

Climate Change Resilience Risk Report for York

October 2022

Contents

Executive Summary

2 Introduction	3
2.1 Background	3
2.2 Aim and Objectives	4
2.3 Local Authorities and Climate Strategies	5
2.4 What is resilience?	5
2.5 UK Third Climate Change Risk Assessment.....	6
3 Methodology.....	7
3.1 The UKCCRA3 and the Adapted Approach for York.....	7
3.2 Stage 1 –Risks & Opportunities Survey.....	7
3.3 Stage 2 - Local assessment.....	9
3.4 UKCCRA3 Risks Excluded from the Report.....	9
3.4.1 International Dimensions.....	9
3.4.2 H13 Risks to education and prison services.....	9
3.4.3 Coastal and Marine	10
4 Results.....	11
4.1 Stage 1 - Survey Results	11
4.1.1 Risks with No Data Available.....	11
4.2 Stage 2 – Interviews and Desk-based Research of the Top Six Risks to York	12
4.2.1 N4 Risk to soils from changing climatic conditions, including seasonal aridity and wetness	12
4.2.2 H9 Risks to food safety and food security.....	13
4.2.3 N1 Risks to terrestrial species and habitats from changing climatic conditions and extreme events, including temperature change, water scarcity, wildfire, flooding, wind, and altered hydrology	15
4.2.4 N3 Opportunities from new species colonisations in terrestrial habitats	17
4.2.5 H3a Risks to people, communities and buildings from river and surface flooding	19
4.2.6 H5 Risks to building fabric.....	21

5	Limitations.....	23
6	Conclusion.....	24
6.1	General Recommendations and Next Steps	24
7	Appendix	26
	Appendix A: Full Council Motion	26
	Appendix B: Survey categorisation of each risk from the UKCCRA3	28
	Appendix C: Calculations of adapted magnitude tables.....	29
	Appendix D: All UKCCRA3 risks/opportunities distribution by average magnitude score	32
	Appendix E: Evidence gaps or questions about implementation of policy in regards to H3a (nationally).....	33
	Appendix F: Large Soilscape 18 area in York	35
	Appendix G: Soilscape 8 (brown) coverage for York	36

1 Executive Summary

This report has been produced in response to the City of York Council motion that requested the Executive provide a report on the city's climate resilience. It uses an approach based on the UK Climate Change Risk Assessment, with modifications to make it more suitable to the local context.

While very few Local Authorities currently have climate change adaptation/resilience strategies, it is an area that will require greater local attention as the impacts of climate change increase. Crucially, not every place will experience those impacts equally, and therefore improving the local understanding of the climate risk risks for York can help our preparedness.

The report identifies 6 priority climate resilience risks for York:

- i. Risk to soils from changing climatic conditions, including seasonal aridity and wetness
- ii. Risks to food safety and food security
- iii. Risks to terrestrial species and habitats from changing climatic conditions and extreme events, including temperature change, water scarcity, wildfire, flooding, wind, and altered hydrology
- iv. Opportunities from new species colonisations in terrestrial habitats
- v. Risks to people, communities and buildings from river and surface flooding
- vi. Risks to building fabric

Local data is scarce for many of these risks, limiting the effectiveness of potential policy and decision making. More needs to be done to capture relevant information to support an evidence-based approach to climate resilience.

Although activity to address several of these risks is limited, York is managing the flood risk particularly well. This is due to a joined up, local, regional, and national response, involving multiple agencies and multiple stakeholders which has produced a response that is proportionate to the risk. We should seek to replicate our approach to the flood response to the other risk areas.

Access to funding and resources is often a problem when trying to address risks from climate change. Climate Change risks are not easily evaluated with traditional cost/benefit analysis making it difficult to make the case and allocate funding. The recent devolution deal for North Yorkshire may provide potential resources to addressing the local and regional challenges.

Finally, the six risks highlighted in this report are not the only ones relevant to York. Resilience is a joined-up, overall response to climate change, and it is important to highlight that building general adaptive capacity, should be prioritised over responses to any singular threats.

This report has been produced to create awareness and start a conversation about the climate change resilience risks relevant for York. It is recommended that work is refreshed and expanded as the impacts of climate change are anticipated to become even more acute and the costs of inaction are likely to far out way the costs of associated with a planned, proportionate response.

2 Introduction

In 2019, City of York Council declared a Climate Emergency and have since set an ambition for York to be net zero carbon by 2030.

The impacts of climate change are already being seen locally. Alongside our net zero and carbon mitigation activity, we also need to adapt to become more resilient to the changes in our climate to create a city fit for the future.

2.1 Background

Climate change is the greatest threat facing our planet. According to the World Resource Institute¹, global temperatures have so far risen by 1.1°C, and already the planet has seen an increase in natural disasters such as flooding, hurricanes, and other extreme natural events.

The 2022 IPCC Report² warned that the world is set to reach 1.5°C above pre-industrial levels within the next two decades and stated that only the most drastic cuts in carbon emissions would help prevent an environmental disaster. The IPCC have historically always used deliberately cautious language, but declared in their latest report that, “it is unequivocal that human influence has warmed the atmosphere, ocean and land”, demonstrating the severity of the situation that humans have created.

The met office produced the below graphic of the expected impacts on urban areas as a result of climate change.

¹ <https://www.wri.org/climate>

² <https://www.ipcc.ch/report/ar6/wg2/>

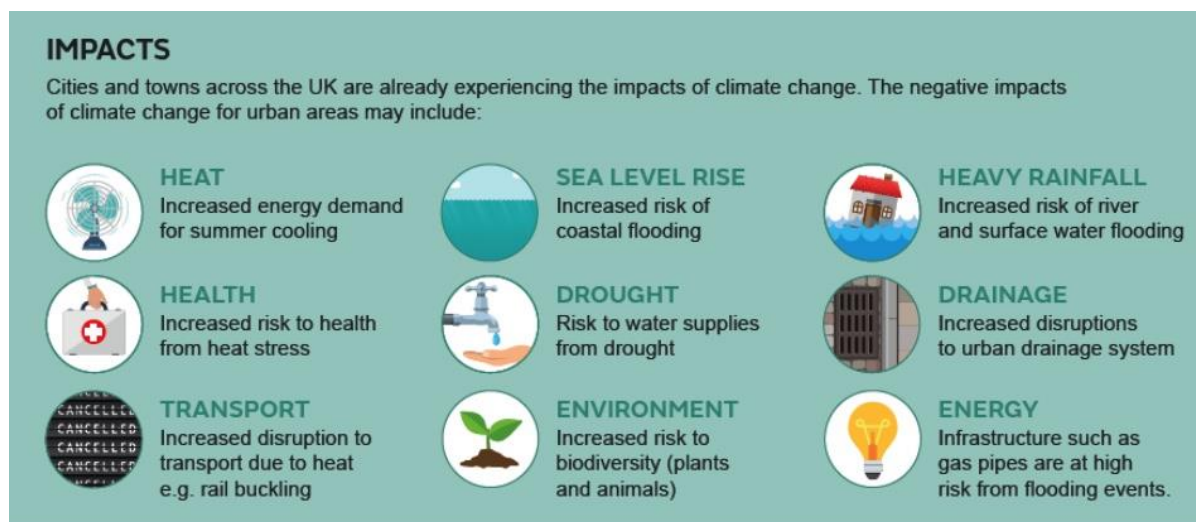


Figure 1: Negative impacts in urban areas from climate change

These impacts will not impact all countries or areas equally; therefore, understanding the local impacts of climate change are an important consideration when developing an appropriate response.

Council Motion

This report has been produced in response to a City of York Council motion (21st October 2021)³ that requested the Executive provide a report on the city's climate resilience:

- *Council therefore resolves: To ask Executive to report on the City's climate resilience by assessing the risks from the eight priority risk areas of the UK Climate Change Risk Assessment (June 2021) <https://www.theccc.org.uk/publication/independentassessment-ofuk-climate-risk/>, plan for enhancement of the city's climate resilience and management of the unavoidable impacts of climate change.*

(For the full council motion see Appendix A)

2.2 Aim and Objectives

This report sets out to improve our understanding of the climate risks to York through:

- Identifying the most significant threats and opportunities to York due to climate change
- Summarising the learning and activity that has taken place to date in these areas
- Presenting initial findings and recommendations for the most significant risks
- Supporting the ambition of the York Climate Change Strategy

³ <https://modgov.york.gov.uk/documents/g12805/Printed%20minutes%20Thursday%202021-Oct-2021%2018.30%20Council.pdf?T=1>

2.3 Local Authorities and Climate Strategies

York is one of 316 Local Authorities to declare a climate emergency and put a strategy in place to address climate change (as of December 2019)⁴. Only 26 of the 409 local authorities have not yet declared a climate emergency, while a further 67 have declared an emergency but have no plans in place. However, only a small number of local authorities have published climate change resilience/adaptation plans:

<u>Council Name</u>	<u>Year Published</u>
Cambridge City Council ⁵	2018
Somerset West and Taunton Council ⁶	2020
Bristol City Council ⁷	2020
Leeds City Council ⁸	2022 (June)
Brent County Council ⁹	2022 (July)
Stafford Borough Council ¹⁰	Draft out for consultation but available online

Table 1.: Councils with Climate Related Resilience/Adaptation Strategies (as of August 2022)

2.4 What is resilience?

According to the IPPC: "Resilience is defined as the capacity of social, economic and ecosystems to cope with a hazardous event or trend or disturbance, responding or reorganising in ways that maintain their essential function, identity, and structure as well as biodiversity in case of ecosystems while also maintaining the capacity for adaptation, learning and transformation. Resilience is a positive attribute when it maintains such a capacity for adaptation, learning, and/or transformation".

Essentially, resilience means how well a complex system (like an ecosystem or a city) can 'bounce back' from adverse events and return to a place where the system functions as normal. Resilience is a dynamic process in which the system actors constantly learn and evolve to build resilience against future events.

⁴https://data.climateemergency.uk/councils/?name=&declared_emergency=False&has_plan=True&promise_combined=&authority_type=®ion=&geography=&population=&sort=-name

⁵ <https://www.cambridge.gov.uk/media/5996/climate-change-adaptation-plan.pdf>

⁶ <https://www.somersetwestandtaunton.gov.uk/media/2429/carbon-neutrality-and-climate-resilience-plan.pdf>

⁷<https://democracy.bristol.gov.uk/documents/s8548/16c%20Appendix%201%20Bristol%20Resilience%20Strategy.pdf>

⁸ <https://democracy.leeds.gov.uk/documents/s233962/CEAC%20Adaptation%20report%201060622.pdf>

⁹ <https://www.brent.gov.uk/neighbourhoods-and-communities/community-priorities/climate-emergency/climate-resilience-and-adaptation-plan>

¹⁰ <https://www.staffordbc.gov.uk/sites/default/files/cme/DocMan1/Policy%20and%20Plans/Climate-Adaptation-Strategy-Draft.pdf>

2.5 UK Third Climate Change Risk Assessment

Recent resilience strategies use the Third UK Climate Change Risk Assessment (UKCCRA3) as a reference point. Within the UKCCRA3, a variety of risks and opportunities from the effects of climate change were analysed under various scenarios (e.g. 2°C of warming by 2050, 4°C by 2080 etc.), with the report concluding that there were eight priority risk areas where the UK required more action to meet the magnitude of the risk.

Priority Risk Area	Magnitude of Risk	Key policy areas
Risks to the viability and diversity of terrestrial and freshwater habitats and species from multiple hazards.	High	Biodiversity ; Soil and water protection and restoration; Environmental land management; Sustainable farming and forestry; Net Zero; Green finance
Risks to soil health from increased flooding and drought.	Medium but will increase to high by 2050.	Biodiversity; Soil and water protection and restoration; Environmental land management; Sustainable farming and forestry; Net Zero; Green finance
Risks to natural carbon stores and sequestration from multiple hazards leading to increased emissions.	Medium but will increase to high by 2050.	Biodiversity; Soil and water protection and restoration; Environmental land management; Sustainable farming and forestry; Net Zero; Green finance
Risks to crops, livestock and commercial trees from multiple hazards.	Medium but will increase to high by 2050.	Biodiversity; Soil and water protection and restoration; Environmental land management; Sustainable farming and forestry; Net Zero; Green finance
Risks to supply of food, goods and vital services due to climate-related collapse of supply chains and distribution networks	Medium but will increase to high by 2050.	Public procurement; Business resilience; Environmental land management; Trade
Risks to people and the economy from climate-related failure of the power system	High	Infrastructure; Energy; Net Zero
Risks to human health, wellbeing and productivity from increased exposure to heat in homes and other buildings	High	Building regulations and strategies Planning reform
Multiple risks to the UK from climate change impacts overseas	High	National resilience; Overseas aid; Research and capacity building

Table 2.: The 8 national priority risk areas to UK, according to the UKCCRA3

Whilst these eight priority risk areas have relevance to York within the national context, more localised impacts are not considered and may, therefore, not be as useful when analysing the local picture.

This report will use the UKCCRA3 as a guide but will identify the priority risks areas to York, assessing where the most urgent climate resilience planning is needed.

Each risk response is summarised and includes information about the national context/response where relevant.

3 Methodology

3.1 The UKCCRA3 and the Adapted Approach for York

The methodology for this report has been adapted from the one used for the UKCCRA3, which identified and assessed 65 climate-related risks and opportunities to the UK. Each risk/opportunity was thoroughly investigated in the UKCCRA3 Technical Report by answering three main questions. The Technical Report provides in-depth, national scale analysis for each risk and opportunity, authored by experts after reviewing both academic and grey literature (such as reports, working papers, government documents and white papers), to arrive at an urgency score. A basic summary of this method can be seen below:

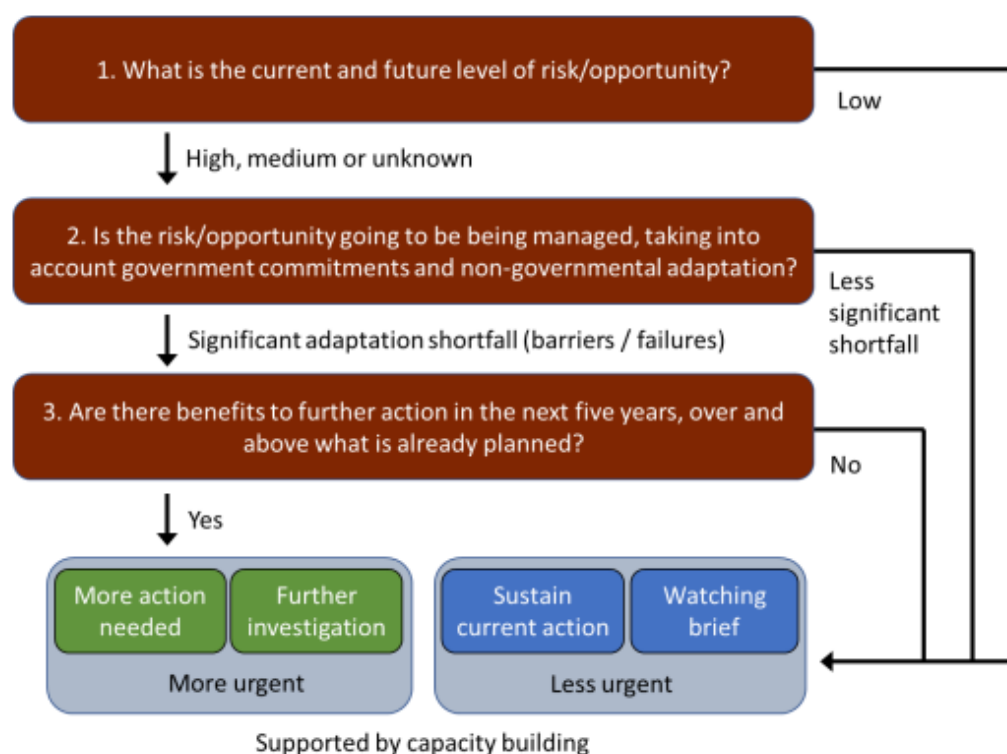


Figure 2.: Assessment criteria of each risk in the UKCCRA3

This approach was used as the basis for this report but has been modified to match the local context for York and to fit the available time and capacity.

3.2 Stage 1 –Risks & Opportunities Survey

To collect the data and local knowledge for each risk & opportunity, they were categorised into themes and a bespoke survey was produced for each theme. (See Appendix B).

This was done to:

- Guide respondents to provide meaningful information that could be analysed
- Increase participation by limiting responses that most closely aligned with the experts subject areas

Due to the interdisciplinary nature of the risks contained in UKCCRA3, some risks have been designated more than one category and were sent to numerous experts, across multiple disciplines.

Experts were asked to assign an order of magnitude to each of the risks & opportunities to York by 2050, based on their expert knowledge. The magnitude scoring system was adapted from the UKCCRA3 and adjusted to formulate the approximate values that were appropriate for York's size and population. The adapted magnitude scoring table for York is below in Table 3.

The survey ran for three weeks in June. It is worth noting that this was before York recorded the record temperatures in July 2022's extreme heatwave.

Note: For those interested in how this table was produced, please see the calculations in Appendix C.

	<u>High Magnitude</u> Major annual damage and disruption or foregone opportunities:	<u>Medium Magnitude</u> Moderate annual damage and disruption or foregone opportunities:	<u>Low Magnitude</u> Minor annual damage and disruption or foregone opportunities:
Economic	£1.4m+ damage (economic) or foregone opportunities, and/or	£140,000 - £1,400,000 of damage (economic) or foregone opportunities, and/or	Less than £140,000 damage (economic) or foregone opportunities, and/or
Health	1+ death(s) , 3+ major health impacts, 30+ people affected / minor health impacts, and/or	No deaths, a few major health impacts, 3 - 30 people affected / minor health impacts. and/or	No deaths, no major health impacts, a few people affected / minor health impacts, and/or
Land	10+ hectares of land lost or severely damaged , and/or 10+ km of river water/km2 of water bodies affected, and/or	1 - 10 hectares of land lost or severely damaged, and/or 1 - 10 km of river water/km2 of water bodies affected, and/or	Less than 1 hectare of land lost or severely damaged, and/or less than 1 km of river water/km2 of water bodies affected, and/or
Habitat Loss	Major impact (~10% or more at local level) to valued habitat or landscape types (e.g., BAP habitats, SSSIs), and/or	Intermediate impact (~5% at local level) to valued habitat or landscape types (e.g., BAP habitats, SSSIs), and/or	Minor impact (~1% at local level) to valued habitat or landscape types (e.g., BAP habitats, SSSIs), and/or
Species Loss	Major impacts on or loss of species groups, and/or	Intermediate impacts on or loss of species groups, and/or	Minor impacts on or loss of species groups, and/or
Natural Assets	Major impact (10% or more at local level) to an individual natural capital asset and associated goods and services ⁴ , and/or	Intermediate impact (1 to 10% at local level) to an individual natural capital asset and associated goods and services, and/or	Minor impact (~1% or less at local level) to an individual natural capital asset and associated goods and services, and/or
Cultural Heritage	Major loss or irreversible damage to single locally iconic heritage asset (e.g., Minster)	Medium loss or irreversible damage of locally iconic heritage asset (e.g., Minster)	Low loss or irreversible damage to locally iconic heritage asset (e.g., Minster)

Table 3. Adapted Magnitude for York Area

The results of the survey were assigned a numerical value for analysis purposes:

- High Magnitude = 3
- Medium Magnitude = 2
- Low Magnitude = 1

An average magnitude score was taken for each risk, highlighting those risk areas that were most significant for York. Those risks with the highest magnitudes were progressed to Stage 2 for further investigation.

Note: The survey results that came back as “does not apply to the risk”, “not my area of expertise” or “unknown magnitude” were not included in the average magnitude score calculation to avoid skewing the data. “Not my area of expertise” and “unknown magnitude” are useful to highlight where more research is needed.

3.3 Stage 2 - Local assessment

The most significant risks identified in the survey were investigated further by a combination of desk-based research and semi-structured interviews with technical and academic experts. The interviews were conducted throughout July 2022.

The guiding questions for Stage 2 have been modified from the UKCCRA3 methodology to fit the more localised scope of this report. The questions asked were:

- Are the risks and opportunities going to be managed at the local level now and in the future?
- Are there benefits to further action in the next five years, over and above what is already being planned?

Follow-up questions were asked depending on the response to the above and included:

- What is already being done in and around York to combat the risk/opportunity?
- Are there any plans to manage this risk/opportunity in the future?
- Does the current response match the magnitude of the risk/opportunity at the local level?

3.4 UKCCRA3 Risks Excluded from the Report

Not all risks & opportunities included in the UKCCRA3 have local relevance to York. The following risks & opportunities were excluded from the analysis.

3.4.1 International Dimensions

Whilst international dimensions are a key part of the climate change problem, some of risks have been excluded from the analysis as they encompass issues that are unlikely to be able to be affected by Council policy e.g., “ID4 Risks to the UK from international violent conflict resulting from climate change on the UK”, was excluded as it is more in the scope of the national governments remit, as seen in the Ukraine/Russia conflict.

3.4.2 H13 Risks to education and prison services

This risk was omitted as:

- i) York does not have a prison within its boundary.
- ii) The effect on education that the UKCCRA3 Technical Report details concerns issues that are not regionally dependent or affected by location e.g., the effect on concentration

levels of children due to warmer classroom conditions. As this risk applies largely equally across all local authorities, no new information can be gained that isn't already contained in the UKCCRA3.

3.4.3 Coastal and Marine

The risks in Table 4 were omitted because they only referred to coastal and marine related threats. York does not have a coastline and is therefore not relevant in trying to inform local resilience strategy decisions.

Risk ID	Risk
N14	Risks to marine species, habitats, and fisheries from changing climatic conditions, including ocean acidification and higher water temperatures
N15	Opportunities to marine species, habitats, and fisheries from changing climatic conditions
N16	Risks to marine species and habitats from pests, pathogens, and invasive species
N17	Risks and opportunities to coastal species and habitats due to coastal flooding, erosion, and climate factors
I3	Risks to infrastructure services from coastal flooding and erosion
H3b	Risks to people, communities, and buildings from coastal flooding
H4	Risks to the viability of coastal communities from sea level rise

Table 4.: Excluded Risks

4 Results

4.1 Stage 1 - Survey Results

46 risks & opportunities received a response and were assigned a magnitude by experts. Of these, the 6 most significant were progressed to stage 2:

Risk	Average Magnitude Score	No. Responses	UKCCRA3 Magnitude Results (based on 2°C warming pathway by 2050)
N4 Risk to soils from changing climatic conditions, including seasonal aridity and wetness	2.93	3	High
H9 Risks to food safety and food security	2.92	2	High
N1 Risks to terrestrial species and habitats from changing climatic conditions and extreme events, including temperature change, water scarcity, wildfire, flooding, wind, and altered hydrology	2.64	2	High
N3 Opportunities from new species colonisations in terrestrial habitats	2.57	2	Medium (Opportunity)
H3a Risks to people, communities and buildings from river and surface flooding	2.57	1	High
H5 Risks to building fabric	2.45	3	Medium

Table 5.: Top Risks as a Result of Climate Change

It is important to note that these are not the only risks & opportunities that should be considered in resilience planning. Limitations to the approach of this study and available responses provide a low level of confidence in the assignment of severity and a more general approach to resilience planning is recommended.

4.1.1 Risks with No Data Available

Of the fifty risks that were assessed in the various surveys, four returned no data, as experts were not able to attribute a magnitude to the risk (Table 6.). The national magnitude of each risk from the UKCCRA3 is included below, these risks may need to be investigated further as part of a future study for their relevance to York. The national magnitude of each risk from the UKCCRA3 is included below for reference. As no data is available, these risks will be excluded from the analysis of this report.

Risk	UKCCRA3 Magnitude Classification

I7 Risks to subterranean and surface infrastructure from subsidence	Medium
H10a Risks to health from water quality	Medium
H10b Risks to health from household water supply	High
H7b Risks to health and wellbeing from changes in aeroallergens	Medium

Table 6.: Risks that returned no data from the surveys

4.2 Stage 2 – Interviews and Desk-based Research of the Top Six Risks to York

The average magnitude for each impact area is shown at the start of each of the risks in this section and summarised in a table.

4.2.1 N4 Risk to soils from changing climatic conditions, including seasonal aridity and wetness

Impact Area	Average Magnitude	Impact if no action taken (annually)
Economic	3.00	£1.4m+ damage (economic) or foregone opportunities
Health	3.00	1+ death(s), 3+ major health impacts, 30+ people affected / minor health impacts
Land	3.00	10+ hectares of land lost or severely damaged, and/or 10+ km of river water/km ² of water bodies affected
Habitat Loss	3.00	Major impact (~10% or more at local level) to valued habitat or landscape types
Species Loss	3.00	Major impacts on or loss of species groups
Natural Asset	3.00	Major impact (10% or more at local level) to an individual natural capital asset and associated goods and services
Heritage	2.50	Major loss or irreversible damage to single locally iconic heritage asset (e.g., Minster)
Overall Average	2.93	High

Table 7: Summary of Impact Areas for Risk N4

There have been strong calls from the UK Climate Change Committee for a comprehensive soil monitoring programme. This is particularly important for York as a local Environment & Land Use Advisor for the National Farmers Union raised that there are concerns about the health of soil in York and the surrounding area. Much of the land around York is classified as grade 2 or 3¹¹ conditions suitable for high quality arable crops (such as wheat, barley, oilseed rape etc.) and horticultural crops

“... soil health is a huge challenge... you can’t improve what you can’t measure”

Wetter winters, flash flooding and waterlogged fields are always a concern for farmers, but especially those in York, as geographically the land is relatively flat and has lots of rivers and waterways. Climate

¹¹ (Very good quality to good/moderate quality (Agricultural Land Grades | Land Research Associates (lra.co.uk)).

change will exacerbate these risks. Flooding is covered in more detail in risk H3a, but it is an important factor that impacts soil health, both for agricultural and non-agricultural land use (e.g., planted woodland).

Increasingly, at the other end of the spectrum, seasonal aridity in York is also catastrophic for soil health. York is on the Eastern side of the UK and is therefore likely to experience less rainfall than other parts of the country. This risk is already being experienced, the only month with above average rainfall in 2022 has been February, with data from Yorkshire Water showing that rainfall in July 2022 was only 33.3% of historical average and reservoirs are at 53% of typical levels for the time of year ¹².

With regards to adaptation, there has been action taken at a range of scales – both locally and nationally. The agricultural sector is coming together to improve soil health and increase resilience to the impacts of climate change, however more action is required to fully address the risk. The new Environmental Land Management Scheme (ELMS) will have a focus on management of soils through data collection and monitoring. This will help to further incentivise positive and informed management decisions of soils to not only adapt and become more resilient to the impacts of climate change, but also ensure food security (see Risk H9).

A healthy soil balance of good structure, organic matter, nutrients, soil fauna and flora through skilful management, leads to good yields and increased productivity with reduced erosion. Better crop yields from productive land means less productive land could be used to provide services such as growing trees and storing more carbon. This can be done by implementing ‘regenerative’ farming practises and Integrated Farm Management, which have grown in popularity and interest over the past few years.

Summary:

- Increasing recognition and awareness of the risk
- Risk not well managed at the local or the national level
- Farmers are a key stakeholder in addressing the risk
- Urgent soil monitoring programme is needed

Recommendations:

- A good soil monitoring programme
- Requires explicitly defined sustainable outcomes for soils
- Working more closely with farmers and landowners on this risk

4.2.2 H9 Risks to food safety and food security

Impact Area	Average Magnitude	Impact if no action taken (annually)
Economic	2.50	£1.4m+ damage (economic) or foregone opportunities
Health	3.00	1+ death(s), 3+ major health impacts, 30+ people affected / minor health impacts
Land	3.00	10+ hectares of land lost or severely damaged, and/or 10+ km of river water/km ² of water bodies affected

¹² <https://www.yorkshirewater.com/about-us/open-data/watsit-report/>

Habitat Loss	3.00	Major impact (~10% or more at local level) to valued habitat or landscape types
Species Loss	3.00	Major impacts on or loss of species groups
Natural Asset	3.00	Major impact (10% or more at local level) to an individual natural capital asset and associated goods and services
Heritage	n/a	n/a
Average	2.92	High

Table 8: Summary of Impact Areas for Risk H9

“We need to be thinking about food security and environmental protection as the same thing. The two can be interlinked.”

The risk to food safety is difficult to be directly influenced or managed at a local level. The UK has some of the highest environmental and safety standards of anywhere in the world. Farmers in the York area are required to ensure these high standards are upheld. While climate change will impact food safety and security, through changeable weather patterns and warmer weather resulting in new pests and diseases, the application and enforcement of national standards is the responsibility of organisations such as the Food Standards Agency and the Health and Safety Executive (via the Chemicals Regulation Division) as opposed to local authorities.

There are pressures from climate change effects on both domestic growing, as well as the international food supply chain. Securing local supply chains will help protect against international supply side shocks and price increases. Local and regional farming is therefore, crucial to addressing this risk; However, so far there are no formal plans to help address the threat of food security from climate change.

Farmers are not the only actors in addressing this risk. Action needs to be taken throughout the supply chain and include logistics companies and major retailers who often have significant power in price setting.

Building resilience into food supply networks is being managed somewhat by the private sector. However, due to the complex nature of the food supply system and their multi-staged processes, coupled with the uncertainty around climate change impacts, there are indications that the private sector might struggle to take all appropriate actions. Therefore, there is a role for Government in removing some of the barriers to enable and encourage private sector adaptation, as well as ensuring a higher level of resilience along supply chains. This is particularly relevant for York, as there is a significant proportion of the local businesses community that are small independents, who will find it hard to employ the resources needed to help mitigate and adapt to the risk.

The UK is well placed to ensure food security for the country and from further afield. It is essential that this ability is supported both locally and nationally and is not undermined by cheaper imports from elsewhere that may not be to the same standards. Local authorities can support local farmers and ensure food safety by procuring locally produced, seasonal food where possible. However, this particular risk presents a unique problem in that while supporting British Farmers does have many benefits in food safety, it could adversely affect food security, as cheaper imports are excluded from the market, driving food prices up further, and may result in greater usage of food banks. This is a

political choice that may need to be looked at further, so no recommendation was able to be made in this regard.

Food security might be an area that councils should become more involved in. Increases in food prices means that the poorest people may find it increasingly harder to access food and the council may need to do more in terms of supporting these people. Routine monitoring of food security is essential to public health and should help policy-makers better plan for any future threats. Early warning systems would also be useful in addressing the risk but will also help reduce any unnecessary knock-on effects and costs to the health and social care systems.

Summary:

- Food safety and food access are both likely to be aggravated from climate change effects
- The food access and food security issue will have adverse knock-on effects to the health and social care systems
- The private sector is adapting to the risk partially, but government needs to close the gaps
- The agricultural sector is a key stakeholder in addressing the risks

Recommendations:

- Activities such as horizon scanning¹³ to understand changing risk of food safety
- Food early warning systems or food detection systems¹⁴ will also be crucial in mitigating climate related food threats and should be utilised wherever possible
- Routine assessment of food security to protect public health and limit costs for the health and social care sectors
- Work with local farmers to increase resilience in food supply chain
- Urgent assessment should be done to fully understand the impact that climate change could have on food supply and how many will be pushed into poverty if price spikes in food occur

4.2.3 N1 Risks to terrestrial species and habitats from changing climatic conditions and extreme events, including temperature change, water scarcity, wildfire, flooding, wind, and altered hydrology

Impact Area	Average Magnitude	Impact if no action taken (annually)
-------------	-------------------	--------------------------------------

¹³ Horizon scanning is used as an overall term for analysing the future: considering how emerging trends and developments might potentially affect current policy and practice. This helps policy makers in government to take a longer-term strategic approach and makes present policy more resilient to future uncertainty.

¹⁴ Early Warning Systems (EWS) alert to the presence of food crises and related drivers, informing decision makers and saving lives. The Early Warning Hub brings together information from across Early Warning Systems in one place. There is a range of Early Warning Systems (EWS) relevant for food security. [https://www.foodsecurityportal.org/tools/early-warning-hub#:~:text=Navigating%20EWS-,Early%20Warning%20Systems%20\(EWS\)%20alert%20to%20the%20presence%20of%20food,Warning%20Systems%20in%20one%20place.&text=There%20is%20a%20range%20of,EWS\)%20relevant%20for%20food%20security.](https://www.foodsecurityportal.org/tools/early-warning-hub#:~:text=Navigating%20EWS-,Early%20Warning%20Systems%20(EWS)%20alert%20to%20the%20presence%20of%20food,Warning%20Systems%20in%20one%20place.&text=There%20is%20a%20range%20of,EWS)%20relevant%20for%20food%20security.)

Economic	2.00	£140,000 - £1,400,000 of damage (economic) or foregone opportunities
Health	2.50	1+ death(s), 3+ major health impacts, 30+ people affected / minor health impacts
Land	3.00	10+ hectares of land lost or severely damaged , and/or 10+ km of river water/km2 of water bodies affected
Habitat Loss	3.00	Major impact (~10% or more at local level) to valued habitat or landscape types
Species Loss	3.00	Major impacts on or loss of species groups
Natural Asset	3.00	Major impact (10% or more at local level) to an individual natural capital asset and associated goods and services
Heritage	2.00	Medium loss or irreversible damage of locally iconic heritage asset (e.g., Minster)
Average	2.64	High

Table 9: Summary of Impact Areas for Risk N1

Although geographically York is largely flat, it has wide variety of landscapes within its borders from arable agricultural land, extensive waterways, and woodlands etc. which create habitats for similarly varied species. One of Europe’s strongest populations of the Great Crested Newt live in York and the surrounding area, likely due in part to farming practices and farmers creating water attenuation and drainage ditches, creating the clusters of aquatic habitats that the newts require. However, as the climate warms and we begin to see prolonged dry spells through the year, these habitats dry up and populations dwindle.

There are local conservation programmes that are run to help promote biodiversity and protect species, such as the Community Woodland project in Knapton created by the City of York Council. However, discussions with experts show that action to reduce risk to terrestrial species and habitats often comes from planning and new developments. Developers are currently required to enhance application sites for ecology post construction, resulting in a net gain of biodiversity – in-line with the national Planning Policy Framework and the Draft Local Plan for the City of York. These biodiversity enhancements are secured through planning conditions and are required to be appropriate to the existing site ecology. At present there are no requirements for such enhancements to consider climate resilience, however applicants are often required to provide on-going management and maintenance programmes for biodiversity enhancements and landscaping in general, which are again secured through planning conditions.

In November 2023, the Environment Act (2021) will see the requirement mandated for all developments to provide a minimum of 10% biodiversity net gain. A further obligation for developers will see the safeguarding of enhancements through the provision of a minimum 30-year management plan. These new requirements will place greater emphasis on the resilient, long-term success of newly created habitats as factors such as time and difficulty in creating new habitats must be accounted for when calculating final net gains. The overall aim of biodiversity net gain is to leave sites in a better

state post-construction, however net gain must be used as a tool to create connectivity between green areas, providing a mosaic of habitats that allow existing and new ecology to move through the wider landscape. The isolation of species results in reduced genetic diversity limiting a population's resilience to change, whether this be changing environmental conditions or disease.

"Ecology 101 is do not isolate your populations..."

Biodiversity net gain provides us with a legally secured mechanism to deliver and enforce change through the planning system, however, we are yet to see this theory in practice. This of course must be balanced with the need to encourage investors to invest in York which brings in economic benefits to the city. Connectivity also has implications beyond the local level, and wide roaming species would benefit from local, regional, and nationally joined up conservation and protection plans to ensure resilience at all levels.

There are good indications that these issues have been recognised in policy development, but as of yet the mechanisms for delivery are unclear and the level of funding undetermined: the risks to people and nature are serious and the cost of addressing them should not be underestimated. There is limited evidence on the effectiveness of adaption actions in this area and it is intrinsically difficult to assess the extent to which harm has been avoided, especially given the long timescales over which both climate change and ecological processes operate. Consistent, long-term monitoring and assessment will be important to inform adaptive management and build a robust evidence base for further action.

It is essential that adaptation is consistently factored into decision-making alongside climate change mitigation and the protection of biodiversity from the start. It will also be critical to embed the concept of nature-based solutions at the heart of climate change adaptation across other sectors, including agriculture, flood risk management, water supply, infrastructure, and urban planning. The opportunities for co-benefits are high but there are also serious costs if this does not take place. One expert suggested that for the City of York Council in particular, there may be a role in being proactive in finding sites for developers and suggesting these areas of land that could be improved upon.

Summary:

- This risk is being partially managed through planning applications e.g., biodiversity net-gain requirements
- There are already conservation efforts taking place within the region
- Level of risk will increase over time, and it is unclear if this risk will be managed fully in future

Recommendations:

- Proactive approach to planning and development
- Connecting habitats up to reduce species isolation
- Regularly review and if necessary, adjust boundaries for conservation objectives of protected sites, species objectives and indications of favourable habitat conditions

4.2.4 N3 Opportunities from new species colonisations in terrestrial habitats

Impact Area	Average Magnitude	Impact if no action taken (annually)
-------------	-------------------	--------------------------------------

Economic	3.00	£1.4m+ damage (economic) or foregone opportunities
Health	3.00	1+ death(s), 3+ major health impacts, 30+ people affected / minor health impacts
Land	3.00	10+ hectares of land lost or severely damaged, and/or 10+ km of river water/km ² of water bodies affected
Habitat Loss	3.00	Major impact (~10% or more at local level) to valued habitat or landscape types
Species Loss	2.00	Intermediate impacts on or loss of species groups
Natural Asset	2.00	Intermediate impact (1 to 10% at local level) to an individual natural capital asset and associated goods and services
Heritage	2.00	Medium loss or irreversible damage of locally iconic heritage asset (e.g., Minster)
Average	2.57	High

Table 10: Summary of Impact Areas for Risk N3

Although there have been some projects in the region, the response to the opportunities for new species colonisations has been limited and relates to individual cases rather than an overall strategy. A scheme in Pickering is being trialled by Forestry England and Exeter University to introduce beavers to “slow the flow” and help as Natural Flood Management (NFM) measure (see Risk H3a). There are however, concerns about the knock-on effects this may have to local farmers crops, and is therefore already a contentious issue.

There are also conservation efforts in terms of protecting species (e.g., the Tansy Beetle population on the river Ouse), however in terms of new species introduction it is not an area with much research done in the York area and a Countryside and Ecology Officer commented that they “*don’t think the data is available yet...*” to be able to make an informed decision. Therefore, any opportunities from new species colonisations are not currently being realised.

Research opportunities are available in this space, and the Council could benefit by working closely with local universities and other educational institutions to gain more insight. However, it is recommended that a cautious approach be taken regarding this opportunity as altering ecology can have significant impacts that aren’t always considered in even the most rigorous of research. Changes to the climate may also mean that there is increased disruption from invasive species. The Signal Crayfish has already caused damage to the UK and its rivers, and increased temperatures are shown to boost their performance ¹⁵.

Summary:

- There are some individual projects that could prove successful, although these are in the early stages of research
- The response to the opportunities is not well understood and therefore more research will need to be carried out

¹⁵ <https://onlinelibrary.wiley.com/doi/pdf/10.1002/eco.2258>

- Climate change is already causing problems with invasive species, and could only improve the performance of these species e.g., the Signal Crayfish

Recommendations:

- While there may be benefits not currently realised in relation to the opportunity, it is important that a cautious approach be taken whenever taking steps that may alter ecology
- There could be opportunities to work with the local universities and educational institutions to understand the opportunities for the region

4.2.5 H3a Risks to people, communities and buildings from river and surface flooding

Impact Area	Average Magnitude	Impact if no action taken (annually)
Economic	2.00	£140,000 - £1,400,000 of damage (economic) or foregone opportunities
Health	2.00	No deaths, a few major health impacts, 3 - 30 people affected / minor health impacts
Land	3.00	10+ hectares of land lost or severely damaged, and/or 10+ km of river water/km ² of water bodies affected
Habitat Loss	3.00	Major impact (~10% or more at local level) to valued habitat or landscape types
Species Loss	3.00	Major impacts on or loss of species groups
Natural Asset	3.00	Major impact (10% or more at local level) to an individual natural capital asset and associated goods and services
Heritage	2.00	Medium loss or irreversible damage of locally iconic heritage asset (e.g., Minster)
Average	2.57	High

Table 11: Summary of Impact Areas for Risk H3a

The flood risk from rivers has been described in interviews as “*well managed*” for York and is overseen by the Environment Agency because the rivers are classed as “*main river*”. Numerous assets protect the city from floodwater, including hard defences, upstream storage (Clifton Ings) and the Foss Barrier. These provide a high standard of protection to York, with a risk of overtopping in any year of 1 in 100. The hard defences throughout the city and the Foss Barrier have been upgraded in recent years with significant investment and are designed to maintain the standard of protection until 2039 in the face of predicted rises in river levels because of climate change. This investment followed significant flooding in 2015 when the Foss Barrier being overwhelmed by the volume of floodwater. Although the assets are currently regarded as providing a high standard of protection “*...we’re starting to get towards the upper end of the design capacity*”, and it is not possible to eliminate the risk of flooding. It is important that local communities are supported to focus on being resilient to flooding when it occurs, including signing up to flood warnings and taking action to minimise damage when flooding does occur. It is also important to take a long-term and strategic approach to managing water within the catchment, which is something that partners are committed to and is demonstrated through the York and North Yorkshire Catchment Flood Management project.

Localised surface water flooding is the responsibility of City of York Council and is in many ways more difficult to manage. It can occur at any time of year but particularly in summer when greater levels of convective rainfall occur, and large volumes of rainwater fall in a relatively small area in a short space of time. Drainage systems are unable to cope, and unlike river flooding which can be modelled and well predicted to be able to give citizens some warning and time to plan a response, this particular type of rainfall is very hard to predict.

As Lead Local Flood Authority, the Council takes action to manage flood risk from surface water and smaller ('ordinary') watercourses. This includes both managing the impact of new development and delivering drainage maintenance and projects to reduce risk. Sustainable Urban Drainage Systems (SuDS) and Natural Flood Management approaches can be sustainable options for managing water at source to help partially mitigate and adapt to the risk in the short to medium term, but such approaches are typically resource intensive to deliver and may be difficult to fund. The impacts of these actions are often hard to quantify and the data available to project planning decision makers are less robust than data for river flooding.

Sustainable Drainage Systems; Responsibility and Accountability; and Property-Level Flood Resilience and were also highlighted as areas of interest through the interviews with experts (see Appendix E).

Although not directly related to the risk, it is also worth mentioning here that the impact to farmers from field flooding for alleviation purposes (see Risk N4 above) and their compensation, did appear in discussions with experts. Flood managers find it difficult to involve wider stakeholders such as farmers who can help in managing some of this risk, when there is little benefit or incentive for them to do so. Therefore, there is potential for cross benefits in the management of surface flood risk, and the soil health of agricultural land if a solution can be found. Government policy in this area is developing however, particularly as part of the new Environmental Land Management Schemes.

Summary:

- This is the most well managed of the risks in the report
- The adaptation and resilience measures that are already taking place offer good protection to the risk, at least in the medium term
- Design capacity for some defences is reaching the limit of what can be achieved
- Surface level flooding is more of the concern for York, because it is much harder to predict
- Work is also being conducted within the wider catchment area to seek solutions for up-stream management

Recommendations:

- For surface level flooding, as it is hard to predict, resilience measures might be the most effective way to manage the risk. Informing households that are more prone to surface level flooding could allow for resilient adaptation measures to protect homes e.g., higher electricity points in the home.
- Sustainable Drainage Systems (SuDS) for new builds, and a review of the old drainage infrastructure where necessary.

- Encouraging individuals and communities who may be vulnerable to flooding in the future to also assume some level of responsibility for flood resilience. Although it is not clear what level of responsibility would be appropriate and should be discussed with stakeholders.

Note: Further information on the evidence gaps or questions about the implementation of policy at the national (that are also relevant to York) are contained in Appendix E

4.2.6 H5 Risks to building fabric

Impact Area	Average Magnitude	Impact if no action taken (annually)
Economic	2.67	£1.4m+ damage (economic) or foregone opportunities
Health	3.00	1+ death(s), 3+ major health impacts, 30+ people affected / minor health impacts
Land	3.00	10+ hectares of land lost or severely damaged, and/or 10+ km of river water/km ² of water bodies affected
Habitat Loss	3.00	Major impact (~10% or more at local level) to valued habitat or landscape types
Species Loss	2.00	Intermediate impacts on or loss of species groups
Natural Asset	2.00	Intermediate impact (1 to 10% at local level) to an individual natural capital asset and associated goods and services
Heritage	1.50	Low loss or irreversible damage to locally iconic heritage asset (e.g., Minster)
Average	2.45	High

Table 12: Summary of Impact Areas for Risk H5

There are some considerations of risks to buildings from effects of climate change, primarily in relation to flooding. This is, however, is mainly reactionary rather than adaptive, as repairs to housing are only done at the point of damage to the building. So far there is no formal strategy to address the risk at the local level, and therefore more work is needed in this area

“the most effective investment might be around data analysis and getting some real expertise in around the analysing of big data sets”.

Further to the risk posed by flooding, “sub-floor flooding” (which occurs when there is a gap in the flooring and water leaks through from underneath) has become a greater concern during the winter months but can happen any time in the year whenever the water table levels in York are high. Whilst there is already a programme running within the Council on this issue, the response to this threat is again, only a reactionary measure, rather than a proactive adaptation strategy.

Another concern within the risk to building fabrics is unusually high heat. July 2022 saw temperatures of nearly 40°C in York and has raised questions about the threat of fires due to the increased dryness during the summer months. Much of York’s building stock was not designed to accommodate such

temperatures (which could impact vulnerable groups such as the elderly in care homes), nor to deal with the increased threat of fires.

Perhaps more worryingly and related to high temperatures, in late July 2022 Liverpool Victoria Insurance highlighted the impact that intense heat can have on building foundations which can lead to subsidence, especially if the building is built on clay soil ¹⁶.

This is particularly concerning for York as much of the soilscape ¹⁷ is either:

- “Slowly permeable seasonally wet slightly acid, **but base-rich loamy and clayey soils**” (Soilscape 18 - indicated in bright green in Figure 3.)
or
- “Slightly acid loamy and **clayey soils with impeded drainage**” (Soilscape 8 - indicated in brown in Figure 3.)

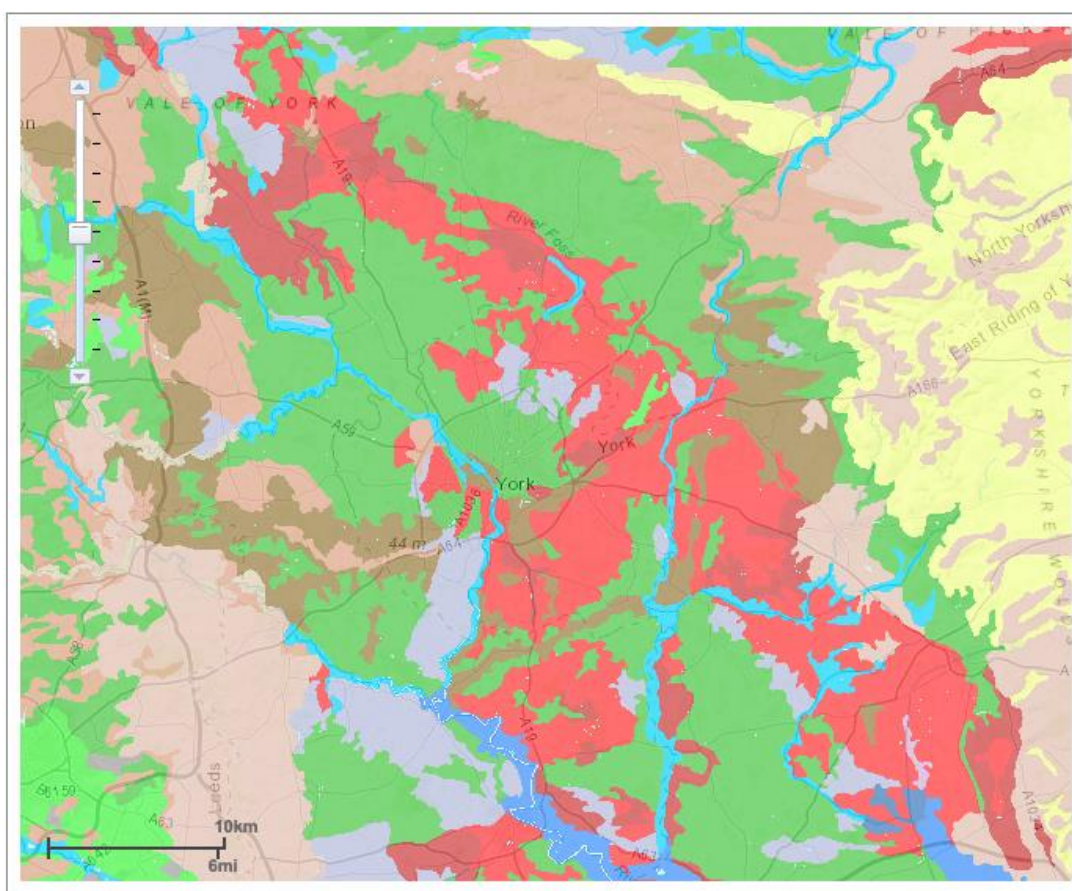


Figure 3.: Map of York's soilscape

Soilscape 18 covers a lot of York's residential areas, particularly in the North of the City, including Rawcliffe, Huntington, Earswick, New Earswick, Heworth, and parts of Clifton and Osbaldwick (highlighted as the striped area in Appendix F). Some smaller but still densely populated areas in the

¹⁶<https://www.insurancetimes.co.uk/news/subsidence-claims-increased-by-49-in-last-year-lvgi/1438289.article>

¹⁷<http://www.landis.org.uk/soilscales/index.cfm>

South, such as the south of Acomb, the area around Hob Moor, and Dringhouses, also share the same soilscape.

Although not as clayey as Soilscape 18, Soilscape 8 (indicated in brown) is also vulnerable to the risk, due to the clay content of the soil (see Appendix G for map). This covers much of the town centre, as well as populated areas in the South such as Askham Bryan, Copmanthorpe and parts of Heslington.

It is also notable that many of these clay soil areas include critical infrastructure to York, such as the outer ring road, although this is not the focus of this particular risk and roads may be less affected by this subsidence issues than house foundations, however it might be worthy of further investigation.

Further investigation and action more action is required to deal with the threats of water damage in the winter and heat damage in the summer, including to better understand the risk of high temperatures causing subsidence to York's building stock and infrastructure. It is worth noting here that risk H5 is not being adequately met at the national level either, so York is not behind compared with the national response, but there is an opportunity for the Council to move ahead of the curve, as the local authority has greater powers in with housing compared with some of the other risks in this report.

Summary:

- The response is mainly reactionary rather than proactive
- Data is limited
- Future risk not really considered at the local level
- Further investigation required

Recommendations:

- Increase the knowledge base around the risk at the local level
- For new builds, the Council should ask for data on how developers are planning to cope with the likelihood of increased temperatures in future summers at the design stage e.g., through the effect on building fabric or how they plan to cope if subsidence becomes increasingly likely etc.
- Opportunity to work with other councils that also have large amounts of clay soils to understand the impact.

5 Limitations

There are a number of limitations associated with the production of this report which need to be considered alongside the conclusions:

- The survey sent out to experts was done with no weighting involved. Further research could be done into which aspects of each are valued e.g., health may be given more weighting than heritage sites, but this is more of a managerial choice and therefore not done in the survey.
- The survey could have benefitted from more respondents, as the amount of survey responses averaged only 2.1 per risk
- The water related survey was not completed so this input from experts in this area was not contained in the survey outcomes

- The survey was conducted over a very short period of time in July 2022 when the weather was dry and hot and therefore participants may have been more aware of dry weather-related risks e.g., effects from high temperatures, fires, soil erosion etc.
- The six risks highlighted in Stage 2 of this report are not the only ones relevant to York. The purpose of this report is to investigate some of the top risks in more detail and is by no means comprehensive. Further work should be done on ALL risks/opportunities from the UKCCRA3 in the report, however not all risks could be considered due to the shorter time scale to deliver the report.
- This was a brief survey done over a relatively short space of time and therefore other risks/opportunities that are not included here should not be discounted. For example, the “risks to business from reduced employee productivity due to infrastructure disruption and higher temperatures in working environments” was also investigated, but the risk is not very well understood, at neither the local or the national level, and therefore requires more research.

6 Conclusion

This report has highlighted those risks taken from the UKCCRA3 that local experts felt were most relevant to York. Where possible (from talking with experts through semi-structured interview) recommendations have been proposed for each risk.

Some key findings from this work include:

- For a lot of the risks, local data was quite limited, and for decisions to be made to address the risks, more needs to be done in terms of gathering the information for data-driven decisions to be made. The Council could consider working more closely with the academic community, and the educational institutions within the city for these data collections.
- York is managing the flood risk particularly well. This is due to a joined up, local, regional, and national response, involving multiple agencies and multiple stakeholders which has produced a response that is proportionate to the risk. This is not the case with the other risks outlined in this report. Lessons should be learnt from the flood response and applied to the other risk areas, as well as those risks that were not included in the reports analysis.
- Resilience is a joined-up, overall response to climate change, and it is important to highlight that building general adaptive capacity, should be prioritised over responses to any singular threats.
- Access to funding and resources is often a problem when trying to address risks from climate change, as many risks aren’t able to have the costs and benefits to actions easily quantified. The recent devolution deal may provide some hope that more resources will be allocated to addressing the local problems; however, this is not a guarantee.

6.1 General Recommendations and Next Steps

- The risks contained in the report should be reviewed on a regular basis and updated as more learning occurs.

- A bigger range of scores could be offered to identify the magnitude with greater accuracy e.g., in the report there is no distinction in the 'high magnitude category' if a risk could cause annual damage of £1.5m or if a risk could cause £10m of annual damage. This would allow those more extreme affects to be captured in the analysis.
- Responsibility and accountability are sometimes difficult to assign to actors in cases of multi-stakeholder, complex, and shared problems like the ones outlined in this report. It may therefore be worth the council conducting some assessment of the biggest risks to York outlined in the report and decide where the council can add value (beyond current action), and where the council draw the line in terms of involvement, and the onus is placed on other stakeholders.
- The survey could be conducted over a longer time-period to avoid any temporal biases in responses.

7 Appendix

Appendix A: Full Council Motion

Government Must Work with Councils to Tackle Worsening Heatwaves and Extreme Weather

Council notes:

- *The work currently being done by City of York Council to progress towards our 2030 zero carbon ambition including the community woodland, new zero carbon housing and energy efficiency retrofit schemes as well as a draft city-wide strategy.*
- *That progress in most areas is nonetheless held back by a lack of substantial and consistent Government investment and closer working with local councils.*
- *The signs in York over the last few years that climate change has already begun in earnest, with hotter drier summers, warmer wetter winters and increased frequency of extreme weather and flooding.*
- *That in 2018 at COP24 the UK Government signed up to working with local communities to deliver the UK's 'Nationally Determined Contributions' in the 2015 Paris Climate Agreement.*
- *That, in May 2021, the Rt. Hon. Alok Sharma MP, President of COP26, said collaboration would be a key objective of the COP26 Climate Summit in November - "Governments, business and civic society need to work together to transform the ways we power our homes and businesses, grow our food, develop infrastructure and move ourselves and goods around".*

Council believes:

- *That despite these agreements and statements, there is still no formal relationship allowing joint partnership working between Local and National Government to take mitigation and adaptation actions against the climate emergency.*
- *That greater collaboration and action are required if we are to mitigate our greenhouse gas emissions and meet our commitments under the Paris Climate Agreement;*²⁶
- *That mitigation strategies should be accompanied by effective adaptation measures to ensure that we are equipped to deal with the changes in our climate that have already begun. These include the potential for heatwaves and extreme weather that will threaten the health and wellbeing of our most vulnerable residents and may also impact on food security.*

Council therefore resolves:

- *To ask Executive to report on the City's climate resilience by assessing the risks from the eight priority risk areas of the UK Climate Change Risk Assessment (June 2021) <https://www.theccc.org.uk/publication/independentassessment-ofuk-climate-risk/> , plan for enhancement of the city's climate resilience and management of the unavoidable impacts of climate change.*
- *To add this Council's voice to calls by the Local Government Association and the Association of Directors of Environment, Economy, Planning and Transport, and others, for a joint local and national government taskforce to plan action to reach 'net zero' emissions.*

- *To call for such a partnership to set appropriate regulations, benchmarks and targets and create the much-needed long-term funding to enable local council areas, communities, and economies to decarbonise whilst remaining resilient and able to realise the benefits of decarbonisation in terms of new green jobs and a healthier environment.*
- *To therefore ask the Chief Operating Officer to write to Alok Sharma MP, President for COP26, the Prime Minister, and the Leadership Board of the LGA, informing them of our support for a joint Local/National Government Climate Change Partnership Taskforce and asking for one to be established as soon as possible.*

Appendix B: Survey categorisation of each risk from the UKCCRA3

ID	Risk or Opportunity	Category 1	Category 2	Category 3	Category 4
N10	Risks to aquifers and agricultural land from sea level rise, saltwater intrusion	Agriculture	Land management		
N6b	Risks to and opportunities for agricultural productivity from extreme events and changing climatic conditions (including temperature change, water scarcity, wildfire, flooding, coastal erosion, wind and saline intrusion).	Agriculture	Land management		
N7	Risks to agriculture from pests, pathogens and invasive species	Agriculture			
N9	Opportunities for agricultural and forestry productivity from new/alternative species becoming suitable	Agriculture	Forestry		
H11	Risks to cultural heritage	Built environment			
H5	Risks to building fabric	Built environment	Flooding		
B4	Risks to finance, investment and insurance including access to capital for businesses	Business/Economy			
B5	Risks to business from reduced employee productivity due to infrastructure disruption and higher temperatures in working environments	Business/Economy	Public health	Transport	
B6	Risks to business from disruption to supply chains and distribution networks	Business/Economy			
B7	Opportunities for business from changes in demand for goods and services	Business/Economy			
H6a	Risks and opportunities from winter household energy demand	Energy	Built environment		
H6b	Risks and opportunities from summer household energy demand	Energy	Built environment		
I10	Risks to energy from high and low temperatures, high winds, lightning	Energy			
I11	Risks to offshore infrastructure from storms and high waves	Energy			
I13	Risks to digital from high and low temperatures, high winds, lightning	Energy			
B1	Risks to business sites from flooding	Flooding	Business/Economy		
B2	Risks to business locations and infrastructure from coastal change from erosion, flooding and extreme weather events	Flooding	Business/Economy		
H3a	Risks to people, communities and buildings from river and surface flooding	Flooding			
H4	Risks to people, communities and buildings from sea level rise	Flooding			
I2	Risks to infrastructure services from river, surface water and groundwater flooding	Flooding	Water Supply	Energy	Transport
I4	Risks to bridges and pipelines from flooding and erosion	Flooding	Transport		
I6	Risks to hydroelectric generation from low or high river flows	Flooding	Energy		
I7	Risks to subterranean and surface infrastructure from subsidence	Flooding	Built environment		
N6a	Risks to and opportunities for forestry productivity from extreme events and changing climatic conditions (including temperature change, water scarcity, wildfire, flooding, coastal erosion, wind and saline intrusion)	Forestry	Land management		
N8	Risks to forestry from pests, pathogens and invasive species	Forestry			
N11	Risks to freshwater species and habitats from changing climatic conditions and extreme events, including higher water temperatures, flooding, water scarcity and phenological shifts	Biodiversity			
N12	Risks to freshwater species and habitats from pests, pathogens and invasive species	Biodiversity			
N13	Opportunities to freshwater species and habitats from new species colonisations	Biodiversity			
N18	Risks and opportunities from climate change to landscape character	Land management			
N4	Risk to soils from changing climatic conditions, including seasonal aridity and wetness	Land management	Agriculture		
N5	Risks and opportunities for natural carbon stores, carbon sequestration and GHG emissions from changing climatic conditions, including temperature change and water scarcity	Land management			
H1	Risks to health and wellbeing from high temperatures	Public health			
H12	Risks to health and social care delivery	Public health			
H2	Opportunities for health and wellbeing from higher temperatures	Public health			
H7a	Risks to health and wellbeing from changes in air pollution	Public health			
H7b	Risks to health and wellbeing from changes in aeroallergens	Public health			
H8	Risks to health from vector-borne diseases	Public health			
H9	Risks to food safety and food security	Public health	Agriculture		
N1	Risks to terrestrial species and habitats from changing climatic conditions and extreme events, including temperature change, water scarcity, wildfire, flooding, wind, and altered hydrology	Biodiversity			
N2	Risks to terrestrial species and habitats from pests, pathogens and invasive species	Biodiversity			
N3	Opportunities from new species colonisations in terrestrial habitats	Biodiversity			
I12	Risks to transport from high and low temperatures, high winds, lightning	Transport			
I5	Risks to transport networks from slope and embankment failure	Transport			
B3	Risks to businesses from water scarcity	Water Supply	Business/Economy		
H10a	Risks to health from water quality	Water Supply	Public health		
H10b	Risks to health from household water supply	Water Supply	Public health		
I1	Risks to infrastructure networks (water, energy, transport, ICT) from cascading failures	Water Supply	Energy	Transport	
I8	Risks to public water supplies from reduced water availability	Water Supply			
I9	Risks to energy generation from reduced water availability	Water Supply	Energy		

Appendix C: Calculations of adapted magnitude tables

Climate Magnitude categories for UK and England (Taken from UKCCRA3)

	<u>High Magnitude</u>	<u>Medium Magnitude</u>	<u>Low Magnitude</u>
	Major annual damage and disruption or foregone opportunities: ¹	Moderate annual damage and disruption or foregone opportunities:	Minor annual damage and disruption or foregone opportunities:
Quantitative Evidence	£hundreds of millions damage (economic) or foregone opportunities, and/or	£tens of millions damage (economic) or foregone opportunities, and/or	Less than £10 million damage (economic) or foregone opportunities, and/or
	Hundreds of deaths ² , thousands of major health impacts, hundreds of thousands of people affected / minor health impacts, and/or	Tens of deaths, hundreds of major health impacts, tens of thousands of people affected / minor health impacts. and/or	A few deaths, tens of major health impacts, thousands of people affected / minor health impacts, and/or
	Tens of thousands of hectares land lost or severely damaged ³ , and/or thousands of km of river water/km ² of water bodies affected, and/or	Thousands of hectares of land lost or severely damaged, and/or hundreds of km of river water/km ² of water bodies affected, and/or	Hundreds of hectares of land lost or severely damaged, and/or tens of km of river water/km ² of water bodies affected, and/or
	Major impact (~10% or more at national level) to valued habitat or landscape types (e.g., BAP habitats, SSSIs), and/or	Intermediate impact (~5% at national level) to valued habitat or landscape types (e.g., BAP habitats, SSSIs), and/or	Minor impact (~1% at national level) to valued habitat or landscape types (e.g., BAP habitats, SSSIs), and/or
	Major impacts on or loss of species groups, and/or	Intermediate impacts on or loss of species groups, and/or	Minor impacts on or loss of species groups, and/or
	Major impact (10% or more at national level) to an individual natural capital asset and associated goods and services ⁴ , and/or	Intermediate impact (1 to 10% at national level) to an individual natural capital asset and associated goods and services, and/or	Minor impact (~1% or less at national level) to an individual natural capital asset and associated goods and services, and/or
	Major loss or irreversible damage to single nationally iconic heritage asset (e.g., Stonehenge, Giants' Causeway)	Medium loss or irreversible damage of nationally iconic heritage asset (e.g., Stonehenge, Giant's Causeway)	Low loss or irreversible damage to nationally iconic heritage asset (e.g., Stonehenge, Giants' Causeway)
	Qualitative Evidence	Expert judgement of chapter authors, confirmed with agreement across authors, CCC and peer reviewers suggest there is a possibility of impacts of the magnitude suggested above.	

¹ This could be an annual average or expected annual damages. Where evidence is only related to a single event, authors should make a judgement on the magnitude and state this in their assumptions.

² The implied value of number of deaths is broadly in line with the value of prevented fatalities used by Government in the appraisal of policies (see DfT, 2019). It should be noted that this applies to an 'average' prevented fatality, i.e., someone of average age and who is otherwise healthy. The number of major injuries / major health outcomes, and minor injuries / minor health outcomes / people affected, are also in line with values used in appraisal.

³ These values are based on the average value for an agricultural hectare of land in England that is estimated to be £22k

(https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/710539/Land_Values_2017.pdf).

It is noted that the average value for residential, commercial, and industrial land is much higher, and thus if urban land areas are affected, these scoring categories might be adjusted, i.e., so that a lower number of hectares would be equivalent to a low, medium, or high ranking.

⁴ The areas of natural capital assets are based on the definitions and reported values in the ONS Natural Capital Accounts and expert analysis of equivalence, <https://www.ons.gov.uk/economy/environmentalaccounts/bulletins/uknaturalcapitalaccounts/2019>.

	York
Economics	<p>Metrics in table above adjusted for gross value added¹, thus, to give relative importance, values in table are reduced by a factor of 71⁵.</p> <ul style="list-style-type: none"> - £1.4m+ of damage or foregone opportunities, - £1,400,000 - £140,000 of damage or foregone opportunities - Less than £140,000 damage or foregone opportunities.
Health	<p>Metrics in table above adjusted for population, reduced by a factor of 316⁶ for York.</p> <ul style="list-style-type: none"> - 1+ deaths, 3+ major health impacts, 30+ people affected / minor health impacts, and/or - No deaths, a few major health impacts, 3 - 30 people affected / minor health impacts, and/or - No deaths, no major health impacts, a few people affected / minor health impacts, and/or <p>Adjusted values have been rounded to produce useful metrics with which to guide magnitudes decision</p>
Land	<p>Metrics in table above adjusted for land, reduced by a factor of 900⁷.</p> <ul style="list-style-type: none"> - 10+ hectares of land lost or severely damaged, - 1 - 10 hectares of land lost or severely damaged, - Less than 1 hectare of land lost or severely damaged.
Habitat / Natural Capital	As table above

⁵ Economics. Gross Value Added (GVA) is taken from Office for National Statistics <https://www.ons.gov.uk/economy/grossvalueaddedgva/bulletins/regionalgrossvalueaddedbalanceduk/1998to2017>

	GVA (2017 £M)	Factor calculation
UK	1,802,741	
York	25,270	1,802,741 / 25,270 = 71.34

⁶ UK population = 66.4 million

(<https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/bulletins/nationalpopulationprojections/2018based#table-1408dbb6>)

York population approx. 210,000

(<https://www.healthyyork.org/place.aspx#:~:text=People%20who%20live%20in%20York&text=The%20population%20of%20York%20is,than%20England%20as%20a%20whole>)

Calculation: 66,400,000 / 210,000 = approx. **316**

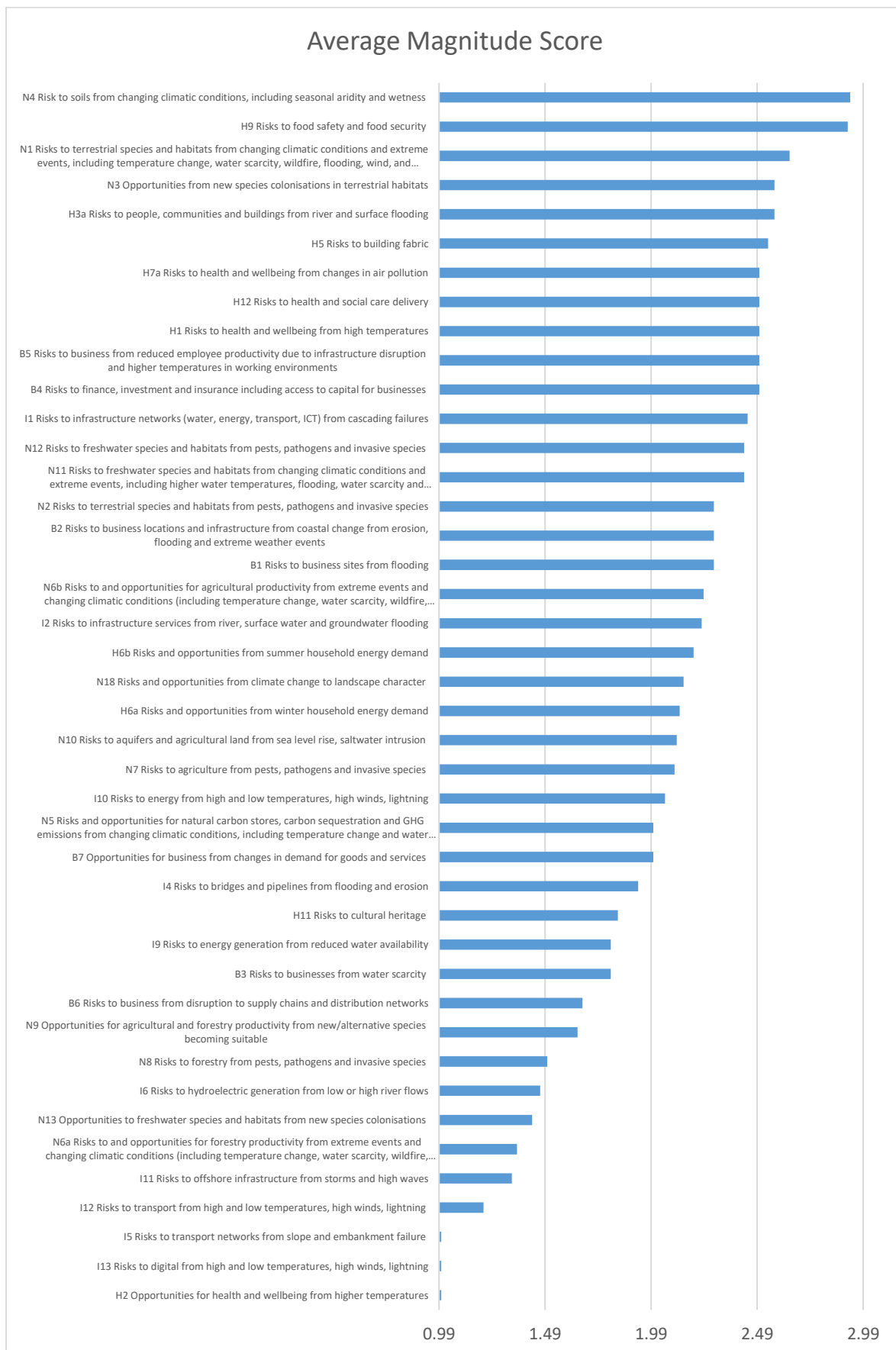
⁷ UK land area = 24,417,000 hectares

(<https://www.ons.gov.uk/economy/environmentalaccounts/articles/uknaturalcapitallandcoverintheuk/2015-03-17>)

York council area = approx. 105 square miles (Source: www.york.gov.uk) which is approx. 27,195 hectares

Therefore (24,417,000 / 27,195 = **898**) gives reduction factor for York based on UK land cover statistic

Appendix D: All UKCCRA3 risks/opportunities distribution by average magnitude score



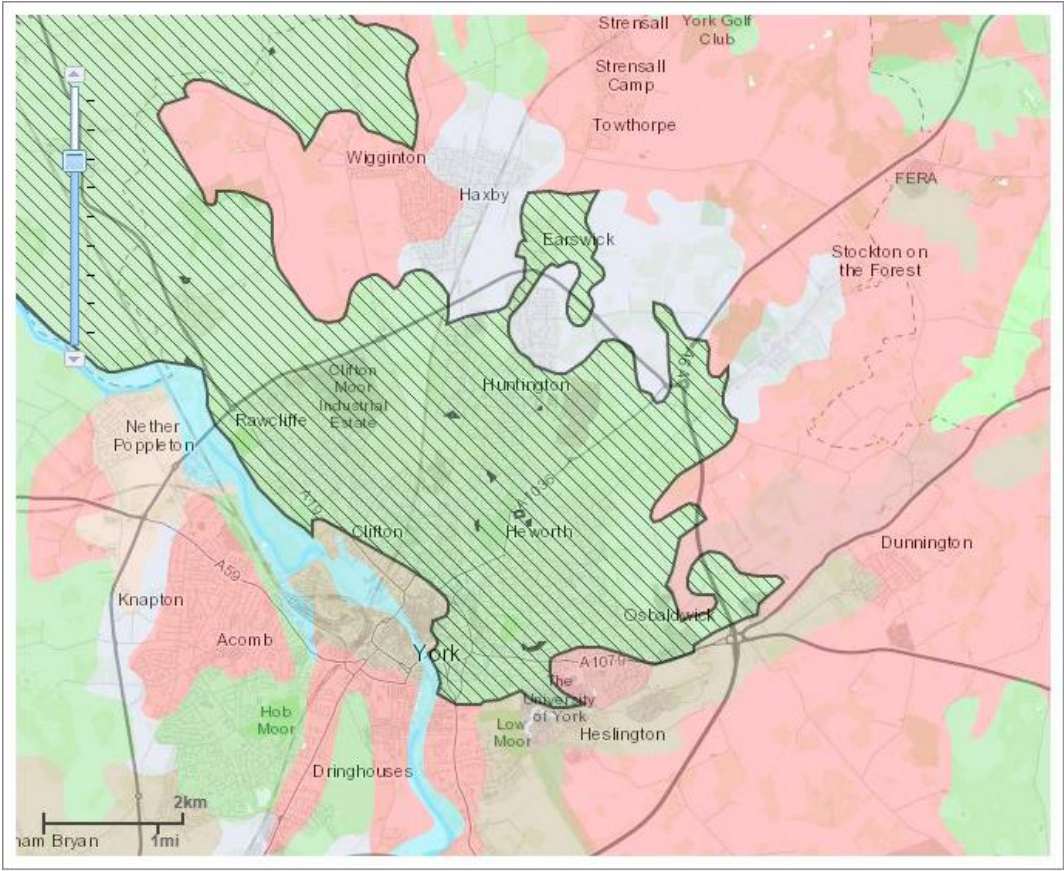
Appendix E: Evidence gaps or questions about implementation of policy in regards to H3a (nationally)

- Lock-in from new development.** Housing development continues to occur on the flood plain e.g., in England (the latest data suggests that this accounts for 9% of all new development in England (MHCLG, 2020)) and in Scotland. Research conducted in 2016 regarding the effectiveness of Scotland’s local planning authorities in implementing national planning policy suggested that the outcomes of flood risk assessment and climate change were not sufficiently influencing spatial strategies (LUC, 2016), which could lead to inappropriate development. Whilst climate resilient homes can be built on the flood plain, either with community level defences in place or with PFR measures, further evidence regarding the degree to which resilient measures are being incorporated is required and whether these homes are resilient to future changes in flood risk.
- Uptake of green sustainable urban drainage.** There is insufficient evidence regarding the implementation of SuDS (Sustainable Drainage Systems), and particularly green SuDS, as this is not monitored (e.g., CCC (2019a)).
- Flood insurance.** Across the UK, while Flood Re is providing support to increase access to affordable insurance for households at high risk of flooding who seek support, there are still many households that do not have insurance or have insurance that does not include flood cover. While flood insurance can play a protective role and a safety net in the event of a flood, household take-up rates vary by income and tenure, and some groups are less well protected.
- PFR (Property-Level Flood Resilience).** The rate of PFR installation is almost certainly well below the optimum, which is certainly the case in England (CCC, 2019b), and there is a lack of incentives across the UK to increase take up of property level flood resilience measures where these are an appropriate household response. Some well-known barriers include lack of motivation from householders, lack of familiarity and access to information, costs, and behavioural biases to acting, and lack of professional skills and knowledge (CCC, 2019a). The new FCERM Policy Statement commits to encouraging a faster transition of the marketplace for PFR, providing more advice, products, and incentives to enable this transition.
- Responsibilities and accountability.** There is a public expectation that risk will be managed by the UK Government, devolved administrations, and national environmental regulation agencies, as well as other public bodies such as local authorities (e.g., Power et al. (2020)). This may hinder individuals and communities’ own involvement in taking steps to improve their preparedness. Governments and other national agencies across the UK are keen to enhance greater individual and organisational responsibility by setting out expectations and roles and responsibilities for managing flood risk now and in the future. This area is likely to remain a continued challenge requiring continual awareness raising and knowledge sharing. Behavioural science insights should inform future measures to encourage a greater sharing of responsibility.
- Inequalities.** Disadvantaged communities in urban and rural areas remain at proportionally high risk of flooding now and in the future, although flood risks to health affect all populations, not just low-income households (Sayers et al., 2017a). This situation is projected to continue despite current Government investment regimes in England, Scotland and Wales prioritising deprived communities. Greater attention needs to be given to integrating policy objectives

and delivery across agendas including preferentially selecting interventions to reduce flood risk and response measures that do not disadvantage certain population groups.

- **Maintenance budgets.** Further investment in maintenance is required to ensure that flood risk management measures can continue to manage current risk and have the potential to manage future risk. This has been particularly highlighted for England with the Efra Committee's flood report highlighting the need for a long-term resource budget settlement, aligned with the increased capital investment, so that the Environment Agency and other RMAs can plan for and maintain new and existing flood and coastal defences (Efra, 2021).

Appendix F: Large Soilscape 18 area in York



Appendix G: Soilscape 8 (brown) coverage for York

