood Zone 2. Heading downstream there are several properties along Marton Road located within Flood Zone 3 and most properties within the village of Marton are located within Flood Zone</p>	<p>River Rye by Rye House Farm</p> <ul style="list-style-type: none"> <li>• Embankment along both banks of the River Riccal from Crook House Farm to where it joins the River Rye</li> <li>• Embankment along both banks of the River Seven from Sinnington Grange Mill to where it joins the River Rye</li> </ul>		<ul style="list-style-type: none"> <li>• Salton – there is a large low to high risk flow path and surface water pooling in Salton with several properties at flood risk.</li> <li>• Marton – there is a high-risk flow path flowing north to south through Marton following the course of the River Seven. There are a couple of properties to the east of the Seven that are at a high risk of flooding.</li> <li>• Brawby – there are areas of low to high risk surface water pooling along Moor Lane with several properties at a low risk of flooding.</li> </ul>							
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	<p>3 where the floodplain extends to the west due to the underlying topography. There are further properties located in Flood Zone 3 along Malton Road and into Normanby. Here the floodplain extends further east where the land is largely unoccupied but there are a couple of isolated properties located within Flood Zone 3. Downstream the topography flattens, and the floodplain widens and becomes indistinguishable with flood extents from Double Dike and Ackland Beck. Despite the wider floodplain the area is predominantly rural with only a few isolated properties and properties on the western edge of Great Barugh located within Flood Zones 2 and 3. Further downstream, just upstream of the Rye and Seven confluence, there are a number of properties in Brawby located within Flood Zone 3, with several more properties located within Flood Zone 2. There are also a couple of properties further west along Brawby Lane located within Flood Zone 2.</p> <p>Between its confluence with the River Dove and its confluence with the River Seven, the River Rye floodplain is rural with only a couple of isolated properties at flood risk.</p>									
<p>Downstream reaches of the Vale of Pickering (downstream of confluence of the River Rye and the River Seven)</p>	<p>The downstream reaches of the Vale of Pickering are characterised by low-lying flat topography with wide floodplains. The area is predominantly rural with the main settlements at risk being Pickering, The Carrs and Great Habton.</p> <p>Ackland Beck originates north of Great Barugh and flows south parallel to the River Seven past Great Barugh where a few properties on the western edge are located within Flood Zone 3. Ackland Beck then flows east until its confluence with Costa Beck. It has a wide floodplain due to the flat underlying topography however the floodplain is rural with only a few isolated properties and farms at flood risk.</p> <p>Pickering Beck enters the study area to the north of Pickering and flows south until it joins Costa Beck. Pickering Beck flows through the centre of Pickering where there are several properties and infrastructure located within Flood Zones 2 and 3. Downstream of Pickering the</p>	<p>The EA AIMS dataset shows the following defences:</p> <ul style="list-style-type: none"> <li>• Embankment along both sides of the River Rye for most of its length from High Waterholmes to where it joins the River Derwent. The embankment along its northern bank extends further upstream to Low Woods</li> <li>• Embankment along the western bank and parts of the eastern bank of Costa Beck from Low Carr Farm to Bulmer Farm. Embankment also along both</li> </ul>	<p>None</p>	<p>Surface water in the area follows the topography, flowing downhill from the surrounding slopes and pooling across the low-lying Vale of Pickering. Surface water flowing downhill predominantly follows the paths of the watercourses. The area is rural so there are relatively few assets at risk of flooding; however, there are a number of built up areas where there is flood risk to properties and infrastructure:</p> <ul style="list-style-type: none"> <li>• Pickering – there are several low to high risk flow routes along roads through Pickering, particularly along the main Whitby / Malton Road (A169) and Westgate / Hungate / Eastgate roads. There are areas of surface water pooling around Pickering Station and Westgate and to the west around Westgate Carr Road affecting several properties. Further properties across Pickering are at flood risk from smaller localised pools of surface water.</li> <li>• Great Habton – there is a low risk flow path flowing south along Kirby Misperton Lane with an area of high-risk pooling at the junction with Habton Lane and some medium risk</li> </ul>	<p>✓</p>	<p>✓</p>	<p>✓</p>	<p>✓</p>	<p>Pickering Flood Storage Reservoir – follows the flow of Pickering Beck to the south of Pickering where the flow route splits, with some flow heading south along Pickering Beck, some flow heading west and following the path of Pry End Drain and some flow heading east along Malton Road (A169)</p>	<p><b>From the EA's Recorded Flood Outlines Shapefile:</b></p> <ul style="list-style-type: none"> <li>• February 1991 – fluvial flooding due to overtopping of defences along the River Derwent upstream of its confluence with the River Rye and overtopping of defences along the River Rye downstream of its confluence with the River Seven</li> <li>• March 1999 – fluvial flooding due to overtopping of defences along Costa Beck, Pickering Beck, the River Rye and the River Derwent</li> <li>• Autumn 2000 – fluvial flooding due to overtopping of defences along Costa Beck, Pickering Beck, the River Rye and the River Derwent</li> <li>• June 2007 – fluvial flooding due to Pickering Beck exceeding its capacity from Beacon Hill downstream to Mill Lane. The River Seven also exceeded its capacity at Sinnington, just upstream of where the river crosses Sinnington Cliff Road</li> <li>• December 2015 – fluvial flooding due to channel capacity</li> </ul>



	<p>floodplain widens due to the low-lying topography. This area is rural with several farms located within Flood Zone 3.</p> <p>To the west of Pickering, Costa Beck and its tributary West Drain originate. This area is rural and flood risk is limited to farm buildings and small roads. Costa Beck passes north of Kirby Misperton but the flood extent does not reach the village. The flood risk is limited to the surrounding roads and northern parts of the Flamingo Land Resort located to the north of Kirby Misperton.</p> <p>The River Rye continues to flow east from its confluence with the River Seven until it joins the River Derwent. There are several isolated properties located within Flood Zone 3. Malton Grange Lodges, located east of Amotherby Lane, are located within Flood Zone 3. There are also a few properties at the southern end of Great Habton which are located within Flood Zone 2. Further east, near the confluence of the River Rye and The Cut the floodplain extends further south, finishing just north of the A64, covering a rural area with a few isolated properties that are at risk. To the east, the A169 is located in Flood Zone 2 with some areas within Flood Zone 3.</p> <p>The River Derwent flows west across the Vale of Pickering, entering the area between West Ayton and East Ayton where there are several isolated properties located within Flood Zones 2 and 3. The Derwent has a number of small tributaries along its length and the floodplain is wide. However, the area is rural and flood risk is predominantly limited to minor roads and isolated farm properties.</p>	<p>sides of Costa Beck from Pickering to High Costa Mill, with the eastern embankment continuing downstream to Low Costa Mill</p> <ul style="list-style-type: none"> <li>• Embankment along both sides of Pickering Beck from Barker Stakes Farm to Wintofts Farm</li> <li>• Embankment and flood wall along both sides of the River Derwent / The Cut from West Ayton Carr through The Carrs to Malton</li> </ul>		<p>along Alverton Close. Most of the surface water remains confined to the roads however there is low flood risk to a few of the properties towards the south of Kirby Misperton Lane.</p> <ul style="list-style-type: none"> <li>• Kirby Misperton – there are large areas of low to high risk surface water pooling across the Flamingo Land Caravan Site to the northwest of Kirby Misperton. Through Kirby Misperton there is a low to high risk flow route along Kirby Misperton Road with a low risk flow route to the south along Main Street. These flow routes remain confined to the roads but there are areas of low to medium risk surface water pooling around properties along Shire Grove to the west of Main Street.</li> </ul>						<p>exceedance along the River Derwent from Espersykes down to Low Hutton</p> <ul style="list-style-type: none"> <li>• February 2020 (Storm Ciara) – fluvial flooding due to channel capacity exceedance along parts of the River Derwent, Ackland Beck, Costa Beck and the River Rye</li> <li>• February 2020 (Storm Dennis) – fluvial flooding due to channel capacity exceedance along parts of most watercourses across the area</li> </ul>
Whitby and surrounding settlements	<p>The River Esk enters the area from the southwest and flows northeast, along the northern boundary of the North York Moors National Park, then flows north through Whitby where it enters the North Sea.</p> <p>Within the town of Sleights there is a large area of Flood Zone 2 which extends south along Thurndale Beck at its confluence with the Esk. There are a small number of properties at flood risk.</p>	<p>The EA AIMS dataset shows one embankment in the area located along the eastern bank of the River Esk in Ruswarp providing protection to properties along Larpool Lane.</p>	<p>There is coastal risk along the northern boundary of Whitby from the North Sea which was assessed using present day (2021) projection modelling.</p> <p>There is a small area of risk during the 200-year event along Sandsend Road at Teapot Hill to the northwest of the area.</p>	<p>Across the area there are many locations of localised flood risk, but in a lot of these areas the flood risk remains confined to the roads or the flow paths of watercourses through the area and does not pose a risk to properties.</p> <p>There are areas of low to high flood risk in Whitby around properties to the west of the River Esk along Uppgang Lane and Station Avenue, and Spring Vale. There is also low to medium flood risk to properties along Stakesby Road.</p>	✓	✓	✓		None	<p><b>From the 2012 Whitby Coastal Strategy provided by Scarborough Borough Council:</b> Coastal flooding due to wave overtopping occurs regularly in this area, particularly at:</p> <ul style="list-style-type: none"> <li>• Sandsend car park</li> <li>• Whitby West Cliff promenade</li> <li>• Whitby Harbour piers and extensions</li> </ul>





	<p>Heading east from Sleights to Ruswarp the floodplain extends to the north with the B1410 and a small number of isolated farm properties located within Flood Zone 3. Here the extents for Flood Zones 2 and 3 are very similar.</p> <p>In Ruswarp, there are a number of properties along The Carrs and the High Street which are at flood risk. At the eastern side of Ruswarp the floodplain extends considerably to the north of the river however this area of land is unoccupied.</p> <p>As the River Esk flows east into Whitby the tidal influences will become greater than the fluvial influences. The flood risk in Whitby is assessed below from both the Fluvial Esk model and the Tidal Esk model.</p> <p><b>Fluvial Esk</b> The floodplain extends out both east and west of the river with a number of properties at risk, including along Church Street to the east and along Pier Road, Haggarsgate, St Ann's Staith and Langborne Road to the west.</p> <p>There are two areas where the floodplain extends a considerable distance from the river:</p> <ul style="list-style-type: none"> <li>To the west just north of the railway station along Bagdale. There are several properties around the station at flood risk with the flow path mostly confined to the road as it heads west.</li> <li>At the confluence of Spital Beck and the River Esk affecting a number of properties along Spital Bridge.</li> </ul> <p><b>Tidal Esk</b> The tidal Esk model shows a similar floodplain to the fluvial model along the east of the river but a smaller floodplain to the west, with less properties shown to be at flood risk around the railway station. The tidal model shows a similar flood extent at the confluence with Spital Beck, with the floodplain extending a considerable distance to the west but does not show any flooding along Bagdale.</p>		<p>For the 1000-year event the risk here is relatively unchanged.</p> <p>Heading south from Teapot Hill at Sandsend towards the River Esk tributary at Whitby the flood risk is confined to the rural coastline and does not impact any roads or properties.</p> <p>At Whitby the coastal risk extends inland along the River Esk. The flood risk mostly remains confined to the channel but there is some risk around Whitby Station and Church Street where there are a number of properties at risk. There is also a large area of coastal risk to the north of Ruswarp, however, the area of risk is predominantly unoccupied with a small number of properties at coastal risk.</p> <p>East of the River Esk tributary, the flood risk is again confined to the rural coastline and does not impact any roads or properties.</p>	<p>There is low to high flood risk to the north of Whitby train station along Station Square and Bagdale, showing flood risk to several properties across all events.</p> <p>South of the A171, there are localised areas of low to high flood risk around properties on Shackleton Close and Mayfield Place.</p> <p>To the east of Whitby there is a surface water flow path heading southeast from Spital Vale towards Stainsacre, which passes through a number of residential streets resulting in low to high flood risk to properties on Fairfield Way and Enterprise Way.</p> <p>There is a large area of flood risk to the north of Ruswarp to the west of the River Esk where there is an area of low-lying land. However, the land here appears to be agricultural and does not impact upon any properties. Further south towards Ruswarp station there are several properties at low to medium flood risk.</p> <p>To the southwest of the area, there are a number of properties in Sleights along Linden Close that are at low flood risk, with a couple of properties at medium to high risk as well, although the flow paths are mostly confined to the road during these events. South of Sleights railway station, there is also low flood risk to a small number of properties along Beck Holme.</p>						<p>In November 2011, there was notable flooding on the east bank of Endeavour Wharf at Church Street.</p> <p><b>From Section 19 reports provided by North Yorkshire County Council</b> Sleights experienced surface water flooding in November 2016 due to widespread rainfall. Obstructed and damaged culverts along the A169 meant surface water from the moors could not pass under the road and therefore flowed down the A169 into Sleights. The water transported material from the arrestor bed which blocked highway gully's and land drains in the village preventing water from draining away. Approximately eight homes in the village were flooded.</p> <p><b>From the EA's Recorded Flood Outlines Shapefile:</b></p> <ul style="list-style-type: none"> <li>December 2013 – tidal flooding due to overtopping of defences along the River Esk around Whitby railway station causing flooding along Church Street on the east bank of the river and Langborne Road on the west bank of the river</li> <li>January 2017 – tidal flooding due to overtopping of defences at Sandsend affecting a small section of the A174 around East Row Beck. Defences were also overtopped along the River Esk causing flooding along Church Street on the east bank and along Pier Road on the west bank</li> <li>November 2019 – small area of coastal flooding along Pier Road</li> </ul> <p><b>From Scarborough Borough Council's Incident Record:</b></p> <ul style="list-style-type: none"> <li>June 2012 - flooding at East Row Sandsend, Whitby due to a diverted land drain</li> <li>September 2013 - Public sewer flooding along Lowdale Lane, Sleights</li> <li>November 2016 – Lowdale Farm, Sleights, flooding from Iburndale Beck</li> <li>April 2019 – external flooding of 20 holiday homes due to emergence of a groundwater spring</li> </ul>
The East Coast (Scarborough, Filey and	Across the area the extents of Flood Zone 3 and Flood Zone 2 are shown to be similar and are generally confined to narrow floodplains along the	The EA AIMS dataset shows embankments on Scalby Beck providing protection	There is coastal risk along the eastern boundary of this area from the North Sea	There is a high-risk flow path through Burniston, following the path of Burniston Beck. Several properties and roads are within the high risk area with	✓	✓	✓	✓	None	<b>From the Burniston, Cloughton &amp; Quarry Becks Flood Alleviation Scheme – Phase 2 Report 2004</b>



<p>surrounding villages)</p>	<p>watercourses due to the underlying topography.</p> <p>To the north of Scarborough, there is an area of flood risk between Peasholm Lake and the coast causing flood risk at the Burniston Road roundabout.</p> <p>Scalby Beck (Sea Cut) flows west to east across the centre of the area and its floodplain is mainly confined to the channel. There is a small area of flood risk to the south of Scalby Beck along Hackness Drive with several properties located in Flood Zone 2.</p> <p>Burniston Beck, and its tributaries (including Quarry Beck and Cloughton Beck), flow from north to south through the area, turning into Cow Wath Beck just upstream of its confluence with Scalby Beck. The floodplain is mainly confined to a narrow channel however there are some properties located in Flood Zone 3 along the western edge of Cloughton. There are also several properties along the eastern side of Burniston and at the junction of Coastal Road and Cross Drive that are in Flood Zone 3. Just upstream of the confluence with Scalby Beck, there are a couple of properties along Station Road located in Flood Zone 2.</p> <p>The River Hertford has its source near Muston and flows across the area from east to west until it flows under Spital Road (A64) and then joins the River Derwent near Haybridge Farm. The flood extent from the River Hertford is wide-reaching however most of the area at flood risk from this watercourse is rural and unoccupied. There are a couple of isolated farms that are shown to be at risk alongside a number of roads including Flotmanby Lane (A1039) at Muston, Filey Road and Carr Lane. There are also a couple of properties located in Flood Zone 2 on the east side of Muston.</p>	<p>to the properties just west of Scalby Road.</p>	<p>which was assessed using present day (2021) projection modelling.</p> <p>The area at risk is mostly unoccupied coastline, with no properties or other infrastructure at risk. However, there are a couple of areas where the flood risk encroaches inland causing flood risk to roads and properties for both the 200-year and 1000-year events including:</p> <ul style="list-style-type: none"> <li>• Cleveland Way from Scalby Ness to Scarborough</li> <li>• Foreshore Road and Sandside, Scarborough, and several properties along these roads</li> </ul>	<p>many more properties at low to medium flood risk. South of Burniston there is a large area of high risk which includes a caravan park.</p> <p>There is a high-risk flow path through the centre of the area following the path of Scalby Beck. There are properties within the high-risk area to the south of Scalby along Scalby Road and Hackness Road, with further properties at low to medium risk along Hackness Gardens and Glynndale Drive. There are areas of localised flood risk across Scalby with several properties at risk, including along High Street, South Street and Low Street.</p> <p>There are many areas of low to high risk across Scarborough. Many of these flow paths are confined to the roads, particularly the high-risk flows, however there are several areas of properties at low to high flood risk including:</p> <ul style="list-style-type: none"> <li>• Briardene Avenue, Thornville Avenue and Cleveland Avenue to the northwest</li> <li>• Trafalgar Square, Sandringham Street and Wrea Lane to the north</li> <li>• Between Longwestgate and Eastborough to the east</li> <li>• Around the junction of Westwood Road and Valley Road to the south</li> <li>• Along Stepney Road and Stepney Drive to the south west</li> <li>• Between Commercial Street and St John's Road to the west</li> </ul> <p>There are many areas of low to high risk across Filey with many properties at flood risk. Key areas of flood risk include:</p> <ul style="list-style-type: none"> <li>• High risk to several properties north of Scarborough Road and south of Filey field along roads including Sycamore Avenue and Thorn Tree Avenue. Further properties are at low to medium risk</li> <li>• High to low flood risk to several properties along Fir Tree Drive between Arndale Way and Church Cliff Drive</li> <li>• High to low flood risk to properties west of Muston Road (A1039) along Cawthorne Crescent and side streets</li> <li>• High to low flood risk to properties along South Crescent Road between Brooklands and Glen Gardens</li> </ul>						<p><b>provided by Scarborough Borough Council</b> This report highlights five flood events that occurred from Cloughton, Quarry and Burniston Becks: June 2000, November 2000, August 2002, October 2002 and January 2003</p> <p>The August 2002 event was the most severe, causing flooding to land, houses and gardens due to insufficient channel capacity, blockages and surface runoff</p> <p><b>From Section 19 reports provided by North Yorkshire County Council</b> Flooding caused by high intensity rainfall over a short duration led to flooding across North Yorkshire in August 2017, with Scarborough the most severely affected location. More water fell than the drainage network was able to cope with resulting in flooding across Scarborough with internal flooding to several residential and commercial properties alongside damage to infrastructure and the road network. Other instances of localised surface water flooding are reported to have occurred in August 2011 and December 2011.</p> <p>Areas along the sea front at Scarborough have previously been affected by tidal flooding in December 2013, January 2017 and March 2018.</p> <p>Peasholm Lake has overtopped twice (July 2007 and July 2012) resulting in flooding of the surrounding area.</p> <p>Heavy rainfall during the 2015 Boxing Day floods caused flooding in Scalby, Eastfield and Cayton Bay.</p> <p><b>From the EA's Recorded Flood Outlines Shapefile:</b></p> <ul style="list-style-type: none"> <li>• Autumn 2000 – overtopping of the River Hertford downstream of the A64</li> <li>• December 2013 – tidal flooding due to overtopping of defences along North Bay affecting Royal Albert Drive and along South Bay affecting Foreshore Road and Sandside</li> <li>• January 2017 – tidal flooding due to overtopping of defences along North Bay affecting Royal Albert Drive and along South Bay</li> </ul>
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										<p>affecting Foreshore Road and Sandside</p> <p><b>From Scarborough Borough Council's Incident Record:</b></p> <ul style="list-style-type: none"> <li>• June 2013 – surface water flooding in Cloughton due to a track alteration</li> <li>• August 2017 – flooding along Hackness Road, Scarborough following heavy rainfall</li> <li>• March 2018 – Edgehill Road, Scarborough, flooding due to a blocked debris screen on a surface water sewer</li> <li>• 2004-2015 – internal flooding of properties in Hunmanby Gap due to runoff from adjacent agricultural land</li> <li>• April 2012 – Scalby Hayes, Scarborough flooded externally due to surface water</li> </ul>
Rural south east (Gypsey Race)	<p>The Gypsey Race flows west to east across the south-east of the study area. This area consists of steep slopes with clearly defined flow routes and Flood Zones 2 and 3 are generally confined to narrow channels along the Gypsey Race and other clearly defined flow routes.</p> <p>This area is rural and as such there is limited flood risk to infrastructure and properties, however, there are several properties located within close proximity of the Gypsey Race and at flood risk:</p> <ul style="list-style-type: none"> <li>• At the source of the Gypsey Race at Duggleby there are several properties located within Flood Zone 3.</li> <li>• There are a small number of properties at Kirkby Grindalythe located within Flood Zone 3.</li> <li>• There are several properties in West Lutton, East Lutton, Helperthorpe and Weaverthorpe located in Flood Zone 3, with continual flood risk along the road connecting these villages.</li> <li>• Along the course of the Gypsey Race there are also a few isolated properties that are located within Flood Zone 3.</li> </ul>	None	None	<p>In this rural area, surface water typically flows downhill from higher ground into the Gypsey Race. As such, the properties at risk of surface water flooding are largely the same as those at risk of fluvial flooding, however, there are a few key areas where this differs:</p> <ul style="list-style-type: none"> <li>• There is a low risk surface water flow path flowing south to north towards Kirby Grindalythe with several properties at low flood risk.</li> <li>• There is a low to medium risk flow path from north to south down the B1249 towards Foxholes with a small number of properties at low to medium flood risk.</li> </ul>	✓	✓	✓		None	
Malton and Norton-on-Derwent	<p>The River Derwent flows northeast to southwest between the towns of Malton (to the north) and Norton-on-Derwent (to the south). Flood Zone 3 encompasses a large number of properties in Old Malton, along Town Street, Castlegate and Lascelles Lane. In Malton there are a number of properties in Flood Zone 3 along</p>	The EA Aims dataset shows there is a flood wall on the Malton (north) side of the River Derwent which extends east from the Railway Street bridge to the top of Sheepfoot	None	<p>There are limited areas of high flood risk across Norton and Malton, with small areas of pooling predominantly confined to roads or areas of unoccupied land.</p> <p>These localised areas of pooling increase in size for medium flood risk. There are several properties at risk, particularly around the junction of</p>	✓		✓	✓	None	<p><b>From information on the Malton, Norton and Old Malton Flood Alleviation Scheme available from</b></p> <p><a href="https://www.northyorks.gov.uk/">https://www.northyorks.gov.uk/</a></p> <p>Since the November 2012 event, flooding issues occurring in Malton</p>



	<p>Castlegate. In Norton there are many properties at flood risk along roads including Norton Road, Church Street and St Nicholas Street.</p> <p>There are also areas of wider floodplains and increased flood risk where Mill Beck and Priorpot Beck flow into the Derwent from the Norton (south) side. Along Priorpot Beck there is a large difference in the flood zones, with many more properties located in Flood Zone 2 than in Flood Zone 3. This particularly affects properties to the south of the Beck, including some along Maudon Grove, Priorpot Lane and Westfield Way.</p> <p>To the south of Malton there are a number of properties to the south of the York Road located in Flood Zone 2.</p>	<p>Hill, offering protection to properties along Castlegate and Sheepfoot Hill.</p> <p>There are also a series of flood walls and embankments on the Norton (south) side of the River Derwent which extend from Welham Hall Farm to the south of Norton up to Westfield Way offering protection to properties south of the river.</p> <p>There is also an embankment along the north of the River Derwent in Old Malton offering protection to properties along Lascelles Lane and Town Street.</p>		<p>Westgate and Town Street in Old Malton and in the residential area south of Priorpot Beck in Norton.</p> <p>The area of low flood risk is considerably greater with clear flow paths along a number of roads including:</p> <ul style="list-style-type: none"> <li>• B1257 (Newbiggin, Wheelgate and Castlegate), Malton</li> <li>• B1248 (Yorkersgate and Old Maltongate), Malton</li> <li>• Wood Street, Norton</li> <li>• Many smaller residential roads</li> </ul> <p>Significant areas of surface water flood risk to properties include:</p> <ul style="list-style-type: none"> <li>• The residential area south of Priorpot Beck with properties at low to medium risk along Fletton Road, Brindle Way, Priopot Way and Toisland View</li> <li>• The residential area south of Wood Street with properties at low to medium risk</li> <li>• Properties in north Malton along Showfield Lane and Ryngwood Drive</li> </ul>						<p>and Norton are caused by 'flood-locking' where high river levels prevent the drainage systems flowing into the rivers.</p> <p><b>From the EA's Recorded Flood Outlines Shapefile:</b></p> <ul style="list-style-type: none"> <li>• March 1999 – fluvial flooding due to overtopping of defences along the length of the River Derwent</li> <li>• Autumn 2000 – fluvial flooding due to overtopping of defences along the length of the River Derwent</li> <li>• December 2015 – fluvial flooding due to overtopping of the River Derwent from Espersykes down to Low Hutton</li> <li>• February 2020 (Storm Dennis) – fluvial flooding due to channel capacity exceedance along the River Derwent around Castlegate bridge and to the east of Old Malton</li> </ul>
<p>Rural south-west (lower reaches of the River Derwent)</p>	<p>Downstream of Malton and Norton-on-Derwent the River Derwent continues to flow in a south/south-westerly direction. It has several tributaries including Menethorpe Beck, Whitecarr Beck, Leppington Beck and Pasture Beck. Flood Zones 2 and 3 are generally confined to a relatively narrow floodplain along the River Derwent and its tributaries.</p> <p>This area is predominantly rural with most of the flood risk confined to unoccupied land or along small roads/tracks.</p> <p>Downstream there are several properties in Stamford Bridge located in Flood Zones 2 and 3, however, this area lies predominantly outside of the Scarborough Borough and Ryedale area.</p>	<p>The EA AIMS dataset shows there is an embankment along the eastern bank of the River Derwent at Scrayingham and Bridge End Fields.</p>	<p>None</p>	<p>In this rural area, surface water typically flows from higher ground into the smaller watercourses and downhill into the River Derwent. There are some localised areas of surface water pooling around isolated farmhouses.</p> <p>There is a considerable area of pooling at Scrayingham with several properties at high flood risk.</p> <p>There is also a clear flow path along Steelmoor Lane at Barton-le-Willows. The medium to high risk flow path is confined to the road, but a small number of properties are at low flood risk.</p> <p>Other areas with several properties at surface water flood risk include:</p> <ul style="list-style-type: none"> <li>• Whitwell-on-the-Hill where there is a low to high risk flow path along the main street with several properties at low flood risk and a couple at high flood risk with a few areas of surface water pooling.</li> <li>• Northwest of Welburn along Chestnut Avenue where there is a low to high risk flow path with a couple of properties at medium flood risk. There are also a number of properties at low flood risk further west along Chanting Hill Close and the adjacent residential streets.</li> </ul>	<p>✓</p>	<p>✓</p>	<p>✓</p>	<p>✓</p>	<p>Castle Howard Great Lake – follows the route of Mill Hills Beck and then Cram Beck downhill to the River Derwent. Extent includes the Castle Howard Lakeside Holiday Park and a small number of properties in Low Gaterley and Crambeck.</p>	<p><b>From the EA's Recorded Flood Outlines Shapefile:</b></p> <ul style="list-style-type: none"> <li>• February 1991 – fluvial flooding due to the overtopping of defences along the River Derwent downstream of Malton</li> <li>• March 1999 – fluvial flooding due to the overtopping of defences along the length of the River Derwent</li> <li>• Autumn 2000 – fluvial flooding due to the overtopping of defences along the length of the River Derwent</li> <li>• December 2015 – fluvial flooding due channel capacity exceedance along the River Derwent from Espersykes down to Low Hutton</li> <li>• February 2020 (Storm Dennis) – fluvial flooding due to channel capacity exceedance along parts of the lower River Derwent. There was also an overtopping of the defences along the east bank of the River Derwent just upstream of its confluence with Howl Beck</li> </ul>



## Appendix F – Cumulative Impact methodology

### 1.1 Methodology

#### 1.1.1 Sensitivity to increases in flood flows

This is the measure of the increase in the number of properties at risk of surface water flooding in a 1 in 100-year event to a 1 in 1,000-year event. It is an indicator of where local topography makes an area more sensitive to increases in flood risk that may be due to any number of reasons, including climate change, new development etc. It is not an absolute figure or prediction of the impact that new development will have on flood risk.

The National Receptor Database (NRD) dataset 2014 was used to identify all properties within the Scarborough Borough and Ryedale District study area.

This data was intersected with the 1,000-year and 100-year surface water flood extents separately to determine the number of properties in each catchment, in each surface water flood extent. The difference between the two values was then taken as a percentage of the total number of properties within the catchment to allow comparison between catchments of different sizes.

#### 1.1.2 Growth in the area

Development in neighbouring authorities can affect flood risk in Scarborough Borough and Ryedale District, especially if the catchment is draining towards the study area. Development sites in neighbouring authorities were assessed to determine if any neighbouring development would affect flood risk in Scarborough Borough and Ryedale District.

Likewise, development within the Borough and District has the potential to affect flood risk in neighbouring authorities, especially if there are existing flood risk issues. The River Derwent drains out of Ryedale District towards north East Riding of Yorkshire whilst the River Foss drains out of Ryedale District towards York city centre.

Areas for future proposed development were received from Scarborough Borough, Ryedale District Councils and York City Council. The area of new development within each catchment was expressed as a percentage of the total catchment area to determine the potential for increase in flood risk as a result of new development.

#### 1.1.3 Historic flood risk

Historic flood risk information was provided by North Yorkshire County Council for the area of Scarborough Borough. Points were plotted as accurately as possible to the historic flooding descriptions based on the data available. Each point represents a location where it is known there has been at least one flood event since 2012 (however, the nature and scale of these flood events varies significantly).

Attribute data for each Incident Recording System data point includes the:

- Date
- Location (postcode)
- Description of incident

Due to potential data gaps, historic flood risk was compared to the rankings of catchments following an initial assessment of the first two risk categories (surface water and growth).



A summary of the datasets used to calculate the historic flood risk and the sensitivity to increases in flood flows for each catchment is shown in Table F-1.

**Table F-1: Summary of datasets used in the cumulative impact assessment**

Dataset	Coverage	Source of data	Use of data
Catchment Boundaries	Scarborough Borough and Ryedale District study area (any other local authority areas that intersect these catchments)	Water Framework Directive Catchments	Surface Water and Development Flood Risk
National Receptor Database (2014)	Scarborough Borough and Ryedale District study area	Environment Agency	Assessing the number of properties at risk of surface water flooding within each catchment
Risk of Surface Water Flooding Mapping	Scarborough Borough and Ryedale District study area	Environment Agency	Assessing the number of properties at risk of surface water flooding within each catchment
Future development areas	Scarborough Borough, Ryedale District study area and neighbouring local authorities	Scarborough Borough, Ryedale District and City of York	Assessing the impact of proposed future development on risk of flooding.
Historic Flooding Incidents	Scarborough Borough study area	North Yorkshire County Council	Assessing incidences of historic flooding within the Scarborough Borough study area.
Catchment Boundaries	Scarborough Borough and Ryedale District study area (any other local authority areas that intersect these catchments)	Water Framework Directive Catchments	Surface Water and Development Flood Risk

#### 1.1.4 Ranking the results

The results for each assessment were ranked into high, medium and low risk as shown in Table F-2 for Scarborough Borough and Table F-3 for Ryedale below.

**Table F-2 Risk banding for Scarborough Borough**

Flood risk ranking	% of properties at increased risk of SW flooding	% Area of Catchment Covered by new development
Low risk	<0.5%	<0.5%
Medium risk	>0.5%, <2.5%	>0.75%, <3%
High risk	>2.5%	>3%



**Table F-3 Risk banding for Ryedale District**

Flood risk ranking	% of properties at increased risk of SW flooding	% Area of Catchment Covered by new development
Low risk	<2%	<1%
Medium risk	>2%, <4%	>1%, <2%
High risk	>4%	>2%

The ranking results were combined from the two assessments to give an overall high, medium and low ranking for all catchments within the district. Each catchment received a score for its ranking in each category, which were totalled to give a total risk score as shown in Table F-4.

**Table F-4: Final combined rankings**

Individual Rank	Score	Total Score (out of 9)	Final Rank
High risk	3	7-9	High risk
Medium risk	2	5-6	Medium risk
Low risk	1	3-4	Low risk

### 1.1.5 Assumptions

The assumptions made when conducting the cumulative impact assessment are shown in Table F-5.

**Table F-5: Assumptions of the cumulative impact assessment**

Assessment aspect	Assumption made	Details of limitation in method	Justification of method used
Surface water flood risk	Total number of properties flooded	Assumption that all properties have been included in the 2014 NRD dataset. It may not include all new build properties.	This was the most up to date and accurate data available.

The results of the assessment and policy recommendations can be found in Chapter 7 and Chapter 10 of the main SFRA report.