Notice of a public meeting of

Decision Session - Combined Executive Member Decision Session

To: Councillors Douglas, Webb, Kent, Kilbane, Lomas, Steels-Walshaw, Merrett and Perrett

Date: Tuesday, 6 October 2026

Time: 10.00 am

Venue: West Offices, York

AGENDA

Notice to Members – Post Decision Calling In:

Members are reminded that, should they wish to call in any item* on this agenda, notice must be given to Democratic Services by **4:00pm on Tuesday, 13 October 2026.**

*With the exception of matters that have been the subject of a previous call in, require Full Council approval or are urgent which are not subject to the call-in provisions. Any items that are called in will be considered by the Corporate Scrutiny Committee.

Written representations in respect of items on this agenda should be submitted to Democratic Services by **5:00pm on Friday, 2 October 2026.**

1. Appointing a Chair

To confirm arrangements for chairing the meeting as follows:

- Cllr J Kent (Agenda Items 1-6)

- Cllr K Lomas (Agenda Items 7-8)

2. Apologies for Absence

To receive and note apologies for absence.

3. Declarations of Interest

At this point in the meeting, Members and co-opted members are asked to declare any disclosable pecuniary interest, or other registerable interest, they might have in respect of business on this agenda, if they have not already done so in advance on the Register of Interests. The disclosure must include the nature of the interest.

An interest must also be disclosed in the meeting when it becomes apparent to the member during the meeting.

(1) Members must consider their interests, and act according to the following:

Type of Interest	**You Must**
Disclosable Pecuniary Interests	*Disclose the interest, not participate in the discussion or vote, and leave the meeting unless you have a dispensation.*
Other Registrable Interests (Directly Related) ***OR*** *Non-Registrable Interests (Directly Related)*	*Disclose the interest; speak on the item only if the public are also allowed to speak, but otherwise not participate in the discussion or vote, and leave the meeting unless you have a dispensation.*
Other Registrable Interests (Affects) ***OR*** *Non-Registrable Interests (Affects)*	*Disclose the interest; remain in the meeting, participate and vote unless the matter affects the financial interest or well-being:* *(a) to a greater extent than it affects the financial interest or well-being of a majority of inhabitants of the affected ward; and*

	(b) a reasonable member of the public knowing all the facts would believe that it would affect your view of the wider public interest. In which case, speak on the item only if the public are also allowed to speak, but otherwise do not participate in the discussion or vote, and leave the meeting unless you have a dispensation.

(2) Disclosable pecuniary interests relate to the Member concerned or their spouse/partner.

(3) Members in arrears of Council Tax by more than two months must not vote in decisions on, or which might affect, budget calculations, and must disclose at the meeting that this restriction applies to them. A failure to comply with these requirements is a criminal offence under section 106 of the Local Government Finance Act 1992.

4. Public Participation

At this point in the meeting members of the public who have registered to speak can do so. Members of the public may speak on agenda items or on matters within the remit of the committee. Please note that our registration deadlines are set as 2 working days before the meeting, in order to facilitate the management of public participation at our meetings. The deadline for registering at this meeting is **5:00pm** on **Friday, 2 October 2026**.

To register to speak please visit www.york.gov.uk/AttendCouncilMeetings to fill in an online registration form. If you have any questions about the registration form or the meeting, please contact Democratic Services. Contact details can be found at the foot of this agenda.

Webcasting of Public Meetings

Please note that, subject to available resources, this meeting will be webcast including any registered public speakers who have given their permission. The meeting can be viewed live and on

demand at www.york.gov.uk/webcasts.

5. Minutes (Pages 7 - 12)

To approve and sign the minutes of the Combined Executive Member Decision Session held on Tuesday, 8 September 2026.

6. York and North Yorkshire Climate Change Adaptation Study (Pages 13 - 386)

This report provides an overview of the study's aims and summary findings and invites the Executive Member for Environment and Climate Emergency to endorse the study so it can be used as an evidence base to inform City of York Council (CYC) policy and practice.

7. Decision Report: Application for Community Right to Bid under the Localism Act 2011 (Pages 387 - 448)

This report details applications to list the following properties as Asset of Community Value (ACV) for consideration by the Council.

a) Hempland Lane Allotment Community Wildlife Area, Hempland lane, York, YO31 0QG
b) Hagg Wood, Intake Lane, Dunnington, York, YO19 5HY

The applications have been received, for a decision by the Executive Member in the Council's statutory capacity as an Asset of Community Value (ACV) listing authority.

8. Urgent Business

Any other business which the Chair considers urgent under the Local Government Act 1972.

Democracy Officer:
Ben Jewitt
Contact details:

- Telephone: (01904) 55 3073
- Email: benjamin.jewitt@york.gov.uk; democratic.services@york.gov.uk

For more information about any of the following please contact the Democratic Services Officer responsible for servicing this meeting:

- Registering to speak
- Business of the meeting
- Any special arrangements
- Copies of reports and
- For receiving reports in other formats

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Alternative formats

If you require this document in an alternative language or format (e.g. large print, braille, Audio, BSL or Easy Read) you can:

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我們也用您們的語言提供這個信息 **(Cantonese)**

এই তথ্য আপনার নিজের ভাষায় দেয়া যেতে পারে। **(Bengali)**

Ta informacja może być dostarczona w twoim własnym języku. **(Polish)**

Bu bilgiyi kendi dilinizde almanız mümkündür. **(Turkish)**

یہ معلومات آپ کی اپنی زبان (بولی) میں بھی مہیا کی جاسکتی ہیں۔ **(Urdu)**

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City of York Council	Committee Minutes
Meeting	Decision Session - Combined Executive Member Decision Session
Date	8 September 2026
Present	Councillors Merrett [until 10:14am], and Lomas
Officers in Attendance	Ben Murphy – Head of City Development Nicola Greyson – Regeneration Project Co-ordinator Pauline Stuchfield – Director of Housing and Community Services David Walker – Head of Customer Finance Risk and Insurance Susan Wood – Welfare Benefits and Strategic Partnership Manager

28. Appointing a Chair (10:01am)

Resolved: That arrangements for Chairing the meeting were confirmed as follows:

- Councillor Merrett – All standard agenda items 1-5, and agenda item 8 – Walmgate Improvement Scheme.
- Councillor Lomas – Agenda item 7 - Financial Inclusion/Welfare Benefits Outturn 2025/26, and 8 – Urgent Business.

29. Apologies for Absence (10:01am)

There were no apologies.

30. Declarations of Interest (10:01am)

The Executive Members were invited to declare any personal interests not included on the Register of Interests, any prejudicial interests, or any disclosable pecuniary interests that they might have in respect of business on the agenda. None were declared.

31. Minutes (10:02am)

Resolved: That the minutes of the Combined Executive Member Decision Sessions held on Tuesday, 7 July, Tuesday, 30 July and Tuesday, 11 August 2026 be approved and signed as a correct record.

32. Public Participation (10:02am)

It was reported that there was one registration to speak under the Council's public participation protocol.

Ben Ffrench spoke on item 6, representing York Green Party. He supported the proposed plans but noted uneven wealth distribution within the city and specifically the Walmgate area, which he felt created antisocial behaviour leading to demands on the authority such as maintenance requests. He stressed the importance of increasing pride in this area as part of the scheme and suggested that following recent successes in other parts of the city, there was an opportunity for a more colourful Walmgate, with street art and energy, noting that this was the first area of city that many students and tourists saw when arriving.

33. Walmgate Improvement Scheme (10:06am)

The Head of City Development presented the report assisted by the Regeneration Project Co-ordinator.

Officers noted that the final version of the South Walmgate Masterplan investment aligned with the Willow House redevelopment scheme and set out eight themes and 13 projects to improve existing spaces within the wider area.

Officers confirmed that Executive Members had approved a budget of £250,000 in January 2026 and since that time officers had secured further funding, taking this up to nearly £1,000,000 together with Mayoral Combined Authority and Local Transport Grant funding. They also sought to invest in the space together with Yorkshire Water.

Officers summarised the long-term Masterplan vision; phase one included promotion of active travel improvements and greening with community-

backed plans to attract further funding to reinvest for future development. He confirmed that they also intended to proceed with community artwork and addition of colour as suggested by the speaker in Public Participation.

They advised that with Executive Members' approval, procurement would commence over the autumn of 2026 work would begin later in the calendar year and delivery would follow as soon as possible, with the intention of demonstrating measurable improvement for residents from spring of 2027.

They noted that assuming success in Walmgate, they would be able to take this coordinated neighbourhood investment approach to other areas of the city as well.

The Executive Member for Housing and Safer Communities (Cllr Merrett) welcomed the report, thanking officers and his predecessor for their hard work on the scheme.

He asked to what extent officers were confident that they could work within the stated budget to deliver all of the works for phase one of the scheme.

The Head of City Development responded that he was confident that a sizable amount of the scheduled works would be deliverable within the available budget, though he noted that the transport side could be capital-heavy and it was only once works were tendered that they would know for sure.

The Executive Member for Housing and Safer Communities asked about the potential of bidding for further funds to become available, since quite a lot of the security improvements were potentially linked to those further projects.

The Head of City Development responded that officers had begun early conversations with North Yorkshire Police around how investment would be coordinated, and while there were no other immediate sources he anticipated other opportunities would arise going forward.

Resolved:

i. To approve the final version of the South Walmgate Masterplan.
ii. To approve the initial project prioritisation of phase 1 and subsequent phases
iii. That approval be given to carry out a procurement process to procure multi-disciplinary design and project delivery teams to deliver the South Walmgate Masterplan in line with the existing financial

approvals, and that authority be delegated to the Director of City Development or Director of Housing & Communities as relevant in accordance with their respective functions (in consultation with the Executive Members for Housing, Planning & Safer Communities, the Chief Finance Officer and the Director of Governance or their delegated officers) to take such steps as are necessary to procure, award and enter into the resulting contract(s).

Reasons:

i. To enable delivery of a first phase of projects.
ii. To ensure transparency and clear decision making around the South Walmgate Masterplan programme.
iii. To ensure all grant funding and contractual arrangements are in compliance with the Finance Regs, CPRs, the Procurement Act, PCRs, Subsidy Control Act 2022 and related legislation.

34. Benefits Financial Inclusion/Welfare Outturn 2025/26 (10:14am)

[Cllr Merrett left the meeting at 10:14am]

The Director of Housing and Community Services presented the item, assisted by The Head of Customer Finance Risk and Insurance and The Welfare Benefits and Strategic Partnership Manager.

The Director of Housing and Community Services explained that the report outlined the support provided by the council and its partners for residents facing significant financial pressures arising from the cost of living, housing, affordability, health inequalities, and wider economic challenges; spanning welfare benefits, advice, services, digital inclusion, community support, crisis assistant and partnership working across the city.

She noted that there was a major focus on income maximisation and welfare advice, and welfare benefits officers and community-based benefit advisers had secured residents millions of pounds in increased welfare entitlement. She stated that the availability of data allowed easier targeting here and the amount of funding represented an overall reduction, so they were making less go further, therefore effective partnership working was increasingly important.

The Head of Customer Finance Risk and Insurance added that this programme of work had been developed over several years. There had

been a small decrease in the number of families living in poverty, and the Household Support Fund's work had directly impacted the figures.

He added that officers were not just using this system for paying out Household Support Fund and Crisis and Resilience Fund benefits but they could also track Healthy Start and other programmes with it. Support around food and fuel vouchers was ongoing, with a more person-centred approach. All residents of working age in receipt of benefits had now migrated to Universal Credit but not everyone was yet claiming household support, which was one point to flag.

Executive Member for Finance, Performance, Major Projects, Human Rights, Equality and Inclusion congratulated officers and partners, stating that this was a good opportunity to make life better for many residents and it was important to work with partners and share intelligence to this end. She asked officers to provide her with further information on the figures on reduction of families in poverty. She acknowledged that many families were feeling financial pressure and council were helping with this. She praised use of Lift data for Highlighted targeted support and the work of Welfare Benefits Officers in making real genuine improvement with £2.2 million across 400 residents and she highlighted crucial role of digital inclusion.

She also highlighted less visible work by the wider community such as warm spaces in winter and Cool Spaces in Summer schemes and highlighted York Hungry Minds – specifically for their holiday scheme.

Resolved: To note and comment on the details of the report in relation to the support provided to residents affected by the impacts of the continuing high cost of living.

Reason: To ensure councillors, residents and stakeholder groups are aware of the ongoing financial inclusion activity across the city.

Cllr D Merrett and Cllr K Lomas, Chairs
[The meeting started at 10.01 am and finished at 10.32 am].

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Agenda Item 6

Meeting:	Combined Executive Member Decision Session
Meeting date:	06/10/2026
Report of:	Director of City Development
Portfolio of:	Executive Member for Environment and Climate Emergency

Decision Report: York and North Yorkshire Climate Change Adaptation Study

Subject of Report

1. This report provides an overview of the study's aims and summary findings and invites the Executive Member for Environment and Climate Emergency to endorse the study so it can be used as an evidence base to inform City of York Council (CYC) policy and practice.

Benefits and Challenges

2. Adopting the evidence base and collaborating with our regional partners and communities to address the risks and vulnerabilities highlighted will ensure the council works towards its stated climate and environmental goals.

3. If the study is not formerly endorsed, the insights and findings will not form part of the council's evidence base and there is a risk that action on climate change adaptation is not evidence-led, nor delivered at the pace and scale required to address climate risks.

Policy Basis for Decision

4. Understanding climate risks is the first step in being able to effectively manage them. The Council Plan sets clear ambitions to achieve Net zero carbon by 2030 and to become climate ready. Climate risks have a direct bearing on affordability, the

environment, equalities and health.

5. York and North Yorkshire Combined Authority (YNYCA) and its constituent authorities aspire to be at the forefront of tacking climate change, both in terms of emissions reduction and building climate resilience through effective climate adaptation.

Financial Strategy Implications

6. There are no financial strategy implications arising directly from the recommendations within this report.

Recommendation and Reasons

7. The Executive Member for Environment and Climate Emergency is recommended to:

    i. Support Option 1 and formerly endorse the York and North Yorkshire Climate Change Risk and Opportunities Assessment (CCROA) so it can be used as an evidence base to inform council policy and practice.

    Reason: Endorsement of the study will ensure that council policy and practice continue to be evidence-led. It will underpin robust and informed decision-making and ensure the council's resources are directed and prioritised to areas and issues that deliver greatest impact.

Background

8. On behalf of the York and North Yorkshire (YNY) region, YNYCA commissioned the preparation of an Adaptation Study (attached at Annex 1) designed to better understand climate risks and opportunities across the region and to assess the area's vulnerability and preparedness.

9. The study provides a basis of understanding for the development of a regional climate adaptation strategy and will guide how YNYCA supports local authorities and organisations to adapt to climate change.

10. The Study includes four primary sections:

i. A climate risk and opportunity assessment (CCROA) for City of York Council (CYC) and North Yorkshire Council (NYC) jurisdictions, including protected landscape authorities.
ii. An assessment of climate-related vulnerabilities within the region
iii. Development of adaptation pathways.
iv. A cost-benefit analysis to understand the costs of action relative to inaction.

11. The study was supported by CYC, NYC, the protected landscape authorities and the Northeast and Yorkshire Net Zero Hub. It is intended to build on, and link to, more specific and localised risk assessments and adaptation plans, such as the 'Climate Ready York' evidence base, approved by members in 2023.

12. This new regional-level assessment provides an opportunity to further update CYC's understanding of climate risks, opportunities and vulnerabilities as part of the 2026 York Climate Change Action Plan refresh process and the planned update of York's Climate Change Strategy in 2027.

Study overview

13. The study highlights the extent to which the changing climate already impacts the region, citing examples such as the 2015 Boxing Day floods in York, 2023 winter rainfall (wettest winter since 1872), Storm Daragh and flooding in Knaresborough 2024, and droughts and wildfires in 2025. It asserts that extreme weather events are increasing in frequency and magnitude, with projections showing this is set to continue under all plausible global warming scenarios.

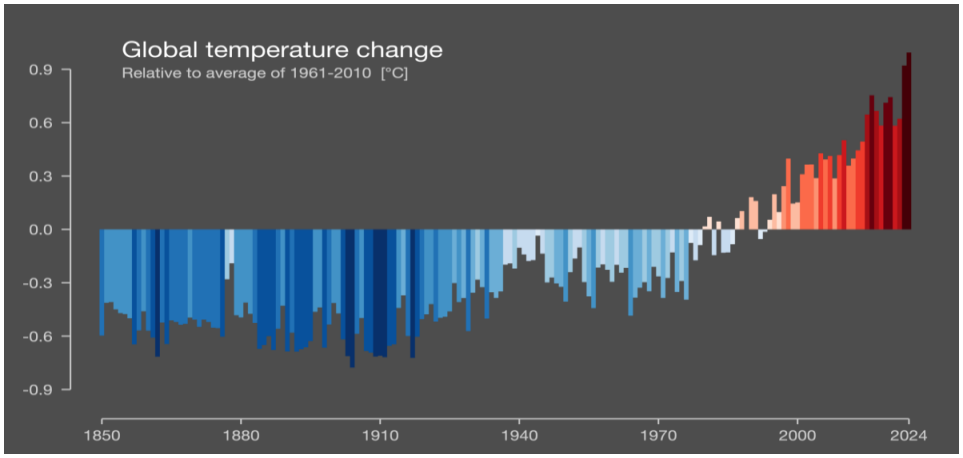

Figure 1: Accelerating global temperature increases.

14. It is predicted that the UK will experience the same weather as central-northern Spain by 2070, entailing hotter drier summers and warmer wetter winters. Figure 2 shows the predicted increase in the number of summer days, hot summer days and extreme summer days with increasing Global Warming Levels (GWL). By 2050, under a 2°C global warning scenario (currently the most plausible), the number of summer days in York reaching temperatures above 25°C will increase from 9 to 26 a year with summer rainfall decreasing by 7%.

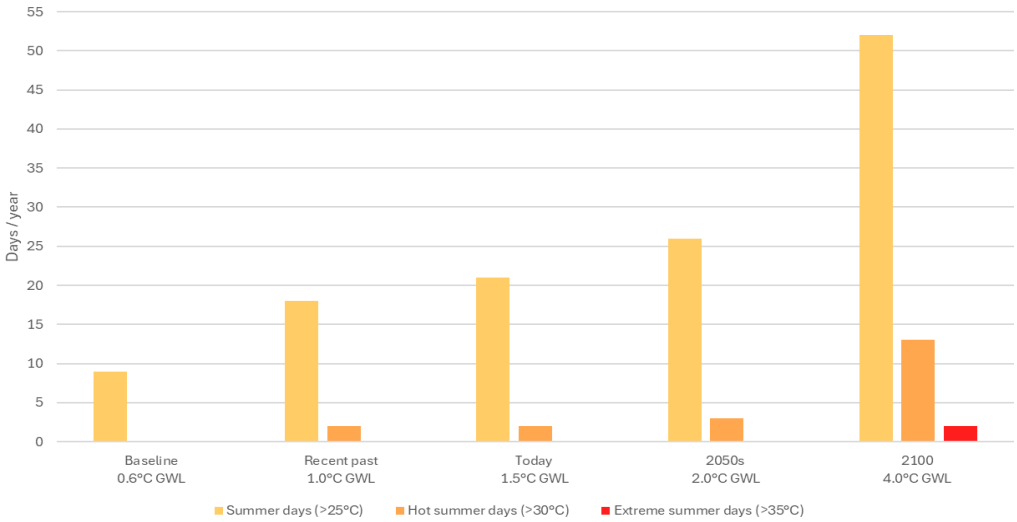

Figure 2: Predicted increase in the number of hot/extreme summer days

Climate change risks and opportunities

15. The study evaluated 134 climate change impacts for the region, considering twenty-one positive and 113 negative effects. The risks were arranged by theme with twenty associated with business and industry, 25 health, communities and the built environment, 34 infrastructure, 34 natural environment including farming, fishing and forestry.

16. The scope of the CCROA focused specifically on impacts within the YNY region. The assessment did not examine in any depth the cascading global risks and their consequent impacts on the region as these are more likely to be managed at the national level.

17. The CCROA identified short-term priority risks, defined as the remainder of 2020s and the 2030s. Whilst no risks were rated

'Severe'[1] within the 2°C warming scenario, 8% were rated 'Major'[2]. These include:

- Flooding (river, surface, and groundwater) and extreme rainfall – risks to business sites, people, communities and buildings and risks to wastewater and sewer infrastructure with overflow and release into water courses
- Extreme heat and wildfires – risks to health and wellbeing from high temperatures (especially for those with existing conditions) and risks wildfires and destruction of terrestrial habitats
- Drought and water security – risk of reduced public water availability due to drought conditions
- Climate induced pests and diseases – risks to terrestrial species and habitats from pests, pathogens, and invasive species, including viral and parasitic diseases
- Cascading – risks to transport and energy networks
- General changing climatic conditions – risks to business's insurance, investment and finance requirements, risks to soils and associated eco-system services and risks to the integrity of cultural and historic collections from changing climatic conditions within buildings.

18. Within the 2°C scenario, the proportion of climate risks rated 'Major' and 'Severe' increases from 8% to over 30% by the 2050s. Under the 2100s / 4.0°C GWL scenario it increases to 55% of all identified risks.

	2030s 1.5°C GWL		2050s 2.0°C GWL		2100s 4.0°C GWL	
Risk score	No. risks per category	%	No. risks per category	%	No. risks per category	%
[1] Negligible	15	13%	5	4%	1	1%
[2] Minor	39	35%	28	25%	13	12%
[3] Moderate	50	44%	45	40%	37	33%
[4] Major	9	8%	35	31%	43	38%
[5] Severe	0	0%	0	0%	19	17%

Table 1: Number of climate risks identified during the YNY climate change risk assessment and proportion in each risk rating category, split by climate change scenarios.

[1] Major risk: Major impact expected, from either high magnitude and moderate frequency events, or high frequency and moderate magnitude events.
[2] Severe risk: Severe impact expected, associated with a catastrophic consequence and almost certain probability of occurrence.

19. The full risk register shows the types of hazards expected, a description of the risks posed, the specific regions within YNY most affected, a risk rating under various GWLs / timescale scenarios and an overall risk score (attached at Annex 2).

20. Annex 2 also details the twenty-one opportunities arising from climate change under various GWL/timeframe scenarios, ranging from those within the tourism sector, changes in demand for goods and services, and diversification of the agricultural economy.

Vulnerability mapping

21. The study mapped climate vulnerability and exposure for the region to identify where exposed and susceptible populations, infrastructure and natural assets intersect with climate hazards. The approach identified vulnerability hotspots and priority areas for adaptation, with vulnerability partly determined by adaptive capacity. For example, some groups with reduced capacity to respond to or recover from hazards are disproportionally impacted, particularly when multiple sources of disadvantage coincide.

22. Certain groups were found to emerge as consistently more vulnerable to climate impacts, including those aged over 65, those with physical or mental health conditions and disabilities, children, lower income households, minority groups, homeless populations, and those in rural areas. In some cases, this is linked to a particular group or cohort's reduced adaptive capacity to mitigate climate change impacts.

23. The mapping showed flood risks extending beyond residential areas, affecting transport and energy infrastructure, with an increasing proportion of assets projected to fall into higher risk categories under all warming scenarios. This raises the potential for cascading impacts, including disruption to essential services, reduced connectivity, and wider economic consequences. Vulnerability to flooding is most pronounced towards the southern part of the region around Selby, whilst York's existing flood defences help reduce York's exposure to negative impacts.

24. Water security emerged as an additional and growing concern within the study, as recent weather events demonstrate regional water system vulnerability – with implications for households,

agriculture, eco-systems, and economic growth.

Adaptation Pathways

25. The study found that YNY authorities had made important progress in preparing for climate change, particularly in managing flood risk and restoring natural systems. Yet it also found that adaptation activity remains uneven across sectors and is not yet operating at the scale required to address future risks.

26. Adaptation across the region is characterised by a growing number of successful projects and partnerships, but these are often delivered through sector, and location–specific initiatives rather than a coherent regional framework.

27. Flood risk management and nature-based solutions have been successful in reducing vulnerabilities and strengthening resilience across many communities, but despite this progress, the study found that preparedness for several significant climate risks remains low – with limited action in relation to extreme heat, drought, transport and infrastructure resilience, business continuity, public health preparedness, business related financial risks and climate-driven pests and diseases.

28. The study recommends that the region should move beyond predominantly flood-focused approaches towards a broader, multi-hazard adaptation programme that addresses the full range of climate risks facing communities, businesses, and public services. Priority actions include strengthening governance and accountability, maintaining a regional climate risk register, developing a coordinated ‘Adaptation Action Plan’ and embedding adaptation considerations within planning, infrastructure, economic development, and public service delivery.

29. A range of identified adaptation actions arranged by sector is detailed in Annex 3. Each action has been allocated a timeframe, impact value, and cost band. Many of the actions are already underway or planned whilst others remain conditional on resources and capacity being identified.

Regional cost estimates

30. The study took a limited number of material risks forward for

economic impact analysis, to understand the potential scale of economic impact if no adaptation action was taken. A range of methodologies were used, reflecting the limited data available and the diverse nature of climate change impacts. The picture emerging was one of significant increases in economic costs, especially over longer-term time horizons.

31. At the national level, the London School of Economics estimates that the total cost of climate change damages to the UK will increase from 1.1% of gross domestic product (GDP) at present to 3.3% by 2050 and 7.4% by 2100. Relative to 2024 UK GDP, this is equivalent to around £30 billion at present, £90 billion by 2050 and £200 billion by 2100.

32. Current estimates suggest that regional property damages from river flooding alone already average around £38 million per year. By the 2050s, this figure could rise to over £70 million annually under high emissions scenarios, with upper estimates exceeding £120 million. This represents a doubling of damages and a growing drag on the regional economy.

33. As the frequency and intensity of hot days rise, productivity losses will grow across multiple sectors, particularly those involving outdoor work or temperature-sensitive processes. By the 2050s, annual losses to economic output in York and North Yorkshire from extreme heat could reach approximately £35 million.

34. By the 2050s, agricultural costs, property flood costs, extreme heat impacts to productivity and wildfire impacts to natural habitats could result in cumulative damages of over £160 million per year. These costs relate to just four of the 113 risks identified during the risk assessment, indicating that total costs are likely to be significantly greater.

35. The study found that over the longer-term, there is a risk of more fundamental shifts in regional land use, with projections suggesting that arable farming in parts of eastern England could become unviable under high warming scenarios without significant investment in irrigation. At the same time, the region's food system is exposed to climate impacts, with rising costs of commodities driven by heat and water stress overseas. By mid-century these combined pressures could add tens of millions of pounds annually to the cost of food in the region, affecting both

farmers and consumers.

36. Water availability is highlighted as presenting a further emerging risk with national evidence showing that water scarcity can restrict commercial development by limiting new water connections.

37. The region's economy is also closely tied to the health of its natural environment. Climate change is projected to accelerate the degradation of natural systems, amplifying risks such as wildfire, biodiversity loss and declining soil and water quality. The North York Moors wildfire in 2025 caused tens of millions of pounds in damages, with the study projecting that events like this will become more frequent.

38. By contrast, many adaptation measures offer strong economic returns. Preventing new development in high-risk flood zones, for example, could reduce future damages at relatively low cost. Nature-based solutions such as natural flood management have been shown to provide protection at a fraction of the cost of post-event recovery, while also delivering wider environmental benefits.

39. Across all these areas, the study found a consistent conclusion that the costs of inaction are likely to be significantly greater than the cost of adaptation. Cost benefit modelling indicates that adaptation in YNY could yield significant net benefits, with a return of £1.5 for every £1 spent on integrated adaptive measures in urban areas and a £6.5 return for every £1 spent in rural catchments.

Next steps

40. During the later stages of the study, several upskilling workshops were held to disseminate the study's emerging key findings. Officers from a range of teams took part to encourage and support them to consider climate risks and opportunities as part of their service planning and project planning.

41. Recordings of these sessions continue to be shared with relevant teams, for example with the public health team who are currently in the process of populating the Local Authority Risk and Adaptation Tool (Heat Edition) toolkit to strengthen climate action in relation to health.

42. Emerging findings from the study have already helped the climate change team to screen council-led regeneration projects, ensuring they account for short and longer-term climate impacts and consider them during early project initiation and planning stages.

43. If formerly endorsed by the Executive Member, officers will utilise the evidence base to shape and inform ongoing council policy and practice. For example, the study will feed into the planned 2027 refresh of the York Climate Change Strategy and subsequent biennial refreshes of the Climate Change Action Plan.

44. Study findings will feed into the work currently underway to better understand the cost of past climate impacts, including extreme weather events, be these financial, environmental, and social. This work is being led by a University of York Policy Fellowship intern within the council's climate change team and is due to conclude in 2027.

45. YNYCA are exploring opportunities to develop a regional climate adaptation strategy, subject to the necessary resources and capacity being identified. This would directly address key recommendations within the study to strengthen regional governance, ensure climate action is more joined-up and further embed adaptation considerations within planning, infrastructure, economic development, and public service delivery.

46. To support the above, YNYA, CYC and NYC are currently participating, on a non-funded basis, in the European Union-led Pathways2Resilience[2] programme designed to strengthen regional capacity in relation to climate resilience planning.

47. YNYCA intends to publish the study on its website so that the evidence base can be utilised by partners from across the region. It will be supported by an accessible executive summary.

Consultation Analysis

48. Many organisations and over two hundred individual stakeholders contributed to the study over the course of 12 months. The study was overseen by a multi-agency steering group with

[2] https://www.pathways2resilience.eu/

representatives from YNYCA, CYC, NYC, protected landscape authorities, Yorkshire Water, Yorkshire and Humber Climate Commission, local resilience forum, and the University of Edinburgh Climate Change Institute. A comprehensive programme of stakeholder workshops and dissemination sessions ensured a wide range of different inputs was achieved.

49. CYC Corporate Scrutiny Committee approved the recommendation for the Executive Member to endorse the study at a meeting on 7 September 2026.

Options Analysis and Evidential Basis

50. The Executive Members is invited to consider three options:

    - **Option 1:** Endorse the study, in line with the report's recommendation.

    - **Option 2:** Endorse the study subject to specific additional comments / amendments.

    - **Option 3:** Do not endorse the study.

51. Endorsement of the study will ensure that CYC policy and practice continue to be evidence-led. It will underpin robust and informed decision-making and ensure the council's resources are directed and prioritised to areas and issues that deliver greatest impact. Adopting the evidence base and collaborating with our regional partners to address the risks and vulnerabilities highlighted will ensure the council works towards its stated climate and environmental goals.

52. If the study is not formerly endorsed, the insights and findings will not form part of the council's evidence base and there is a risk that action on climate change adaptation is not evidence-led, nor delivered at the pace and scale required to address climate risks.

Organisational Impact and Implications

- **Financial**: There are no financial implications associated with this report
- **Human Resources (HR)**: There are no HR implications associated with this report
- **Legal**: There are no legal implications associated with this report
- **Procurement**: There is no procurement implications associated with this report
- **Health and Wellbeing**: Ensuring CYC policy and practice is evidence-led and based on robust and timely data will support health and wellbeing objectives.
- **Environment and Climate action**: Ensuring CYC policy and practice is evidence-led and based on robust and timely data will support environment and climate action objectives.
- **Equalities and Human Rights**: Ensuring CYC policy and practice is evidence-led and based on robust and timely data will support equalities and human rights objectives.
- **Data Protection and Privacy:** There are no data protection and privacy implications arising from this report
- **Communications**: There are no communication implications arising from this report
- **Economy**: Ensuring CYC policy and practice is evidence-led and based on robust and timely data will support economic objectives.

Risks and Mitigations

53. If the study is not endorsed there is a risk that the value of this investment is not realised and that policy and practice does not benefit from robust evidence and insights contained within the study As mitigation, officers will continue to draw on data and evidence contained within earlier climate risk studies to inform policy and practice.

Wards Impacted

54. All.

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Background papers

- A Climate Ready York report 2023 https://democracy.york.gov.uk/ieListDocuments.aspx?CId=870&MId=14371& Ver=4

- York Climate Change Strategy (2022-2032) https://www.york.gov.uk/downloads/file/8948/york-climate-change-strategy-2022-to-2032

- York Climate Change Action Plan 2022 https://democracy.york.gov.uk/documents/s179441/Annex%20A_York%20Cli mate%20Change%20Action%20Plan_2024.pdf

- Update of the Climate Change Action Plan 2024 https://democracy.york.gov.uk/documents/s179440/EMDS_Climate%20Actio n%20Plan_2024.pdf

- Corporate Scrutiny Committee report 7 September 2026
- https://democracy.york.gov.uk/ieListDocuments.aspx?CId=1117&MId=15631&Ver=4

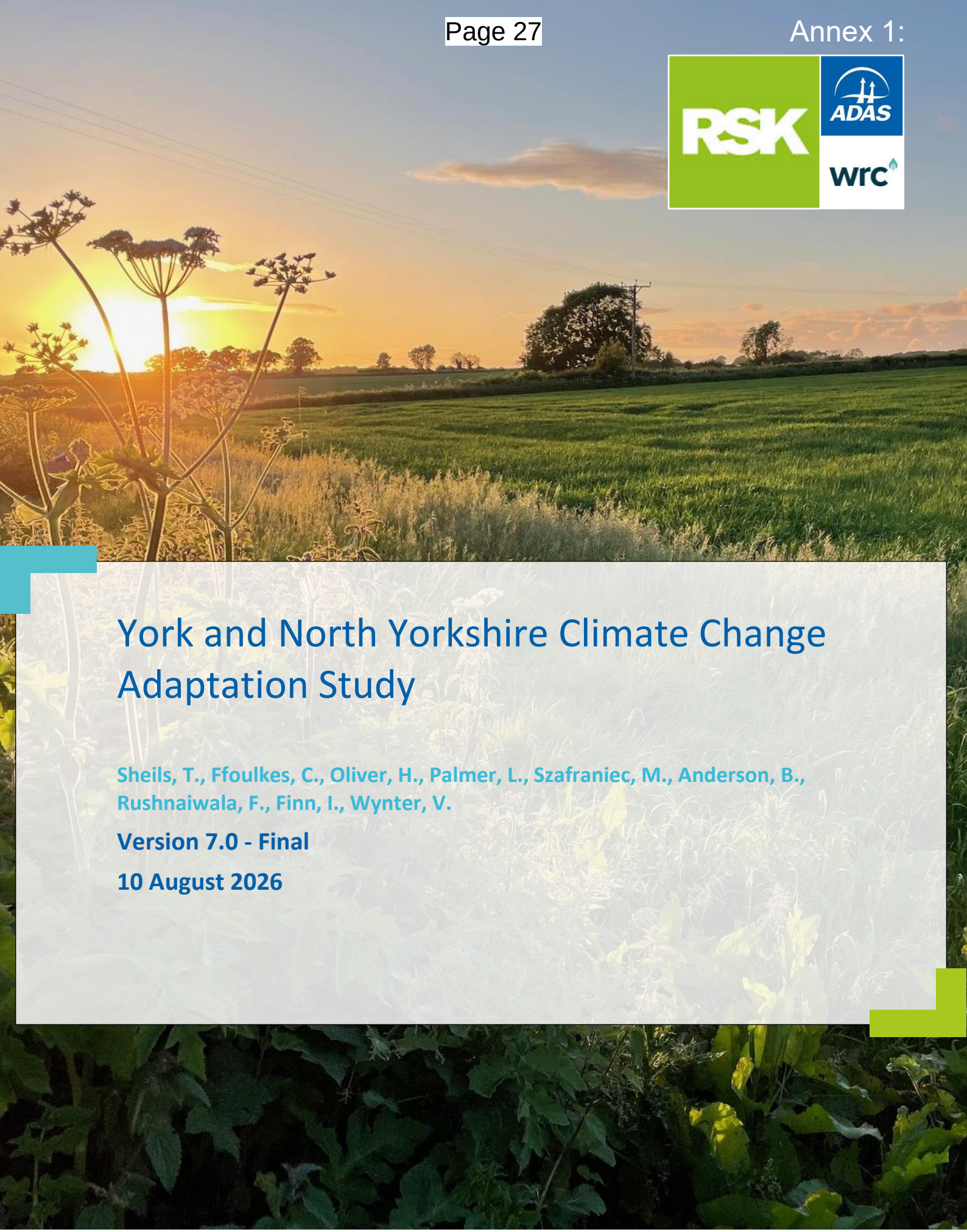
Annexes

- Annex 1 – YNY Adaptation Study (v7.0. 19 August 2026)
- Annex 2 – YNY Climate Change Risk Register
- Annex 3 – YNY Adaptation Pathway Framework

Abbreviations

- CCROA: Climate change risk and opportunity assessment
- CYC: City of York Council
- EMDS: Executive Member Decision Session
- GDP: Gross domestic product
- GWL: Global warming level
- LARA: Local Authority Risk and Adaptation
- NYC: North Yorkshire Council
- YNY: York and North Yorkshire
- YNYCA: York and North Yorkshire Combined Authority
- ^{o}C: Degree centigrade

Annex 1:



York and North Yorkshire Climate Change Adaptation Study

Sheils, T., Ffoulkes, C., Oliver, H., Palmer, L., Szafraniec, M., Anderson, B., Rushnaiwala, F., Finn, I., Wynter, V.

Version 7.0 - Final

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EXECUTIVE SUMMARY

The York and North Yorkshire Combined Authority (YNYCA) commissioned the preparation of this strategic-level Adaptation Study, led by RSK Group (including subsidiaries ADAS and WRc) and co-developed with the YNYCA Adaptation Steering Group.

It comprises of four primary sections:

1. A climate change risk and opportunity assessment (CCRA) for the City of York and North Yorkshire council jurisdictions, including constituent protected landscape authorities (i.e., the YNYCA region).
2. An assessment of climate change-related vulnerabilities within the region.
3. Development of Rapid Adaptation Pathways (RAPs).
4. A cost-benefit analysis to understand the costs of action relative to inaction.

It focuses on climate impacts which most require, or which would most benefit from, coordination and funding from the combined authority. Due to the place-based and context specific nature of climate risk and opportunities, it is not the purpose of this Adaptation Study to plan the detail of how individual areas, communities and businesses should adapt. Such detailed plans will be captured under area- or organisation-specific risk assessments and adaptation plans. The YNYCA adaptation study will help to guide the YNYCA as it supports constituent authorities and organisations to adapt to climate change and is intended to interlink with more specific risk assessments and adaptation plans, such as Shoreline Management Plans.

This report is supported by separate documentation, including a YNY Regional Climate Change Risk Register, Geographic Information System datasets and Rapid Adaptation Pathway Framework.

1. Climate change risk and opportunity assessment

A climate change risk and opportunity assessment was co-developed with the YNYCA Adaptation Steering Group, made up of representatives from YNYCA, NYC, CYC, the four protected landscape authorities, Yorkshire Water, the Yorkshire and Humber Climate Commission, the local resilience forum and the University of Edinburgh. Where relevant it built on previous CCRAs completed by constituent authorities within the YNYCA; including a 2011 risk assessment completed by the Yorkshire Dales National Park Authority and an assessment included within the 2023 Climate Ready York report.

The climate change risk and opportunity assessment evaluated 134 climate change impacts for the region, considering both 21 positive (i.e. opportunities) and 113 negative (i.e. risks) effects. These were categorised into four sectors that broadly correspond with the sectors highlighted in the national climate risk assessment: 1) natural environment (including farming, fishing and forestry), 2) infrastructure, 3) health and built environment, and 4) business and industry. Cross-cutting impact, including international dimensions, were identified where possible.

The scope of this CCRA focused specifically on impacts within the YNY region, with overseas climate change impacts considered through the climate risk register. However, the assessment did not examine in depth the cascading global risks and their consequent impacts on the YNY region. These are likely to be managed at the national level. The evidence base for these international risks is currently in flux, with the release of the nature security assessment in early 2026 by Defra and new research programmes under development to better understand and measure these risks.

The CCRA identified priority risks for the short-term time horizon, defined as the remainder of the 2020s and the 2030s. These risks were all rated as ‘Major’ (the second highest risk scoring within the assessment risk framework); no risks were rated as ‘Severe’ for this time horizon. The priority risks are summarised below:

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Flooding / extreme rainfall

- Risks to business sites from flooding (river, surface water and groundwater)
- Risks to people, communities and buildings from river flooding, including health and safety risks
- Risks of wastewater/sewer infrastructure flooding, overflow or releases into water courses due to heavy rainfall

General changing climatic conditions

- Risks related to finance, investment and insurance for businesses including higher insurance premiums and reduced access to capital for businesses due to recurring extreme weather. This could businesses relocating to other less risky areas and a reduced ability to start businesses in at risk areas.
- Risk to soils (including soil health and associated ecosystem services) from changing climatic conditions, including fluctuations between seasonal aridity and wetness resulting in soil loss events like erosion.
- Risks to integrity of cultural and historic collections including art works within museums, art galleries and storage facilities from changing environmental climate conditions within buildings, including humidity, more frequent / extreme fluctuations in temperature and flooding.

Extreme heat and wildfires

- Risks to health and wellbeing from high temperatures including exacerbation of existing health conditions
- Risks of wildfires and destruction of terrestrial habitats including forests, heathland/moors, peatlands and grasslands, where the habitat is difficult to return to its former state.

Cascading

- Risks to transport networks from cascading failure, e.g., winds impacts to electricity, resulting in rail outages and associated negative effects to services / business

Drought / water security

- Risk of reduced public water availability due to drought conditions (lower reservoir levels), creating pressure on supplies (e.g. need for temporary use ban, increased water pricing)

Climate-induced pest and diseases

- Risks to terrestrial species and habitats from pests, pathogens and invasive species, including viral and parasitic diseases, where climate change improves conditions for these to spread and cause damage.

RSK recommends that CCRAs are updated at least every 5 years to reflect changes in climate change knowledge and adaptation progress, in line with UK government guidance.

2. **Vulnerability mapping**

A spatial climate vulnerability and exposure mapping exercise for the region was developed using geographic information system (GIS)-based analysis that integrated a wide range of datasets to identify where exposed and susceptible populations, infrastructure and natural assets intersect with climate hazards. By combining spatial data on hazards such as flooding, temperature change and drought with indicators of social vulnerability and infrastructure location, the approach identified vulnerability hotspots and priority areas for adaptation. Public and local authority datasets were identified and analysed, informed by stakeholder engagement. A high-level, indicative evidence base was produced that highlights where risks are most concentrated and where further, more detailed analysis will likely be required.

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Vulnerability to climate change is shaped by the interaction of exposure, susceptibility and adaptive capacity. Individuals, communities and assets are not affected evenly; rather, vulnerability reflects underlying social, economic and environmental conditions. Groups with reduced capacity to prepare for, respond to or recover from hazards are disproportionately impacted, particularly where multiple sources of disadvantage coincide. These dynamics are evident across the region, where patterns of deprivation, health inequality and environmental exposure combine to heighten risk.

Certain population groups emerge consistently as more vulnerable to climate impacts. Older people, particularly those over 65, face increased risks during heatwaves and flooding due to physiological sensitivity, pre-existing health conditions and reduced mobility. People with physical or mental health conditions and disabilities may be more exposed and less able to respond effectively, while children are especially susceptible to heat and to the longer-term consequences of disruption, including impacts on development and education. Low-income households are less able to invest in protective measures or absorb shocks, and are more likely to occupy housing that is vulnerable to overheating or flooding. Minority communities, homeless populations and those unfamiliar with local risks may experience additional barriers linked to language, awareness and social marginalisation. In rural areas, these vulnerabilities are compounded by remoteness and reduced access to services, limiting opportunities for support and adaptation.

The analysis also highlighted the vulnerability of key infrastructure systems that underpin economic activity and wellbeing. Transport networks, energy systems, water supplies and built environments are all exposed to climate hazards, with risks often concentrated in specific geographic areas. Flooding represents a key immediate threat. While the total extent of flood-prone areas may not increase substantially, the severity of risk within these areas is projected to intensify. The spatial mapping analysis identified the southern part of the region, particularly Selby, as a critical hotspot where flood exposure coincides with concentrations of population, infrastructure and socioeconomic deprivation. Similar patterns are observed in parts of York and along major river corridors, where elevated risks intersect with communities that have lower adaptive capacity. Scarborough represents a hotspot for socioeconomic deprivation and therefore heightened vulnerability.

Flood risks extend beyond residential areas, affecting transport and energy infrastructure, where an increasing proportion of assets are projected to fall into higher risk categories under future scenarios. This raises the potential for cascading impacts, including disruption to essential services, reduced connectivity and wider economic consequences. Coastal erosion presents a more localised yet longer-term risk, particularly for specific parts of the North Yorkshire coast, such as Filey. Although the area directly affected is smaller than for flooding, the damage per property and asset is likely to be more significant and permanent.

Water security emerges as an additional and growing concern. Recent drought events, notably in 2025, combined with climate change projection data demonstrate regional water system vulnerability. While the region is expected to experience lower overall water stress than other parts of England, this relative position does not eliminate the risk of disruptive events. Both public and private water supplies may face pressure, particularly in rural areas, with implications for households, agriculture, ecosystems and economic growth.

The outputs from the GIS analysis have been provided to the YNY authorities as an evidence base to inform further analysis and adaptation interventions that prioritises those areas and communities most at risk. By strengthening adaptive capacity, improving the resilience of infrastructure and addressing underlying drivers of vulnerability, there is an opportunity not only to reduce risks but to support a more resilient and equitable future for the region.

3. Development of Rapid Adaptation Pathways (RAPs).

York and North Yorkshire have made important progress in preparing for climate change, particularly in managing flood risk and restoring natural systems. However, adaptation activity remains uneven

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across sectors and is not yet operating at the scale required to address future climate risks. While there is strong evidence of action in some areas, particularly flooding and catchment management, preparedness for many other climate hazards remains limited. As climate impacts intensify over coming decades, current approaches are unlikely to be sufficient without stronger coordination, clearer governance and a significant increase in adaptation activity.

The assessment found that adaptation across the region is characterised by a growing number of successful projects and partnerships, but these are often delivered through sector- and location-specific initiatives rather than a coherent regional framework. Flood risk management is the most advanced area of adaptation. Investment in engineered defences, natural flood management, peatland restoration and catchment-scale partnerships has reduced vulnerability and strengthened resilience across many communities. Nature-based solutions are also delivering wider benefits for biodiversity, water quality, carbon storage and soil health, demonstrating the value of integrated approaches that address multiple environmental objectives.

Despite this progress, preparedness for several significant climate risks remains low. Evidence of adaptation action is limited in relation to extreme heat, drought, transport and infrastructure resilience, business continuity, public health preparedness, climate-related financial risks, and climate-driven pests and diseases. These risks are expected to increase in severity and frequency as the climate changes. The assessment identifies a particular need to move beyond a predominantly flood-focused approach towards a broader, multi-hazard adaptation programme that addresses the full range of climate risks facing communities, businesses and public services.

While existing programmes are helping to manage current climate impacts, they are not yet sufficient to manage the scale of risks expected under future climate scenarios. Without earlier and more coordinated action, future adaptation costs are likely to increase and opportunities to build resilience through planned investment may be missed.

The assessment also highlights the increasing importance of interconnected risks. Climate impacts are unlikely to occur in isolation and may cascade across infrastructure systems, water resources, emergency services, health systems and local economies. Addressing these challenges will require greater coordination between organisations, improved risk monitoring and more integrated decision-making across sectors.

The Combined Authority's adoption of an adaptation pathways approach represents an important step towards more strategic adaptation planning. By linking actions to climate thresholds and decision points, the approach provides a framework for sequencing investment over time, reducing the risk of maladaptation an economic inefficiencies and ensuring that decisions remain effective under a range of future climate conditions.

The evidence produced can support the development of a region-wide climate adaptation strategy to provide leadership, align investment and establish a shared framework for delivery. Effective implementation will require clear ownership of adaptation across the York and North Yorkshire authorities, supported by stronger partnership working across infrastructure providers, environmental organisations, health services and resilience agencies.

Priority actions should focus on strengthening governance and accountability, maintaining a regional climate risk register, developing a coordinated Adaptation Action Plan, and embedding adaptation within planning, infrastructure, economic development and public service delivery. Alongside continued investment in flood resilience and nature-based solutions, greater emphasis should be placed on heat resilience, water security, infrastructure adaptation, public health preparedness and business resilience.

The challenge for the next decade is to move from a collection of successful projects towards a coordinated, region-wide adaptation programme capable of managing increasingly complex and

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interconnected climate impacts while supporting sustainable economic growth, thriving communities and a resilient natural environment.

4. Regional cost estimates

A limited number of material risks were taken forward for economic impact analysis, to understand the potential scale of economic impact if no adaptation action is taken. Additional analysis focused on the costs and benefits of adaptive interventions, to help provide indicative, preliminary assessments of the economic incentive to pursue adaptation. A range of methodologies were used, reflecting the limited data available and the diverse nature of climate change impacts. Where quantitative analyses were not possible, qualitative assessments were carried out.

The risk specific cost analysis included as part of this adaptation study relied on limited evidence available at the regional level and, due to project constraints, reviewed a limited number of risks (relative to the broader climate change risk assessment). Even so, the picture emerging is one of significant and increasing economic costs, especially over longer-term time horizons such as the 2050s. By this juncture, agricultural cost increases (excluding acute climate impacts that are likely to entail significant additional costs), property flood costs (rivers and sea flooding only, excluding the significant other costs associated with flooding), extreme heat impacts to productivity and wildfire impacts to moorland and heather could result in damages of over £160 million per annum. These costs relate to just four risks out of a total of 113 risks identified during the climate change risk assessment, highlighting the incompleteness of this assessment and the likelihood that significant additional costs related to climate change can be expected by this juncture.

Climate change has already begun to influence and shape the YNY economy, and the scale and severity of impacts are projected to increase substantially over coming decades. While there are pockets of potential opportunity, particularly in agricultural productivity under certain conditions, the overall trajectory is one of rising risk, growing volatility and increasing economic cost. The available, limited regional evidence suggests that, without timely and effective adaptation, these costs will escalate significantly and outweigh the investments required to manage them.

Flooding represents a particularly acute and immediate risk. The geography of York and North Yorkshire, with its extensive river systems, floodplains and Humber tidal influence in the south of the region, makes it especially vulnerable to both river (including tidal inundation near the Humber) and surface water flooding. Current estimates suggest that property damages from river flooding already average around £38 million per year. By the 2050s, this figure could rise to over £70 million annually under high emissions scenarios, with upper estimates exceeding £120 million. This represents a doubling of damages and a growing drag on the regional economy. Importantly, these figures capture only direct damage to residential and commercial properties and exclude wider impacts such as infrastructure disruption, business interruption and health consequences. Flooding also affects agricultural land, with annual damages projected to increase over time, compounding pressures on the farming sector. These impacts illustrate not only the scale of the risk but also the extent to which current estimates are likely to understate the true economic burden.

Farmers in York and North Yorkshire are already experiencing more frequent and unpredictable extremes, including periods of intense rainfall, drought and heat. These changes disrupt planting and harvesting windows, increase operational risks and lead to higher input costs. Average yields appear to be subject to increasing fluctuation, representing increased instability for farmers. Total production of wheat, a key crop, is declining over time and during the 2025 drought many farmers reported declines in crop yields and quality. Over the longer term, there is a risk of more fundamental shifts in land use, with projections suggesting that arable farming in parts of eastern England could become increasingly unviable under high warming scenarios without significant investment in irrigation. At the same time, the region's food system is exposed to global climate impacts, with rising costs in imported commodities driven by heat and water stress overseas. By mid-century, these combined pressures

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could add tens of millions of pounds annually to the cost of food in the region, affecting both farmers and consumers.

The effects of increasing temperatures are also expected to become more pronounced. As the frequency and intensity of hot days rise, productivity losses will grow across multiple sectors, particularly those involving outdoor work or temperature-sensitive processes. By the 2050s, annual losses to economic output in York and North Yorkshire from extreme heat could reach approximately £35 million.

Water availability presents a further emerging risk. National evidence shows that water scarcity can restrict commercial development by limiting new water connections, and similar pressures could emerge in York and North Yorkshire over time. Conversely, effective management of water resources could become a source of competitive advantage if other regions face more severe constraints.

The region's economy is also closely tied to the health of its natural environment. Climate change is expected to accelerate the degradation of natural systems, amplifying risks such as wildfire, biodiversity loss and declining soil and water quality. The economic impacts of these changes can be substantial, as illustrated by the North York Moors wildfire in 2025, which caused tens of millions of pounds in damages. As climate conditions shift, events of this nature are projected to become more frequent, transforming what are currently viewed as exceptional occurrences into more regular risks. The loss of ecosystem services also has wider economic implications, reducing the natural protection against flooding, limiting agricultural productivity and diminishing the attractiveness of the region for residents and visitors.

Across all these areas, a consistent conclusion emerges: the costs of inaction are likely to be significantly greater than the costs of adaptation. Flood damages alone are projected to increase sharply, while agricultural disruption, productivity losses, and ecosystem degradation will impose additional and interrelated burdens on the regional economy. These costs are not only financial but also social and environmental, affecting livelihoods, health and the long-term sustainability of communities.

By contrast, many adaptation measures offer strong economic returns. Preventing new development in high-risk flood zones, for example, could reduce future damages at relatively low cost. Nature-based solutions such as natural flood management have been shown to provide protection at a fraction of the cost of post-event recovery, while also delivering wider environmental benefits. Investment in natural capital, such as peatland restoration, can generate multiple returns by enhancing carbon storage, improving water quality and reducing flood risk. Similarly, actions to improve water efficiency, support climate-resilient farming and adapt infrastructure and workplaces to higher temperatures can help to reduce long-term risks while supporting economic resilience.

Looking ahead, there is a clear need for more detailed, locally specific analysis to fully understand the scale of these economic risks and to identify the most effective responses. This includes improving modelling of agricultural impacts, assessing the full costs of flooding across infrastructure systems, and evaluating the economic implications of water scarcity and ecosystem degradation. However, the ability to pursue these analyses will be constrained by available funding and it is likely that economic information related to future climate change impacts will continue to remain limited, which itself represents a potential risk to the region. At the same time, there is a need to integrate adaptation into spatial planning, infrastructure investment and regional economic strategy.

Climate change therefore presents a set of interconnected and escalating risks for York and North Yorkshire. While uncertainty remains in the precise scale and timing of impacts, the direction of travel is clear. Without early and sustained action, the region is likely to face increasing economic costs and reduced resilience. By acting now to adapt, there is an opportunity not only to avoid the most severe damages but also to build a more robust and sustainable regional economy over the long term.

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ACRONYMS AND ABBREVIATIONS

ADAS	This is not an acronym, but the name of the organisation
AONB	Area of Natural Beauty (now replaced by 'National Landscape' in official terminology)
ARP	Adaptation Reporting Power
CCC	Climate Change Committee
CCRA	Climate change risk and opportunity assessment
CDP	Carbon Disclosure Project
CRI	Climate Risk Indicators
CYC	City of York Council
GCOM	Global Covenant of Mayors
GIS	Geographic Information System
GWL	Global Warming Level
NAP3	Third National Adaptation Plan
NRR	National Risk Register
NYC	North Yorkshire Council
LACS	Local Authority Climate Service
RCP	Representative Concentration Pathway
SFRA	Strategic flood risk assessment
PL	Protected landscape
UK	United Kingdom
UKCP18	UK Climate Projections 2018
WRc	Water Research Centre
YNYCA	York & North Yorkshire Combined Authority
YNY	York & North Yorkshire

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1 INTRODUCTION

1.1 Aspirations for climate action

The York and North Yorkshire Combined Authority (YNYCA) and its constituent authorities have aspirations to be frontrunners in tackling climate change, both in terms of emissions reduction and building resilience through effective adaptation. The region has already committed to ambitious targets for mitigating climate change and reducing emissions (YNYCA, 2024). YNYCA recognise the need to build resilience to climate change and to effectively manage and adapt to the impacts of a changing climate alongside efforts to reduce further emissions.

The YNYCA, on behalf of the York and North Yorkshire (YNY) region and in collaboration with its constituent authorities and partners, commissioned RSK Group (including its subsidiaries ADAS and WRc) to support the organisation with the preparation of an Adaptation Study. Funding for the study was provided by the City of York Council (CYC), Howardian Hills National Landscape, Nidderdale National Landscape, the Northeast and Yorkshire Net Zero Hub, the North York Moors National Park, North Yorkshire Council (NYC), YNYCA and the Yorkshire Dales National Park. This study included four key components: a Climate Change Risk and Opportunity Assessment (CCRA), a Climate Change Vulnerability Assessment, a Rapid Adaptation Pathway Assessment (RAPA) and a Cost Benefit Analysis. The study sets out the evidence base to support the York and North Yorkshire region in preparing communities, authorities and stakeholders to understand and prioritise the climate change-related risks and opportunities relevant to its jurisdiction, how it can respond to priority risks/opportunities, and consider the regional benefits, costs and constraints of action.

1.2 Why is adaptation necessary?

The evidence on human-induced climate change is compelling and the effects are already being felt. The York and North Yorkshire region is already experiencing a range of impacts from increasingly frequent and severe extreme weather events as a result of climate change. This includes flooding and heavy rain events, drought conditions, extreme heat resulting in health impacts including fatalities, and wildfires, with the worst wildfire on record occurring in North Yorkshire Council in 2025. City of York Council and North Yorkshire Council have both declared climate emergencies, emphasising the urgent need to tackle the climate crises.

Climate refers to the description of average weather over a long period (typically 20 to 30 years or more). Climate projections allow us to assess different future scenarios of plausible outcomes based on climate modelling. The projections show that average and extreme weather can be expected to continue changing as time progresses. Extreme weather events are expected to become more severe and frequent.

Changes to the climate will continue to occur even if the world stopped emitting greenhouse gases immediately due to the time lag between emissions occurring and the atmosphere reacting to them. Action is also dependent on global efforts, so simply achieving net zero in the UK alone will not be enough to prevent the impacts of climate change without sufficient action from other countries. At present, global emissions continue to rise and as a result global climate goals to limit warming to 2 degrees of warming or below are highly unlikely to be met.

Critical infrastructure (e.g. transport networks, telecoms, and sea defences), community assets (e.g. schools, hospitals, green spaces), homes, the environment, businesses and public services are all sensitive to weather and climate. Therefore, climate change will directly affect the resilience of communities and the environment, demand for services, economic productivity, and infrastructure maintenance costs.

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In some cases, adaptation options can result in a range of other benefits. For example, natural flood management can improve biodiversity and achieve the resulting additional benefits, such as carbon sequestration and pollination.

Taking a proactive approach to adapt to climate change is therefore likely to result in many benefits, which could create a fairer, healthier, more resilient and prosperous society now and into the future.

1.3 Aims & objectives

The aim of this Adaptation Study is to provide a robust, shared evidence base to support the development of a regional adaptation strategy for the York and North Yorkshire region, its constituent authorities and delivery partners. The study included four distinct phases with corresponding objectives, each of which aim to provide a data-based approach to support how the region can achieve climate resilience. The objectives underpinning each one of the phases of this study are as follows:

1. To understand the risks and opportunities from climate change through a Climate Change Risk and Opportunity Assessment.
2. To understand regional vulnerabilities through a Vulnerability Assessment and spatial mapping using GIS.
3. To identify key adaptation actions, thresholds and decision points through workshops using the Rapid Adaptation Pathways Assessment.
4. To estimate costs and benefits of adaptation (e.g. action vs inaction) through a regional cost-benefit analysis.

This adaptation study has been prepared at the strategic level. Due to the place-based and context specific nature of climate risk and opportunities, it is not the purpose of this study to provide the full detail of how individual areas, organisations and communities should adapt to local climate risks. It instead acts as a framework to support the success of more detailed risk assessments and adaptation plans by identifying priority impacts and providing a range of feasible responses via the Rapid Adaptation Pathways Approach (RAPA). The cost/benefit analysis will help others understand the costs of action and inaction. Organisational, community or local/parish level adaptation plans that link to this strategy are likely to be developed.

The YNY local and strategic authorities recognise that they have an important role in supporting others to develop their own adaptation plans at a range of scales, from sectoral to household level. This study is intended to inform a programme of regional interventions to adapt to climate change, as well as catalysing place-based, grassroots, and organisational action on climate adaptation. It does not intend to replicate or replace CCRAs, or adaptation plans completed by other government bodies or organisations (e.g. Yorkshire Water).

Whilst the YNYCA and its constituent authorities will play an influential role in preparing the community and other stakeholders for the changes ahead, success will require a collaborative approach involving government departments and agencies, transport and utility providers, organisations, local businesses, communities, and individuals to develop and build the adaptation actions required in each sector and across the region.

1.4 Purpose of this report

This report is intended as a public document available for relevant stakeholders to review and better understand YNY's climate change risk profile and adaptation objectives and plans. It is intended primarily for use by relevant staff working within the YNY constituent authorities and delivery partners as a framework and reference point as they seek to improve their understanding of local climate change risks and opportunities they plan for and/or implement risk assessments and adaptation

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actions within their own authorities/jurisdictions. Beyond the YNYCA, CYC and NYC the report is intended as a resource for all entities engaging with climate change risk and adaptation in the YNY region, including the National Parks and Protected Landscapes.

While YNYCA acts as the strategic coordinating body, this report is intended to support shared understanding, planning and action across the YNY region, including its constituent authorities, protected landscapes and delivery partners. This report will provide a public evidence base on climate risks, vulnerabilities and adaptation options for the region. The report is not a prescriptive plan for individual organisations but a framework for guiding future, detailed adaptation plans

1.5 Intended audience for this report

This report was prepared to provide the evidence-base for climate risk in the YNY region to inform adaptation planning for the following organisations:

The York and North Yorkshire Combined Authority (YNYCA) is a legally recognised, single body that was established in 2024 by the City of York Council and North Yorkshire Council. The role of YNYCA is to use some of the money and powers, that have previously been held by central government, to work with local organisations and communities to invest in ways that will help to make York and North Yorkshire a better place to live, work and do business (YNYCA, n.d.(a)). YNYCA is chaired by the Mayor of York and North Yorkshire, who is directly elected.

The City of York Council (CYC) is the local authority for the city of York, situated within the county of North Yorkshire. The council has acted as a unitary authority since 1996, taking on the responsibilities of a district and county council.

North Yorkshire Council (NYC) is the unitary authority governing body for the non-metropolitan county of North Yorkshire, the largest county in England. The council became a unitary authority in 2023, taking on the responsibilities of the seven previous district councils (Craven, Harrogate, Selby, Ryedale, Scarborough, Hambleton and Richmondshire) as well as existing county council responsibilities. The North Yorkshire Council jurisdiction excludes three other unitary authorities located within the ceremonial county of North Yorkshire: the Borough of Middlesbrough, Redcar and Cleveland, and the City of York.

The authorities for the four Protected Landscapes, of which two are designated national parks – the **North York Moors National Park Authority** and the **Yorkshire Dales National** Park Authority and two are designated national landscapes, previously known as areas of outstanding natural beauty (AONBs), the **Howardian Hills National Landscape Authority** and **Nidderdale National Landscape Authority**. It is noted that a small part of the Forest of Bowland National Landscape falls within the YNYCA jurisdiction; however, the Forest of Bowland authority was not included as a primary stakeholder or user of this adaptation study.

1.6 Climate change action within YNYCA to date

A review of previous assessments and information from relevant national reports, local authorities and key stakeholder organisations was undertaken to provide background context of climate action in the region and to identify initiatives with potential linkages to the Adaptation Study. An overview of the relevant detail in the materials assessed is provided in **APPENDIX 1**.

The YNY region includes the largest county in England, two historic cities (York and Ripon), a significant length of coastline, two national parks and two national landscapes (and a small area of a third national landscape). As a result, a large number of climate adaptation and mitigation actions are already being pursued by a range of different organisations, with varying degrees of ambition and

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success. These include both actions designed to directly address mitigation and adaptation and actions that will have relevant benefits, but which are not specifically labelled as mitigation or adaptation. As the exact impacts of climate change through space and time are highly uncertain, analysing the effectiveness of existing adaptation measures is subject to high uncertainty; furthermore, fully analysing the effectiveness of all existing adaptation measures would require highly detailed analysis that goes beyond the scope of this study.

NYC has adopted a climate change strategy for the 2023 - 2030 period of which the adaptation section focuses on supporting community resilience, service adaptation and the use of nature-based solutions and acknowledging the likely international disruptions that may result from global climate change. A natural capital investment programme (NCIP) is being developed by the YNYCA to enhance capital flows into potential nature-based solutions. The North Yorkshire and York Local Nature Recovery Strategy (LNRS) has been developed to provide a strategic framework for protecting and enhancing biodiversity across the diverse habitats of North Yorkshire and York. The strategy aligns with related policy and legislative requirements, including Biodiversity Net Gain (BNG), and supports landowners, developers and planning authorities in making informed, location-specific decisions that deliver positive outcomes for nature.

A Climate Ready York (City of York Council, 2023a) is a report outlining the council's progress towards strengthening York's resilience to climate change. The report sets out the key climate risks identified through a climate risk and vulnerability assessment and recognises the benefits from improved resilience not only as a protective measure but also as a driver for socio-economic development. Some adaptation actions have been implemented as a result, but these have focused on smaller scale interventions such as ensuring council workers wear lighter personal protective equipment (PPE) during extreme heat events.

York is now benefitting from the Foss Barrier flood protection scheme, which was completed by the Environment Agency in 2022. Modelling indicates that the city is protected from a 1 in 100 flood until 2039.

In general, progress on climate change adaptation has been limited by funding constraints and has not been guided by overarching strategies at the regional level. Priority climate hazards and clear response plans to manage these hazards have not been completed. Historically, measures have not typically been put in place to monitor the effectiveness of pursued actions or understand effectiveness against projected future climate change conditions. With climate change impacts increasing in severity, it is likely that existing measures will need to be enhanced alongside the implementation of new interventions, particularly over longer-term time horizons (such as the 2050s).

1.7 Background to the region

York and North Yorkshire (YNY) is a region of huge geographical variation, from the uplands of the North York Moors and the pastures of the Dales to the coastal headlands in the north east, the relatively low-lying flat areas in the south and east and the historic city of York. With two national parks, three national landscapes and ~ 70% of the region's geography being used for agriculture, YNY are uniquely positioned to use these natural assets for climate mitigation and adaptation. The diversity of land type and use can be used as an opportunity to achieve a diverse, resilient landscape.

Certain areas or habitats will be particularly susceptible to specific climate risks or challenges. The heathlands across the Moors and Dales are likely to become more prone to wildfires and associated challenges, whilst the steep sided valleys of the coastal hinterland present a flood risk that is likely to intensify with the projected increasing frequency and intensity of extreme rainfall events. Habitats such as heather moorland, traditional hay meadows and blanket bogs in the national parks and other upland areas in the region are of great ecological importance. Understanding the vulnerabilities of

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these important, sensitive habitats in a changing climate should be considered in a regional context to enable effective adaptation.

Meanwhile, YNY's primary urban centres such as York and Scarbrough are hotspots for national and international tourism. Their economies are reliant on visitors, and they are also exposed to climate-related hazards such as river flooding and coastal erosion that could threaten a long-term reduction in tourism numbers alongside other socioeconomic damages, such as lost productivity and health impacts due to extreme heat. Whilst tourism is a key part of York's economy other sectors also provide important contributions, including manufacturing, retail and bioeconomy/bioscience. The city is also home to two sizable universities and it is a transport hub for the broader region.

Equally, the vast natural resources of the region provide opportunities to improve resilience through nature-based solutions such as peatland restoration, wetland creation and regenerative agricultural practices. Land use in YNY includes 69% agricultural land, woodland 9%, moor 7% and peat bogs 12%. Urban areas cover just 4% of the region. YNY is ideally placed to harness the potential from a range of nature-based solutions to provide environmental, social and economic benefits alongside improved climate resilience.

YNY has a total population of around 818,000 across an area of 8,308 km^2 and is home to 46,000 businesses. A large part of the region's economy is the tourism sector, and YNY is also a growing hub of agri-tech innovations as well as investment in clean energy. Whilst these are economic strengtheners of the region, parts of YNY also face challenges such as poor transport connectivity, issues with rural digital connectivity and areas of social and economic deprivation particularly around the coast. There is opportunity for climate adaptation action to support YNY in harnessing its economic potential.

Figure 1. YNYCA adaptation study area, showing the YNYCA region and constituent protected landscape areas. The North York Moors area includes the Howardian Hills National Landscape. Source: YNYCA, 2024 [Note: this map will be updated by YNYCA prior to publication].

1.7.1 City of York

York has a population of 202,821 (City of York Council, 2023b) across approximately 85,000 households and an area of 105 square miles, or 271 km^2 (City of York Council, n.d.(a)). The area within the city council's jurisdiction extends beyond the physical limits of the city and includes farmland and

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several significant natural capital assets, such as the 579-hectare Strensall Common SSSI, an example of acidic lowland heath. Several rivers flow through York including the River Ouse and its tributary the River Foss. The River Ouse eventually flows into the Humber Estuary.

York is well known for its culture and the aesthetic value of its built environment which largely consists of stone and brick buildings, ~2,000 of which are protected for conservation (City of York Council, n.d.(b)). It is home to a number of renowned museums and other cultural collections. It is a tourist hotspot with approximately 8 million visitors every year (City of York Council, 2024b).

CYC is responsible for 7,400 council homes, nine bridges across the River Ouse and eighteen smaller bridges and passages across the narrower River Foss, 800km of adopted roads and over 1000km of footways, in addition to a well-developed cycle route network covering over 250km (City of York Council, 2025). There are 63 publicly funded schools currently operating in the York area, including maintained local authority schools and academies. In addition to these state-funded institutions, there are several independent schools, bringing the total to nearly 70 schools.

Flooding is the most material extreme weather impact that has affected York in recent history, with the Boxing Day floods of 2015 causing significant disruption and economic losses across the city. Several flood risk alleviation schemes have been implemented in the city in the subsequent years. In more recent years extreme heat and drought has arisen as a key risk; during the 2025 drought a large number of young trees planted as part of the city's climate change programme died due to heat and lack of water and a 579-hectare wildfire occurred in Strensall Common. Heatwaves in recent years have led to clear excess mortalities at the Yorkshire region level, though specific figures for the City of York are not tracked. Extreme heat events have caused discomfort across the city and are likely to have reduced economic productivity.

Climate impacts that dampen tourism footfall in York, such as increased flooding, are a key concern, due to the economic importance of this sector.

1.7.2 North Yorkshire

NYC had a population of around 615,491 as of the 2021 census (NOMIS, 2021). Harrogate has around 75,070 residents and Scarborough around 52,100 (North Yorkshire Council, n.d.). It has an area of approximately 3,103 square miles (8,037 km^2) making it the largest county in England (North Yorkshire Council, 2024). Approximately 67 km of coastline is located within the NYC area (North Yorkshire Council, 2024). North Yorkshire attracts approximately 31 million tourists annually for day and overnight trips, with Harrogate and Scarborough recording approximately 3 million and 4 million visitors a year, respectively (Visit North Yorkshire, 2025) (Ripon BID, 2024).

Five primary protected landscapes are located within the NYC jurisdiction: the North York Moors National Park, the Yorkshire Dales National Park, the Howardian Hills National Landscape, the Nidderdale National Landscape and a small part of the Forest of Bowland. Beyond this the region is home to a large number of SSSIs and other protected areas.

NYC's responsibilities include:

- Managing and maintaining over 8,330 council homes.
- Maintaining 9,250km of highways and 6,110km of public rights of way.
- Maintaining 1,645 bridges.
- Managing or supporting more than 390 schools, serving over 88,000 pupils.

Further information on the NYC is available from its website and the 2024 – 2028 Council Plan (North Yorkshire Council, 2024).

Key climate risks for NYC differ from York due to its predominantly rural character. Flooding is a key concern, though coastal erosion (especially in hotspot areas such as Filey) and worsening tidal influenced flooding due to rising sea levels in the Humber estuary, moorland wildfires and other

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climate change impacts to agriculture and natural ecosystems also represent material and ongoing risks. Agriculture is a key economic sector for the county and is also highly exposed to the impacts of climate change; recent analysis indicates this sector is already financially stressed, decreasing its potential climate resilience. In 2025, the Langdale Moor wildfire burnt 5,000 acres and a major incident was declared that required responses from various local authority and emergency response departments; this wildfire is considered the worst in NYC's history. Climate change likely played a major role in creating warmer, drier conditions that exacerbated the spread of the wildfire.

Protected Landscapes

Within the YNY region there are four primary Protected Landscapes: The North York Moors National Park, the Yorkshire Dales National Park, the Howardian Hills National Landscape and Nidderdale National Landscape. Each Protected Landscape has unique characteristics, ecosystems, land uses and communities.

- The **North York Moors National Park** covers the upland area in the north-east of the region, including large areas of moorland, and some of the North Yorkshire coastline. The park is drained by three main river catchments, the Esk, Leven and Derwent. The national park is 1,436 km^2 and has approximately 40 km (26 miles) of coastline (North York Moors National Park, n.d.).
- The **Yorkshire Dales National Park** are to the west of YNY, within the Pennines, and are home to dales, upland moors and multiple river catchments. The park totals 2,179 km^2 and extends into Cumbria and Lancashire.
- To the south and outside of the Yorkshire Dales National Park, but within an area widely referred to as the Dales due to the similarities in landscape character, is the **Nidderdale National Landscape** (approximately 600 km^2). This protected landscape contains a variety of habitats including open heather moorlands, rolling pastures, native woodland and steep river valleys.
- The fourth Protected Landscape within YNY is the **Howardian Hills** (204 km^2). Situated to the north of York, and south of the North York Moors National Park, the Howardian Hills is a landscape of rolling countryside with native woodlands, pasture, fens and arable land.

The Howardian Hills and Nidderdale authorities are part of the NYC administration, though with separate management systems and committees.

Due to the variation in land types, and the differing responsible organisations and authorities, the risk from hazards and need to adapt in a changing climate was considered independently for each of the Protected Landscapes.

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2 CLIMATE CHANGE RISK AND OPPORTUNITY ASSESSMENT

The Climate Change Risk and Opportunity Assessment (CCRA) for the YNY region, conducted as part of this study, sets out the risks and opportunities that climate change presents to the region to the end of this century. The key objective of the CCRA methodology is to enable the identification of key climate change impacts to the region, understanding the risks these impacts present and allows for the prioritisation of those risks to understand where priority adaptation action is needed.

The CCRA for YNY was co-developed with key stakeholders from across the region to ensure the findings and recommendations from this assessment were locally relevant, recognising the wide geographic and social variations across the combined authority. This CCRA provides a strategic, non-statutory assessment intended to inform local and organisational adaptation planning. The climate change risks presented in this report summarise more detailed climate change risk registers that are held by the YNYCA.

2.1 Approach to the CCRA

A high-level overview of the process used for the CCRA is shown in Figure 2.

Figure 2. Overview of the steps involved in the YNYCA Climate Change Risk and Opportunity Assessment. Source: ADAS, 2025.

The CCRA began with a review of the national level UK Climate Change Risk Assessment (UK-CCRA3) and climate change impact assessments completed by regional bodies, such as CYC and Yorkshire Water. These were then reviewed for relevant to the YNY region, including multiple engagement sessions with key regional stakeholders. Climate change risk registers were developed, through which risk scores for impact and likelihood were assigned. These were then validated through sectoral workshops with local stakeholders. The ultimate scores allow for the identification of the most material risks for the region at each future time horizon to inform adaptation planning.

This approach was supported by a vulnerability and spatial mapping assessment that was conducted in parallel to support the CCRA, outlined in Chapter 3.

Climate projections and emissions scenarios

There are several different ways to assess future climate impacts. The approach recommended by Defra for the fourth round of the Adaptive Reporting Power (ARP4) was deemed the most appropriate approach for YNYCA to ensure compatibility with wider reporting requirements (e.g. Carbon Disclosure Project (CDP) and Global Covenant of Mayors for Climate & Energy (GCOM)). The ARP4 approach involves assessing the following global warming levels (GWLs) and time horizons:

- Present day (2030s): 1.5°C GWL
- Mid-century (2050s): 2°C GWL
- End of century (2080s to 2100): 2°C GWL

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- End of century (2080s to 2100): 4°C GWL

In addition to these scenarios, observation data for 1981 to 2000 was used as the baseline. This represents a GWL of 0.6°C. Observation data for 2001 to 2020 was also used as an additional scenario to represent the recent past (GWL 1.0°C). Using GWLs aligns with the current methodologies used by the Climate Change Committee (CCC) to assess national climate risk. The six-time horizons and GWLs assessed within this study, based on the Met Office Local Authority Climate Service (LACS) tool, are set out in Figure 3.

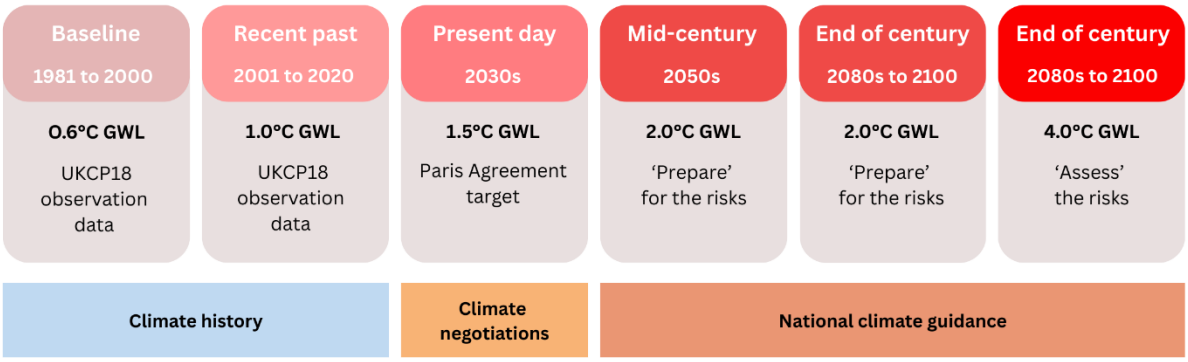

Figure 3. Outline of the climate scenarios and time horizons used to inform the CCRA. Source; ADAS, 2025

Regional data

To understand the extent of the projected climate impacts, on the YNY region, the best available climate projection data from the UK Climate Projections 2018 (UKCP18) was used. This data was used to guide the scoring of the risks and opportunities. Again, as recommended in the ARP4 approach, the median values were used as central estimates of projected changes, and upper and lower values were considered as the uncertainty range.

Data was extracted from the LACS reports available through the Met Office Climate Data Portal for the City of York and North Yorkshire. The LACS reports provided data on the regional projected changes in key climate variables including temperature (maximum, minimum, average for summer, winter, annual), precipitation (summer, winter) as well as a series of climate indicators (e.g. number of days with daily maximum temperature greater than 25°C, 30°C, 35°C). This data was supplemented with UKCP18 data for sea level rise.

Whilst the regional data has the benefit of providing climate averages over a distinct area and within a set boundary of any size, it does have limitations, especially when the area averaged is very large, or contains many different types of landscape that would likely experience differing climate conditions. This is the case for North Yorkshire, whereby the climate data provided by LACS is averaged data from 84 12 by 12-mile grid squares. This compares to York which provides data averaged over just 7 grid squares, illustrated in Figure 4 and Figure 5 below.

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Figure 4. Climate data projection assessment area for North Yorkshire, including spatial assessment grid squares.

Figure 5. Climate data projection assessment area for the City of York, including spatial assessment grid squares.

The impact is that some of the projected extremes that might be observed in a single grid square are masked when assessed across many grid squares, becoming less pronounced. This is apparent in the data, with projections for York generally showing greater changes and extremes in the projection data compared to North Yorkshire. To mitigate this impact, local projections were also captured for select parts within North Yorkshire.

Local data

Data was not available from LACS in a format that represented the four Protected Landscapes, therefore a separate platform, Climate Risk Indicators (CRI), was used to extract data for these areas. Information from CRI is based on UKCP18 data and is therefore comparable to that from LACS. Four 12x12 mile grid squares were selected to represent the North York Moors (the chosen grid squares covered Chop Gate), Yorkshire Dales (Hawes), Nidderdale (Pateley Bridge) and the Howardian Hills (Ampleforth). For each, projected changes in key climate variables and indicators were extracted. Where possible, data was extracted for the same variables and indicators presented in LACS, for consistency.

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As North Yorkshire is a large county which encompasses several different geographical areas stretching from the coast to high moorland, more granular analysis was undertaken to understand how the climate is projected to differ across North Yorkshire. Using CRI data, three 12x12 mile grid squares within North Yorkshire were selected to represent distinct parts of the county: a seaside town (Filey), a southern, lower lying and more urbanised area (Selby) and a northerly market town (Northallerton) which sits in the Vale of Mowbray between the two National Parks. The same variables and indicators were extracted from CRI as for the Protected Landscape grid squares. In addition, the CRI platform was used to gather projected changes in wildfire risk for each of the four Protected Landscapes, as well as York and North Yorkshire.

A full list of the climate variables extracted from LACS, UKCP18 and Climate Risk Indicators is available in **APPENDIX 2**.

Identifying the risks & opportunities

A range of national and regional sources were screened to create a set of risks and opportunities relevant to YNYCA. The 61 risks and opportunities identified in CCRA3 (CCC, 2021) were used as a basis for the CCRA. A desk-based study reviewed reports and evidence from the combined and local authorities as well as core stakeholders to identify risks and opportunities additional to those in CCRA3 with specific, local relevancies to YNY region. For example, relevant risks from the National Risk Register (NRR) (GOV.UK, 2025) were cross referenced against those from CCRA3 and new risks included. Risks and opportunities identified in an earlier CCRA, the Yorkshire & Humber Regional Adaptation Study (Yorkshire Futures, 2009) were also cross referenced with the existing set and incorporated. In some cases, the high-level risks and opportunities from the CCRA3 were split out into more detailed, locally relevant risks.

In total 113 regional risks were identified and 21 regional opportunities. These risks and opportunities were recorded in three separate registers:

- YNY Regional Risk Register;
- YNY Regional Opportunity Register; and
- Organisational Risk Register.

The regional registers provide a set of risks and opportunities that have relevance across the region, covering all sectors and land uses (i.e. rural vs urban).

The Organisational Risk Register (75 risks) provide a set of risks act to the operations (including authority assets and staff) of the YNYCA, CYC and NYC, alongside the protected landscape authorities.

Categorising the risks & opportunities

The list of risks relevant across the YNY region were sorted by various categories to enable a local and/or sector level view of the identified climate impacts. The risks were categorised by sector at three levels of detail, as follows:

- The six chapters set out in the national risk assessment CCRA3 (Natural Environment; Infrastructure; Health; Communities and Built Environment; Business; International Dimensions).
- The 13 systems set out in the national progress reports on climate adaptation from the CCC (nature; working lands and seas; food security; water supply; energy; telecoms and ICT; transport; towns and cities; buildings; health; community preparedness and response; business; finance).
- The seven themes relevant to the Protected Landscapes (landscape; natural environment; historical environment; farming forestry & land management; built environment; community & economy; recreation & tourism).

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The regional relevance of each risk was also identified using the following categories:

- YNY region
- City of York
- North Yorkshire County Council area
- Yorkshire Dales
- North York Moors
- Nidderdale
- Howardian Hills

The set of risks and opportunities and the proposed categories of relevance were shared with the YNYCA Adaptation Study Steering Group to gain stakeholder input and ensure the categorisations were useful to the end users.

Scoring the risks & opportunities

Risk scoring involves assigning a score for the magnitude of the potential consequences of a risk and a score for the likelihood or probability of that risk occurring.

Magnitude was scored on a five-point scale: very low (1), low (2), medium (3) high (4) and very high (5). Likelihood was also scored on a five-point scale: very unlikely (1), unlikely (2), possible (3), likely (4), and very likely (5). By multiplying the magnitude by the likelihood, a risk score was obtained for each of the impacts, which was then assigned a risk rating based on a five-point scale (Table 1):

$$Risk\ Score = Magnitude\ Score \times Likelihood\ Score$$

Table 1. Risk rating matrix.

Risk Rating Matrix		**Magnitude of potential consequences**				
		Very Low	Low	Medium	High	Very High
Likelihood (levels of probability)	Very Likely	Moderate	Major	Major	Severe	Severe
	Likely	Moderate	Moderate	Major	Major	Severe
	Possible	Minor	Moderate	Moderate	Major	Major
	Unlikely	Minor	Moderate	Moderate	Moderate	Major
	Highly Unlikely	Negligible	Minor	Minor	Moderate	Moderate

The descriptions of each risk rating are shown in Table 2. A benefit rating system was used for the opportunities, to recognise that for these impacts a higher score reflects a greater opportunity.

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Table 2. Risk and opportunity rating scores and definitions.

Score	Risk rating	Risk rating definition	Opportunity rating	Opportunity rating definition
20 -25	**Severe**	Severe impact expected, associated with a catastrophic consequence and almost certain probability of occurrence	**Considerable**	Considerable potential for benefit or gain from the opportunity being realised
10 - 16	**Major**	Major impact expected, from either high magnitude and moderate frequency events, or high frequency and moderate magnitude events	**Major**	Major potential for benefit or gain from the opportunity being realised
4 - 9	**Moderate**	Moderate impact expected from events that could be low-high frequency and/or low-high magnitude	**Moderate**	Moderate potential for benefit or gain from the opportunity being realised
2 - 3	**Minor**	Minor impact expected, from either moderate magnitude and low frequency events, or moderate frequency and low magnitude events	**Minor**	Minor potential for benefit or gain from the opportunity being realised
1	**Negligible**	Negligible impact expected, associated with a minimal consequence and highly unlikely probability of occurrence	**Negligible**	Negligible potential for benefit or gain from the opportunity being realised

The scoring was supplemented by evidence and data analysis conducted in the vulnerability assessment.

Specific qualitative and quantitative thresholds were used to score each level of likelihood and magnitude. Magnitude scores were categorised by key types of impact, including economic, health, natural environment and operationally. These are available in the Appendix.

The specific thresholds used in this scoring exercise are provided in **APPENDIX 3** and **APPENDIX 4**.

Inherent and residual risk considerations

In enterprise risk management systems, risks are typically categorised and scored by inherency vs residuality. Definitions of these terms are provided below:

Inherent risk: The risk to an entity in the absence of any mitigation plans and actions.

Residual risk: The risk remaining after an entity's response to the risk – including design and implementation of appropriate risk management process and controls.

Source: Stanford University (Stanford University, n.d.)

The YNYCA CCRA scored risks based on inherent risk values, reflecting the risk as of today and including adaptation that has already been implemented as of 2025, but excluding the potential resilience gained from implementing further risk mitigation / climate adaptation actions.

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Urgency scoring

Providing urgency scores to indicate the need for adaptation action and the timeframe within which the adaptation action should occur was outside the scope of this study. However, space was provided in the risk and authority registers for urgency scores to be assigned to each risk. It was recognised that the urgency of adaptation action will likely vary within the region. Each local authority and protected landscape authority were encouraged to consider the urgency scoring and timeframe for action of each risk within their own boundaries of responsibility.

The urgency scoring framework provided as guidance followed that used in CCRA3, set out in Table 3. The recommended timeframes of adaptation action were two, five and 10-year intervals, as well as beyond 10 years. The scores were expected to be assigned based on expert insight from stakeholders, rather than a further comprehensive analysis of the current and future position for each risk.

Table 3. Urgency scoring framework, adapted from that used in the national CCRA3 (CCC, 2022).

Category	Description
More action needed	Additional adaptation is needed urgently, either over and above what is already happening, or in some cases adaptation needs to start where there is currently nothing happening.
Further investigation	Not enough evidence is available to make a robust judgement on what further action is needed.
Sustain current action	The level of current action is in line with the magnitude of the risk or opportunity.
Watching brief	Further action is not currently justified, but monitoring the situation is.

Risk validation

Identified and scored risks / opportunities were validated in a series of workshops with a range of relevant stakeholders.

The list of engaged organisations engaged for each theme can be found in **APPENDIX**

2.2 Current and future climate

The YNY region has already experienced a range of impacts from extreme weather events and climate-induced changes, from floods and droughts to erosion and sea level rise. These impacts provide an important view of the current risks faced by the region; where adaptation measures have not been pursued in response to these impacts, future climate change could result in similar, but more severe, types of hazards and impacts occurring.

Climate change projection data was primarily obtained from the UK Met Office Local Authority Climate Service (Met Office, n.d.). In the future, summers are likely to become hotter and drier while winters will become milder and wetter. Conditions conducive to wildfires are likely to increase in summer months.

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All projections represent central estimates with inherent uncertainty. They should be used to understand direction of change and relative risk, rather than precise forecasts. Significant levels of interannual variability are expected year on year, with variability likely to increase as global warming levels increase.

2.2.1 Observed impacts in the region

Summary

Climate-related impacts are not tracked formally within the YNY region at present and as such it has not been possible to scientifically analyse whether these are increasing. However, a high-level analysis of climate change impacts indicates that it is highly likely that these events are increasing in frequency and severity. In the forty years between 1960 and 2000, droughts were observed for three years. In the twenty-year period between 2000 and 2020 five droughts were observed (albeit none requiring hosepipe bans). In the five-year period between 2020 and 2025 two hosepipe bans were observed, which nearly equals the number of hosepipe bans implemented during the previous century (see Section 3.3.5 for evidence).

In 2022, temperatures in Yorkshire hit all-time record highs of 40°C, exceeding the previous record of 36°C in 2019 (BBC, 2022). The 2025 drought was described as the worst since 1893, causing water stress in the region and resulting in a hosepipe ban in early July through December 2025. The 2025 spring was similarly described as the driest and warmest on record (Guardian, 2025). 2025 saw a 1,000-acre wildfire at Strensall Common in the CYC area while the 5,000-acre Langdale Moor wildfire is considered the worst in NYC history.

While flooding damages have not exceeded those observed in Boxing Day 2015, extreme rainfall and flooding events continue to be observed in the region, including the 2017 Scarborough floods (return period: 1 in 100+) and the 2019 Upper Dales floods (return period: 1 in 1,000).

The Met Office's climate projection data for the region (see Section 2.2.3 onwards) indicates that these extreme weather trends are likely to continue into the future; without adaptation interventions these events are likely to become more frequent and severe in nature resulting in a range of negative health and economic impacts within the region.

Drought, heatwaves and wildfires

Estimated heat-related mortality for Yorkshire and the Humber is provided in Figure 6*. below (more granular figures for YNY were not available at the time this report was produced).*

August 2025 – North York Moors Wildfires: In August, the North York Moors were gripped by the most extensive wildfire in the park since at least 1976, centred at Langdale Forest and Fylingdales moor. Around 5,000 acres of smouldering peat took several inches of rain or other water to extinguish (Moorland Association, 2025). This event represented an emergency for the region that required coordinated response across a range of local government services and other non-governmental entities. It was later described by NYC as the worst wildfire in the county's history (BBC News, 2026).

Summer 2025 – Heatwaves: the geographic distribution of impacts was relatively limited, with most heat-associated mortality occurring in the southern parts of England. Unlike several previous summers, there was no statistically significant heat-associated mortality detected in the North East, North West or Yorkshire and The Humber. This pattern is consistent with both the HHAs issued during the season and the Met Office's seasonal reviews, which reported that the most sustained and intense heat was concentrated in southern and eastern England (UK Health Security Agency, 2026).

Spring and Summer 2025 – EA announces drought in Yorkshire: After the driest and warmest spring on record, the EA announced a temporary restriction for the residents of Yorkshire on the use of hosepipes to wash their cars, water their gardens and for any other activities. The restrictions were

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scheduled to be in place until the region has seen significant rainfall to restock the reservoirs and groundwater sources. The ban was lifted in December 2025 (Guardian, 2025).

Spring 2025 – Moorland fires: Firefighters attended a fire that broke out close to a heritage railway line in the North York Moors and spread to more than 100 acres of moorland causing disruption to the visitors and surrounding areas. The area was particularly dry, causing this fire to spread rapidly (Gazette Herald, 2025).

Spring 2025 – Nature reserve fire: 10 fire brigade crews tackled a 579-hectare wildfire at Strensall Common, a designated SSSI and Special Area of Conservation. The common covers a section of the Yorkshire Wildlife Nature Reserve run by Yorkshire Wildlife Trust and is the only place in England where a rare dark-bordered beauty moth is found. The fire was reported to have come within 2,000 ft from the moths' habitat (BBC News, 2025b).

Summer 2023 - Heatwaves: During the summer of 2023, an estimated 262 people died from five extreme events in the Yorkshire and Humber region (specific figures for YNY were not published) (UK Health Agency, 2025).

Summer 2022 – Heatwaves: The region experienced a brief but unprecedented extreme heatwave from 16 to 19 July 2022, with 39˚C recorded in Topcliffe, North Yorkshire (Met Office, 2022). As a result of five summer heat episodes, there was an increase in the rate of excess deaths in some regions of England, including an estimated 391 deaths in Yorkshire and Humber (UK Health Security Agency, 2025).

Summer 2019 – Heatwaves: During two heatwave events an estimated 170 people aged 65+ died in Yorkshire and the Humber (Public Health England, 2019).

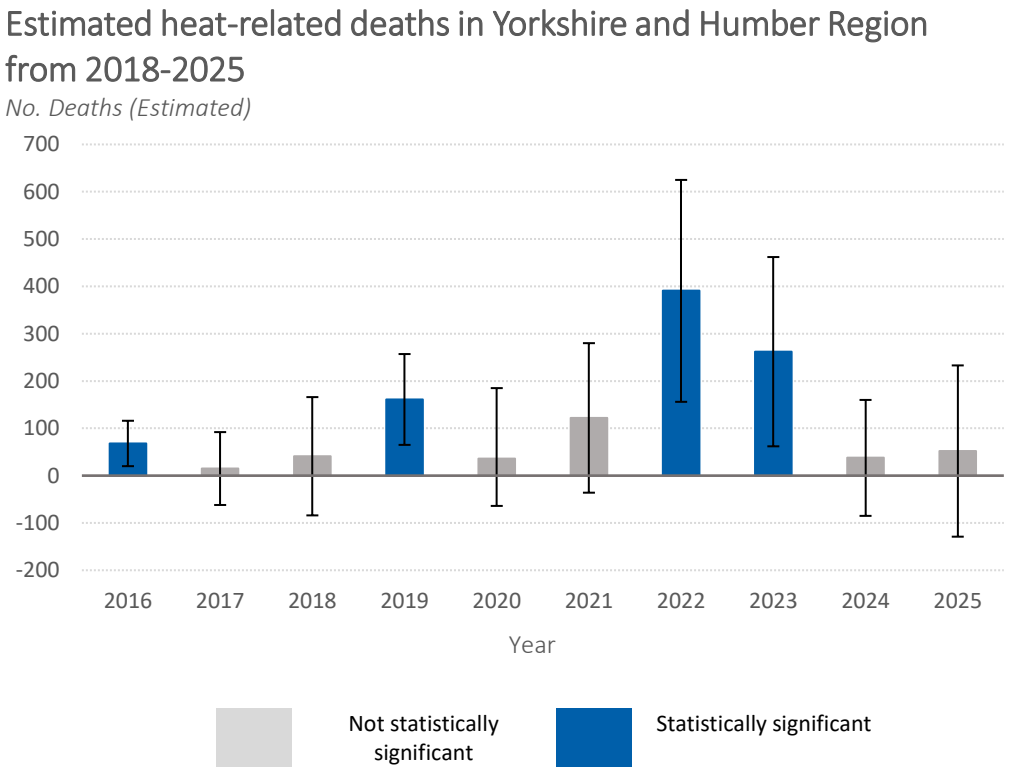

Figure 6. Estimated heat-related deaths from 2016 to 2025 in Yorkshire and Humber Region. The error bars represent 95% confidence intervals. Blue bars indicate statistically significant mortality while grey bars indicate statistically non-significant mortality. 2016 data only included values from significant instances as opposed to estimates from all heatwave events as the other years did. Source: [Heat mortality reports - GOV.UK]

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Coastal erosion

March 2025 – Coastal erosion: 45 properties at Flat Cliffs, near Filey, were reported as "at imminent risk of loss" due to coastal erosion which could destroy the single access road. Officials indicated this could create difficulties for the council as it seeks to manage the property vacation process. (BBC News, 2025a). NYC were developing adaptation plans for Flat Cliffs at the time this report was produced. (source: NYC communications to RSK).

Heavy rainfall and flooding

Winter 2024 – Storm Darragh: North Yorkshire and its residents suffered losses after more than 25 homes flooded and hundreds were left without power during Storm Darragh. North Yorkshire Fire and Rescue Service said the area around Kirkbymoorside was the worst affected, and many residents were moved to local shelters until situation was under control (BBC News, 2024a).

Spring 2024 – Knaresborough floods: Surface Water Flooding occurred in May 2024, impacting over 50 homes and businesses. Evacuations were required (Your Harrogate, 2024). The return of these floods was reported by NYC as 1 in 516 (source: NYC email communications).

Spring 2024 – Floods/Landslides: Severe floods led to a death of one person in a mudslide in Carlton-in-Cleveland, North Yorkshire in May after the area saw a month's worth of rain in 12 hours (BBC News, 2024b).

Autumn 2024 – Storm Bert: Melting snow coupled with heavy rainfall led to the rise in river levels over a short period of time. Tens of flood warnings were issued for the region. Around 27,000 people in North Yorkshire and County Durham were left without power after a power line went down. Flooding reportedly caused road closures and problems in train transport (The Northern Echo, 2024).

Winter 2023/24 – Extreme rainfall: November 2023 to March 2024 was reported as the wettest period since 1872 for the Ouse River catchment according to the Environment Agency (Rayo, 2024). The City of York faced a challenge in defending itself against a series of winter storms as the river level had not had a chance to return to its normal level between multiple storms.

Boxing Day 2015 Floods:

The Boxing Day floods of 2015 were the highest floods on record on the River Foss and the equal second highest on the River Ouse. The flooding followed an intense period of rainfall across November and December due to the impacts of Storms Desmond and Eva. More than 4,000 homes and 2,000 businesses flooded across Yorkshire with 453 properties and 174 businesses flooded in York (Local Government Association, 2022).

- **Brotherton:** On the 26th of December 2015 14 properties in Brotherton were flooded from surface water after the significant rainfall event on the 25th and 26th December.
- **Harrogate:** On the 26th of December 2015, heavy rainfall following Storm Eva inundated approximately five residential properties in the Greenfields Avenue area of Harrogate.
- **Knaresborough:** Fifteen properties by the River Nidd were flooded to a depth of around 1 metre. A further row of ten properties was also flooded.
- **Sessay:** five properties flooded in the village of Sessay, in mid North Yorkshire.
- **South Craven:** 74 properties reported internal flooding.
- **Tadcaster:** The River Wharfe flowing through Tadcaster exceeded the capacity of the flood defences and spilled over into the streets. In total 79 properties in the area reported internal flooding. The flooding affected residential dwellings, St Mary's Church, commercial properties and the town's health and medical centres. The flooding and subsequent collapse of Tadcaster

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Bridge resulted in the closure of A659 at the bridge, separating the two sides of the town either side of the River Wharfe.

- **Tockwith:** 20 properties reported internal flooding.
- **Whixley:** four properties reported flood damage.
- **York:** On Boxing Day, more than 600 homes and businesses in York were affected when exceptionally high rainfall and river levels led to extensive flooding in the city of York, because of the failure of the Foss Barrier due to flooding of the pumping station (Environment Agency, 2016).

Source: North Yorkshire Council Flood investigation reports (available on NYC website).

Other floods recorded in the region:

- 2019 Upper Dales floods (return period: 1 in 1,000)
- 2017 Scarborough floods (return period: 1 in 100+)

Source: YNYCA communications to ADAS, 2025.

Notes:

- Previous instances of flood events in North Yorkshire and associated investigations by North Yorkshire personnel are available online (North Yorkshire Council, n.d.(b)).

2.2.2 Summary of climate projections in the York and North Yorkshire region

Similarly to the rest of the UK, YNY is projected to experience drier, hotter summers and warmer, wetter winters, exacerbating both droughts and extreme heat in the summer and flood events in the winter. Climate projection data indicates that three key hazards will drive fundamental changes to the future climate of YNY by the 2050s: extreme heat, drought (and resulting wildfires) and flooding as a result of increasing levels of winter rainfall and increasingly intense rainfall events.

Recent record hot summers (such as 2018, 2022 or 2025) will become the new normal summer – regularly stressing domestic agricultural production (Climate Change Committee, 2026). Heatwaves lasting at least a week will be common – posing challenges for keeping vulnerable people sufficiently cool. Heatwaves could regularly approach 40°C in YNY. In York, this will be exacerbated by the urban heat island effect.

Drought and wildfire conditions are expected to increase rapidly; while this is unlikely to affect the urban environment around York itself, it may increase the likelihood and severity of wildfires that occur in the vicinity of the city and which affect its supporting infrastructure (both green and infrastructure), such as the 2025 Strensall Common fire. In the broader North Yorkshire countryside and especially the North York Moors, which are drier than the Dales, wildfire conditions such as those that occurred prior and during the 2025 Langdale Moor Wildfire (the worst recorded in NYC history) could become a regular occurrence without interventions.

Winter rainfall will rise with warming, meaning an average winter could be more like a wet winter today. The intensity of heavy bursts of rainfall throughout the year (not just in winter) could be around 15–60% higher than in the late 20th century – driving more risk of flash flooding and potential risks to life. Storms will have stronger extreme winds and bring more rain, and it is possible that they will be more frequent. This raises their potential to cause damage and disruption to property and infrastructure.

Sea levels on the North Yorkshire coast have already risen approximately 11cm since the 1981 – 2000 period. Under a central 2100 GWL scenario (2.5°C) sea level rise is projected to rise to 26 cm (uncertainty range: 18 to 38cm) in the 2050s and 48cm in the 2090s (uncertainty range: 31 to 74cm).

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The areas at risk of sea-related flooding and coastal erosion are small relative to river and surface water, but the effects on coastal properties (such as those at Filey Cliffs) are severe. Due to the sea level rise, tidal inundation and flooding along the Humber estuary is expected to become more severe, causing tidal influenced flooding along tributary rivers in the region to the south of Selby.

Recent climate change observation data indicates that warming is proceeding faster than many models anticipate; in reality future conditions may therefore be more severe than the data below indicates. For example, the projection data indicates that 'extreme summer days' (daily maximum temperature >35°C) would not occur under a 1.5°C GWL, yet 2022 saw temperatures in excess of this value.

2.2.3 Projections for City of York

Summary of the climate in York

The City of York has a temperate climate with four distinct seasons. As with the rest of the UK, weather can often fluctuate. Due to its location in the north of England, its climate is slightly cooler than the south of the UK (e.g., London) including a greater number of air frost days on average. Between 1991 and 2020 on average the city received 634mm with little seasonal variation). The monthly average maximum temperature between 1991 and 2020 ranged between 7.2°C in January through to an average maximum of 21.4°C in July. Average monthly minimum temperatures in this period ranged between 1.3°C in January and 12.1°C in July (Met Office, n.d.).

The City of York is a relatively small area (271 km^2) and therefore there is little difference in climate between different parts of the jurisdiction.

Temperature changes

An overview of temperature projections for York are provided in Table 4. Source:

Table 4. Temperature projections for City of York. The figures in columns four (1.5°C GWL), five (2.0°C GWL) and six (4.0°C GWL) refer to additional changes on top of the baseline (0.6°C GWL). The

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ranges on the lower row for each metric represents the uncertainty associated with each value (10% and 90& intervals) Source: Met Office Climate Report for York.

TEMPERATURE	0.6°C GWL (baseline 1981 – 2000)	1.0°C GWL (recent past 2001 – 2020)	1.5°C GWL (Present day / Paris Agreement)	2.0°C GWL (prepare)	4.0°C GWL (assess risks)
	°C	°C	°C change	°C change	°C change
	Lower sub-row indicates uncertainty ranges (10th and 90th percentiles)				
Summer maximum temperature	28.6	30.5	+2.7	+3.0	+6.5
	28.2 to 28.9	29.9 to 31.8	+1.3 to +3.8	+2.2 to +5.4	+5.9 to +7.9
Summer average temperature	15.4	16.4	+1.3	+1.9	+4.0
	15.4 to 15.4	16.2 to 16.8	+0.9 to +1.8	+1.3 to +2.4	+3.4 to +4.6
Winter average temperature	4.1	4.7	+1.0	+1.3	+2.7
	4.0 to 4.1	4.3 to 5.4	+0.5 to +1.5	+0.6 to +1.7	+1.7 to +3.3
Winter minimum temperature	-7.5	-5.7	+2.3	+2.7	+4.4
	-7.9 to -7.1	-7.1 to -4.6	+0.9 to +3.3	+2.0 to +4.5	+3.3 to +6.1
Annual average temperature	9.5	10.2	+1.1	+1.6	+3.2
	9.5 to 9.5	10.1 to 10.4	+0.9 to +1.2	+1.2 to +1.8	+2.8 to +3.7

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Precipitation changes

An overview of precipitation projections for York are provided in Table 5.

Table 5. Precipitation projections for City of York. The figures in columns four (1.5°C GWL), five (2.0°C GWL) and six (4.0°C GWL) refer to additional changes on top of the baseline (0.6°C GWL). Source: Met Office Climate Report for York.

PRECIPITATION	0.6°C GWL (baseline 1981 – 2000)	1.0°C GWL (recent past 2001 – 2020)	1.5°C GWL (Present day / Paris Agreement)	2.0°C GWL (prepare)	4.0°C GWL (assess risks)
	mm/day	mm/day	% change	% change	% change
Summer precipitation rate	1.70	1.66	+1	-5	-24
	1.69 to 1.71	1.54 to 1.90	-17 to +11	-20 to +4	-34 to -8
Winter precipitation rate	1.57	1.56	+3	+7	+17
	1.56 to 1.58	1.48 to 1.76	-7 to +15	-5 to +15	-6 to +22

Climate indicators

An overview of climate indicators for York are provided in Table 6.

Table 6. Other climate indicator projections for City of York. The figures in columns four (1.5°C GWL), five (2.0°C GWL) and six (4.0°C GWL) refer to additional changes on top of the baseline (0.6°C GWL. Source: Met Office Climate Report for York.

TEMPERATURE	0.6°C GWL (baseline 1981 – 2000)	1.0°C GWL (recent past 2001 – 2020)	1.5°C GWL (Present day / Paris Agreement)	2.0°C GWL (prepare)	4.0°C GWL (assess risks)
Summer days (daily maximum temperature >25°C)	9	18	21	26	52
	9 to 10	16 to 23	18 to 27	22 to 33	46 to 64
Hot summer days (daily maximum temperature >30°C)	0	2	2	3	13
	0 to 1	1 to 3	1 to 4	2 to 5	10 to 21
Extreme summer days (daily maximum temperature >35°C)	0	0	0	0	2
	0 to 0	0 to 1	0 to 0	0 to 1	1 to 4

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TEMPERATURE	0.6°C GWL (baseline 1981 – 2000)	1.0°C GWL (recent past 2001 – 2020)	1.5°C GWL (Present day / Paris Agreement)	2.0°C GWL (prepare)	4.0°C GWL (assess risks)
Tropical nights (daily minimum temperature >20°C)	0	0	0	0	1
	0 to 0	0 to 0	0 to 0	0 to 0	1 to 1
Frost days (daily minimum temperature <0°C)	49	39	35	27	11
	48 to 50	29 to 45	26 to 39	22 to 39	6 to 21
Icing days (daily maximum temperature <0°C)	1	1	1	0	0
	1 to 2	0 to 2	0 to 1	1 to 1	0 to 0
Growing degree days (daily mean temperature: °C >5.5°C)	1761	1978	2064	2218	2720
	1759 to 1765	1931 to 2069	1988 to 2114	2089 to 2271	2602 to 2863
Heating degree days (daily mean temperature: °C >15.5°C)	2367	2164	2084	1959	1594
	2365 to 2368	2136 to 2202	2052 to 2133	1910 to 2090	1507 to 1711
Cooling degree days (daily mean temperature: °C >22°C)	19	35	41	49	121
	18 to 19	31 to 44	33 to 54	40 to 67	103 to 161
Met Office Fire Danger Days (days per year)	23.01	24.84	31.23	34.93	57.98
	23.01to 23.01	23.90 to 25.62	28.60 to 32.82	30.90 to 36.99	44.38 to 65.56

2.2.4 Projections for North Yorkshire

The climate projections for the whole of North Yorkshire are set out below. Climate projections were also extracted for each of the Protected Landscapes. These are not provided in this report due to similarities with North Yorkshire data, but are provided as a separate output for use in informing adaptation planning within the Protected Landscapes specifically.

Summary of the climate in North Yorkshire

North Yorkshire's climate is temperate with four distinct seasons. However, as the largest county in England that includes a diverse range of geographies the climate differs significantly based on location. For example, Scarborough, located on the eastern coast of England, benefits from a coastal climate

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that includes milder winters and milder summers. However, Malham Tarn, located nearly 100 miles to the west of Scarborough in the Yorkshire Dales National Park, relatively close to the west coast of England, is located in the Pennine uplands and has a significantly different climate. Based on long-term weather averages between 1991 and 2020, Malham Tarn had nearly three times as many air frost days as Scarborough (63.80 air frost days vs 22.53). Conversely, Malham Tarn received approximately 25% less sunshine hours on average annually in this period (1,153.85 hours vs 1,578.82). Average monthly temperatures throughout the year were 1-2°C lower. Malham Tarn received more than twice the amount of rainfall over the year (1,587.36mm annually vs 705.50mm) (Met Office, n.d.).

Temperature changes

An overview of temperature projections for North Yorkshire are provided in Table 7.

Table 7. Temperature projections for North Yorkshire. The figures in columns four (1.5°C GWL), five (2.0°C GWL) and six (4.0°C GWL) refer to additional changes on top of the baseline (0.6°C GWL). Source: Met Office Climate Report for North Yorkshire.

TEMPERATURE	0.6°C GWL (baseline 1981 – 2000)	1.0°C GWL (recent past 2001 – 2020)	1.5°C GWL (Present day / Paris Agreement)	2.0°C GWL (prepare)	4.0°C GWL (assess risks)
	°C	°C	°C change	°C change	°C change
Summer maximum temperature	27.0	28.7	+2.5	+2.8	+6.5
	26.5 to 27.3	28.1 to 30.0	+1.0 to +3.3	+1.9 to +5.0	+5.2 to +8.1
Summer average temperature	14.1	15.1	+1.3	+1.9	+3.9
	14.1 to 14.1	14.8 to 15.5	+0.9 to +1.8	+1.3 to +2.3	+3.4 to +4.5
Winter average temperature	3.3	4.0	+1.0	+1.4	+2.8
	3.3 to 3.3	3.6 to 4.6	+0.6 to +1.4	+0.7 to +1.8	+1.8 to +3.4
Winter minimum temperature	-8.1	-6.3	+2.7	+3.2	+5.7
	-8.3 to -7.8	-7.3 to -5.3	+1.1 to +3.7	+2.4 to +4.6	+4.7 to +7.2
Annual average temperature	8.4	9.2	+1.1	+1.6	+3.2
	8.4 to 8.4	9.1 to 9.4	+0.9 to +1.2	+1.2 to +1.8	+2.8 to +3.6

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Precipitation changes

An overview of precipitation projections for North Yorkshire are provided in Table 8.

Table 8. Precipitation projections for North Yorkshire. The figures in columns four (1.5°C GWL), five (2.0°C GWL) and six (4.0°C GWL) refer to additional changes on top of the baseline (0.6°C GWL). Source: Met Office Climate Report for North Yorkshire.

PRECIPITATION	0.6°C GWL (baseline 1981 – 2000)	1.0°C GWL (recent past 2001 – 2020)	1.5°C GWL (Present day / Paris Agreement)	2.0°C GWL (prepare)	4.0°C GWL (assess risks)
	mm/day	mm/day	% change	% change	% change
Summer precipitation rate	2.16	2.10	+2	-6	-25
	2.15 to 2.18	1.89 to 2.39	-20 to +7	-17 to +4	-35 to -14
Winter precipitation rate	2.86	2.94	+3	+5	+13
	2.85 to 2.86	2.78 to 3.20	-6 to +12	-4 to +12	+6 to +20

Climate indicators

An overview of climate indicators for North Yorkshire are provided in Table 9.

Table 9. Other climate indicator projections for North Yorkshire. The figures in columns four (1.5°C GWL), five (2.0°C GWL) and six (4.0°C GWL) refer to additional changes on top of the baseline (0.6°C GWL). Source: Met Office Climate Report for North Yorkshire.

TEMPERATURE	0.6°C GWL (baseline 1981 – 2000)	1.0°C GWL (recent past 2001 – 2020)	1.5°C GWL (Present day / Paris Agreement)	2.0°C GWL (prepare)	4.0°C GWL (assess risks)
Summer days (daily maximum temperature >25°C)	5	10	12	15	34
	5 to 5	9 to 14	10 to 16	12 to 20	29 to 44
Hot summer days (daily maximum temperature >30°C)	0	1	1	1	7
	0 to 0	1 to 2	1 to 2	1 to 3	5 to 12
Extreme summer days (daily maximum temperature >35°C)	0	0	0	0	1
	0 to 0	0 to 0	0 to 0	0 to 0	0 to 2

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TEMPERATURE	0.6°C GWL (baseline 1981 – 2000)	1.0°C GWL (recent past 2001 – 2020)	1.5°C GWL (Present day / Paris Agreement)	2.0°C GWL (prepare)	4.0°C GWL (assess risks)
Tropical nights (daily minimum temperature >20°C)	0	0	0	0	0
	0 to 0	0 to 0	0 to 0	0 to 0	0 to 1
Frost days (daily minimum temperature <0°C)	61	48	43	35	12
	60 to 62	40 to 54	36 to 50	28 to 48	6 to 25
Icing days (daily maximum temperature <0°C)	3	2	1	1	0
	3 to 4	1 to 3	1 to 2	0 to 2	0 to 0
Growing degree days (daily mean temperature: °C >5.5°C)	1463	1662	1741	1883	2367
	1461 to 1467	1621 to 1753	1678 to 1791	1775 to 1993	2258 to 2498
Heating degree days (daily mean temperature: °C >15.5°C)	2681	2465	2371	2230	1824
	2679 to 2682	2425 to 2497	2333 to 2418	2188 to 2366	1733 to 1942
Cooling degree days (daily mean temperature: °C >22°C)	10	20	23	28	75
	10 to 10	17 to 25	19 to 32	23 to 40	63 to 104
Met Office Fire Danger Days (days per year)	9.46	10.32	13.58	15.49	28.19
	9.46 to 9.46	9.99 to 10.90	11.72 to 14.33	12.73 to 16.72	18.71 to 33.06

2.2.5 Projections applicable to NYC and CYC

Wildfire

Periods of prolonged drought and extreme heat conditions are conducive to the ignition and spread of wildfires. These conditions are expected to become more frequent due to climate change. Figure 7 below indicates the median number of Fire Danger days (i.e., the number of days where weather conditions are conducive to wildfires, as defined by the Met Office) expected per year in a scenario of 4°C GWL by 2100. The projections indicate that the uplands in the Pennines and the North York Moors will experience less days of climate conditions conducive to wildfire danger (as defined by the Met Office) on average than more inland, lower altitude areas like the City of York. However, although the climatic conditions for risk are lower in the moors, the habitat conditions are at far greater risk as

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significant quantities of fuel are available. The likelihood of wildfires arising on those days is therefore greater in the areas of moorland.

North York Moors and the Howardian Hills, in the drier east of YNY, are projected to face higher numbers of wildfire condition days than the Yorkshire Dales and Nidderdale in the wetter uplands in the west.

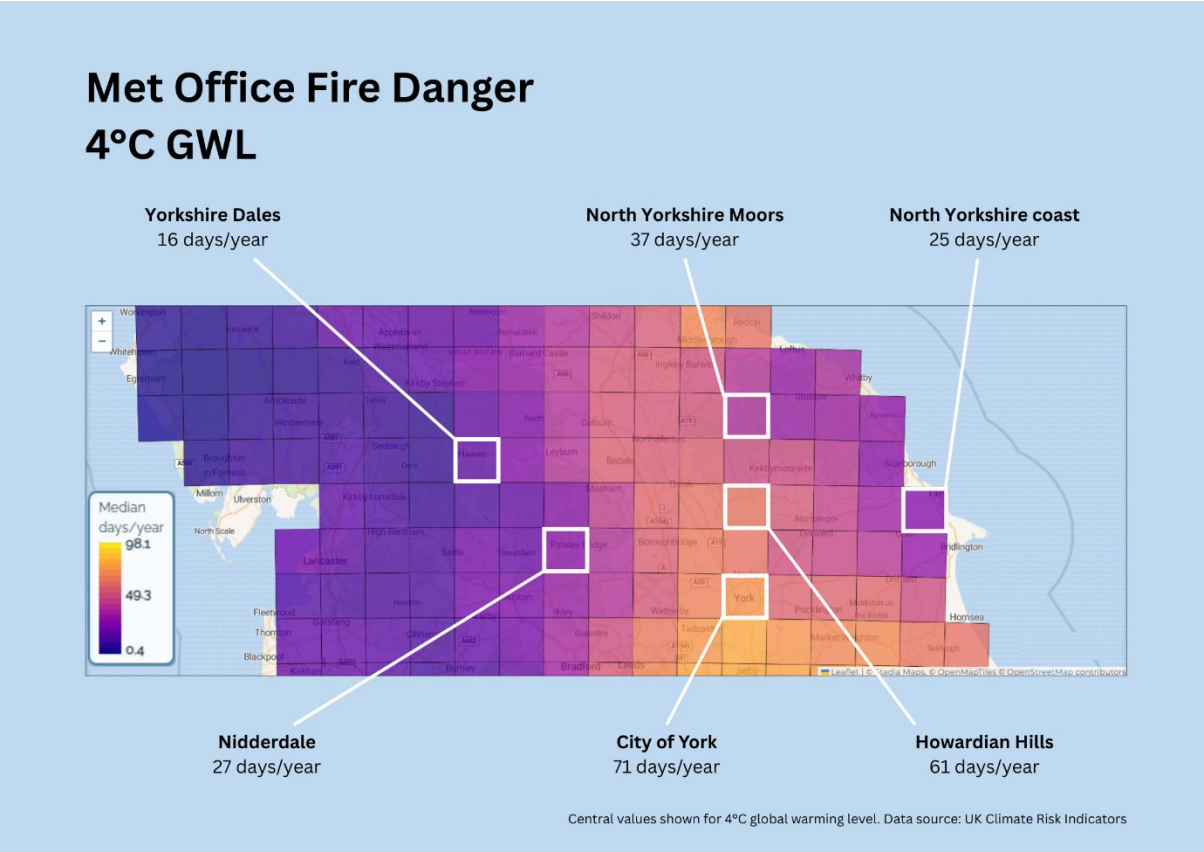

Figure 7. Met Office median 'Fire Danger' days per year projections by climate projection grid square in the YNYCA region under a scenario of 4°C GWL. Source: ADAS, 2025.

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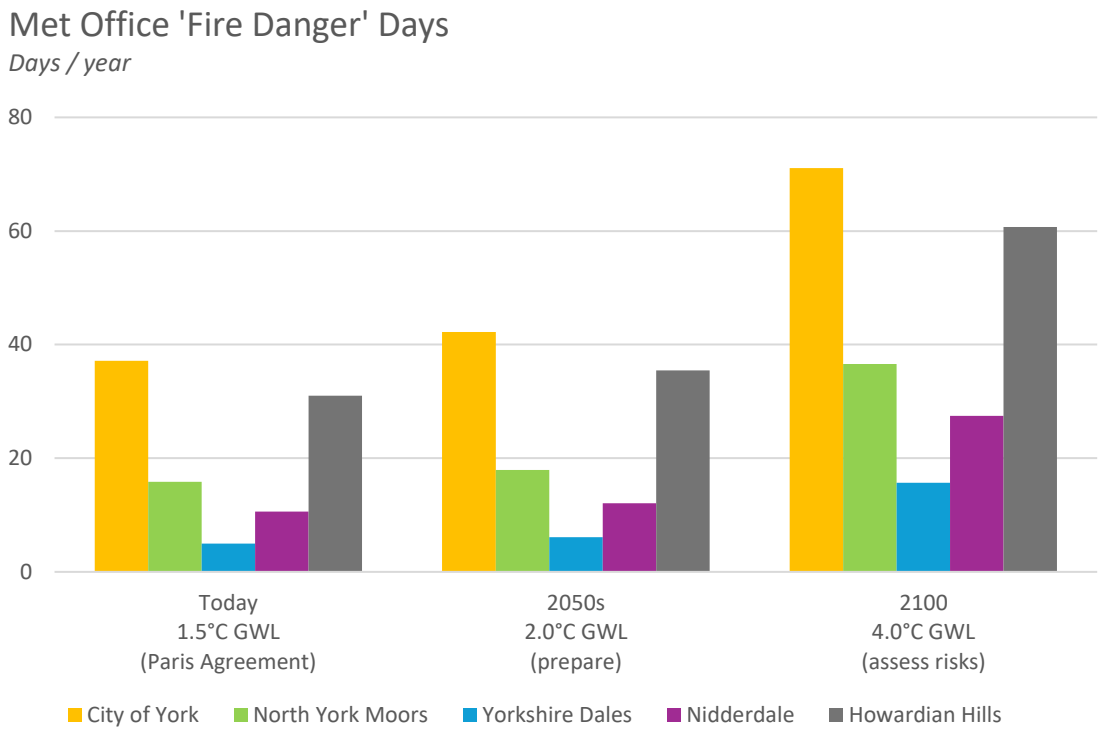

Figure 8 Number of days where 'Fire Danger' days occur, as defined by the Met Office, under different climate change scenarios, including the present day (1.5C Global Warming Level or 'GWL') through to 4C of warming for selected areas within the YNY region. Source: UK Climate Risk Indicators, n.d..

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Sea level rise / Coastal erosion /tidal inundation

Table 10 Sea level anomaly projections (cm) for North Yorkshire relative to the 1981 - 2000 average. Source: Met Office Climate Report for North Yorkshire.

	Sea level anomaly (cm) compared to 1981 - 2000 average										
	Scenario	**Projection**	**2010s**	**2020s**	**2030s**	**2040s**	**2050s**	**2060s**	**2070s**	**2080s**	**2090s**
Sea level rise (UKCP 18)	**RCP2.6 (~1.6°C GWL by 2100)**	*Central projection (median)*	7	11	16	20	24	28	32	36	39
		Uncertainty range (5th to 95th percentiles)	5 to 10	8 to 16	11 to 22	13 to 28	16 to 35	18 to 42	21 to 49	23 to 56	24 to 63
	RCP4.5 (~2.5°C GWL by 2100)	*Central projection (median)*	7	11	16	21	26	32	37	43	48
		Uncertainty range (5th to 95th percentiles)	5 to 10	8 to 16	11 to 22	15 to 30	18 to 38	21 to 47	25 to 56	28 to 65	31 to 74
	RCP8.5 (4°C GWL by 2100)	*Central projection (median)*	8	13	18	24	32	40	49	58	68
		Uncertainty range (5th to 95th percentiles)	6 to 10	9 to 17	13 to 24	17 to 33	22 to 44	27 to 56	33 to 70	39 to 85	45 to 102

The YNY region includes the North Yorkshire coast which is vulnerable to sea level change and coastal erosion and suffers the impacts associated with erosion, such as cliff instability, coastal flooding and land loss. These impacts are often exacerbated by storms and storm surges but generally are chronic impacts happening over a long period of time.

Storms and storms surge

Recent observations show no clear trend in wind or windstorms. The variation in wind speed day-to-day and year-to-year is high, which makes any trend due to climate change in past or future wind speeds difficult to detect. Projections indicate there could be an increase in near surface wind speeds over the UK for the second half of the 21st century for the winter season, as well as an increase in windstorm number and intensity over the UK by the late 21st century. However, the increase in wind speeds is modest compared to interannual variability and inter-model spread. The risk and impacts from storm surges are likely to worsen due to potential changes in the intensity of storms, combined with an increased risk from sea level change.

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2.3 Risks and opportunities to the region

2.3.1 Overview of risks / opportunities

The CCRA identified 113 risks and 21 opportunities across 20 different hazards and four different GWL / time horizon scenarios. These were categorised by the four sectors used within UK CCRA3:

Table 11 Number of risks identified per UK CCRA3 sector

UK CCRA3 Sector	No. Risks identified
Business & industry	20
Health, communities and the built environment	25
Infrastructure	34
Natural environment (incl. farming, fishing, forestry)	34

In the 2030s, with projected GWL of 1.5°C likely to have occurred (Met Office, 2025), 0 risks were scored as Severe (the highest risk scoring within the assessment framework) and 9 were scored as Major (the second highest risk scoring). The CCRA indicates these are the most pressing climate change risks within the YNYCA region for the remainder of the 2020s and 2030s and are detailed below.

In future time horizons, where warming continues to increase (2050s 2.0°C GWL, 2100s 4.0°C GWL) a broad-based shift occurs; whereas just 8% of risks are scored as Major or Severe in the 2030s, in the 2050s 2.0°C GWL scenario this increases to 31%. In the 2100s 4.0°C GWL scenario this increases to 55%. Further detail on this shift is detailed in Table 12 below.

Table 12 Number of climate risks identified during the YNY climate change risk assessment and proportion in each risk rating category, split by climate change scenarios.

	2030s 1.5°C GWL		2050s 2.0°C GWL		2100s 4.0°C GWL	
Risk score	No. risks per category	%	No. risks per category	%	No. risks per category	%
[1] Negligible	15	13%	5	4%	1	1%
[2] Minor	39	35%	28	25%	13	12%
[3] Moderate	50	44%	45	40%	37	33%
[4] Major	9	8%	35	31%	43	38%
[5] Severe	0	0%	0	0%	19	17%

<u>Priority risks (highest rated for the 2030s 1.5 GWL scenario):</u>

Flooding / extreme rainfall

- Risks to business sites from flooding (river, surface water and groundwater)

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- Risks to people, communities and buildings from river flooding, including health and safety risks
- Risks of wastewater/sewer infrastructure flooding, overflow or releases into water courses due to heavy rainfall

General changing climatic conditions - business

- Risks related to finance, investment and insurance for businesses including higher insurance premiums and reduced access to capital for businesses, including businesses relocating to other less risky areas and reduced ability to start businesses in at risk areas.
- Risks to agricultural productivity from extreme events, unpredictable weather and changing climatic conditions such as changing seasonality (primarily water scarcity and extreme / unpredictable rainfall, but also including temperature change, wildfire, flooding, coastal erosion, wind and saline intrusion).

General changing climatic conditions - agriculture

- Risk to soils (including soil health and associated ecosystem services) from changing climatic conditions, including fluctuations between seasonal aridity and wetness resulting in soil loss events like erosion.

Extreme heat and wildfires

- Risks to health and wellbeing from high temperatures including exacerbation of existing health conditions
- Risks of wildfires and destruction of terrestrial habitats including forests, heathland/moors, peatlands and grasslands, where the habitat is difficult to return to its former state.

Cascading

- Risks to transport networks from cascading failure, e.g., wind impact on electricity networks resulting in rail outages and associated negative effects to services / business

Drought / water security

- Risk of reduced public water availability due to drought conditions (lower reservoir levels), creating pressure on supplies (e.g. need for temporary use ban, increased water pricing)

Climate-induced pest and diseases

- Risks to terrestrial species and habitats from pests, pathogens and invasive species, including viral and parasitic diseases, where climate change improves conditions for these to spread and cause damage.

Further breakdown of the risks identified for each sector are provided in the following sections.

Note: the risks and opportunities detailed in this section relate to the Y&NY region and exclude risks that relate to the operations and services provided by the constituent authorities of the YNYCA. Risks relating to the operations / services provided by the constituent authorities of the YNYCA (i.e., 'organisational risks') are detailed in Section 4.1 Organisational Risk Assessment.

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2.3.2 Business & Industry

Risks

The proportion of risks to Business & Industry assigned to each risk rating across the four climate scenarios (2020s, 2050s with 2°C of global warming above pre-industrial levels, 2100s with 2°C and 2100s with 4°C) are shown in Figure 9.

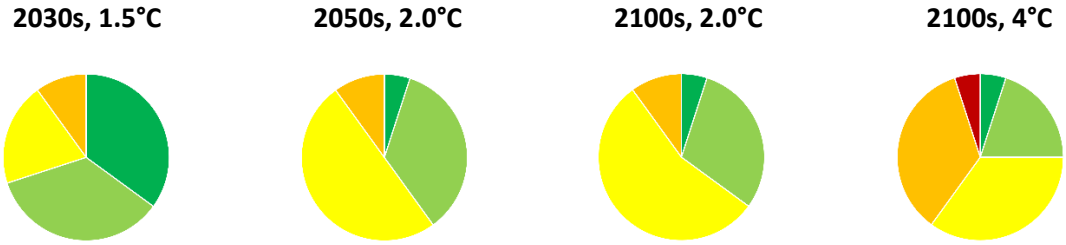

Figure 9. Climate change risks identified during the 2025 YNYCA CCRA relating to the Business & Industry sector, broken down by risk ratings and climate change scenarios. Source: ADAS, 2025.

Key to Figure 22. Proportion of risks to the YNYCA constituent authority organisations for each risk rating across the four climate scenarios. Source: ADAS, 2025.

Colour	Risk scoring level
Dark green	Negligible
Light green	Minor
Yellow	Moderate
Orange	Major
Red	Severe

Key Findings

Flooding of business sites is a critical priority risk to the regional Business & Industry sector grouping. Related to this risk is the potential indirect impact on access to financial services by businesses as a result of escalating climate change impacts. For example, parts of the YNY region may become uninsurable or costly to insure for businesses, reducing their ultimate financial resilience. Risks to tourism activity from climate change impacts also represents a key risk driver for the region, given the importance of this sector to the regional economy. For example, tourist numbers in York decline during minor flood events, even where these do not cause actual damage to the city and tourist infrastructure, while the 2025 Langdale Moor Wildfire caused significant footfall reductions for a range of local businesses. Businesses are also exposed to climate change risks within their supply chains, especially cascading risks arising from within supplying power and digital infrastructure.

Summary for Policymakers

Climate change poses growing risks to the YNY business sector, with flooding representing the most significant threat to business premises, tourism, and local economic activity. This could erode the financial resilience of the region without adaptation, including reduced business rate tax revenue for the local authorities.

- Climate risks to businesses are projected to increase substantially, with most risks rising from Minor/Negligible in the 2030s to Moderate/Major by the 2050s.
- Flooding is the most significant near-term risk, affecting business sites directly and disrupting supply chains, infrastructure and services and causing a range of economic damages.

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Policymakers are recommended to focus preliminary efforts on seeking cost effective flood risk reduction measures (see Section 5 for adaptative actions).

- The tourism sector is highly exposed to climate impacts, particularly in York, Scarborough and the national parks, where flooding, sewage overflows from heavy rainfall, wildfires and resulting negative publicity could reduce visitor numbers. Tailored packages for tourism businesses may be required to maintain sectoral economic resilience.
- SMEs and businesses in climate-risk hotspots face growing financial pressures, including higher insurance costs, reduced access to financial products (including loans and insurance) and slower recovery from extreme weather events. Support may be required to address risk levels in these hotspot areas or initiatives implemented to encourage business activities away from risk areas. Section 3 provides a preliminary analysis of potential climate change risk hotspot areas, though more detailed analysis is also recommended.

By the 2050s, tidal flooding, coastal erosion, extreme heat, drought are expected to intensify, increasing operational costs and constraining economic growth unless adaptation measures are implemented.

Summary

In the nearer term scenario, most risks are rated as Minor or Negligible. However, by the 2050s the majority of risks are rated as moderate or major. Key risk drivers for the 2030s include flooding of businesses sites across all flooding types, impacts to tourism hotspots, cascading risks to businesses from climate impacts to their supply chains and supporting infrastructure (such as data centres) and issues related to finance, investment and insurance for businesses in climate risk hotspots, including higher insurance premiums and reduced access to capital.

Impacts to tourism represent a key risk due to the importance of this sector to local economies in key parts of the YNY region, including York, the coast including Scarborough and the national parks. Heavy rainfall may lead to increased sewage overflow into waters that are popular with tourists, such as those on key rivers or on the coast, including near Scarborough. This may drive away tourists who had been planning to visit the area, reducing footfall for local businesses. Similarly, news reports of flooding incidents in particular areas may also dissuade tourists from visiting. Stakeholders indicated this was a problem for York, even when the floods themselves were not actually causing damage within the city (floods often occur in York with negligible damage occurred, though more significant floods such as Boxing Day 2015 can cause significant economic damages).

Risks to finance, investment and insurance for businesses in climate risk hotspots is more difficult to score accurately, as this is dependent on a range of at highly uncertain factors, including how financial firms respond to the emergency of climate change risk hotspots within the YNY region, i.e., where recurring climate change hazard events result in reduced access to financial products such as insurance for at risk businesses. Hotspots areas were described by stakeholders include Selby and Tadcaster, which are both susceptible to repeat flooding.

Small and medium sized enterprises (SMEs) are already experiencing some disproportionate impacts from climate change due to reduced contingency resources available both to a) reduce extreme weather impacts and b) recover quickly from events once they have occurred. Given the diverse and diffuse nature of SMEs in the YNY region, analysing the aggregate business impacts of climate change is difficult. Further analysis may be warranted to understand how SMEs are being affected.

By the 2050s, with global warming levels likely to reach 2°C, other risks become more severe and are rated as 'Moderate'. Tidal inundation is likely to exacerbate flooding up the Humber Estuary into the tributaries that flow through YNY, such as the Ouse and Wharfe. This is considered a key risk up the River Ouse until Selby; there is tidal influence on the River Ouse to Naburn and on the River Wharfe

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to Tadcaster. Coastal erosion, plus coastal flooding and storms may result in a loss of business locations in coastal areas.

Extreme heat and drought is expected to become a more severe risk by this period, with both tourism and non-tourism businesses potentially facing water restrictions due to hot, dry summers, unless adaptative interventions are taken to secure water supplies. As is being experienced in the south and east of the country currently, mains connections for new residential developments may be prioritised over new commercial developments, limiting local economic growth. Extreme heat may result in increased operational costs by some businesses to cool their facilities, e.g., air conditioning installation and running costs.

Increasingly, intense storm and rainfall events by this juncture may damage wastewater treatment facilities. Water quality reductions may hamper businesses activity for those that require supplies of clean, properly treated water.

The full list of risks and risk rating scores are outlined in **APPENDIX 5 – YNY Regional CCRA Scores**.

Opportunities

Opportunities related to climate change for the Business & Industry sector grouping are scored relatively minor through the 2030s and on the whole are limited relative to the potential risks. By the 2050s, a range of 'Moderate' opportunities may arise, including increased tourism activity during hotter, drier summers (e.g., more people opting to take 'staycations' due to hotter weather). Due to YNY's position in the cooler north of the country, and due to its relative lower population density compared to the south, opportunities may arise for the business sector if climate change effects are more severe in other regions of the UK resulting in businesses viewing the area as a more attractive location, leading to increases in activity. This can be seen in forecasts of economic growth constraints for different regions of the UK as a result of water stress, as discussed in Section 3.3.5.

There may be opportunities for businesses that provide climate resilience related services, such as builders who can complete home adaptation retrofit projects (e.g., installing property flood prevention measures, air conditioning systems and/or heat pumps).

The full list of risks and risk rating scores are outlined in **APPENDIX 5 – YNY Regional CCRA Scores**

2.3.3 Health, Communities and the Built Environment

Risks

The proportion of risks to Health, Communities and the Built Environment sector grouping assigned to each risk rating across the four climate scenarios (2020s, 2050s under 2°C of global warming, 2080s under 2°C and 2080s under 4°C) are shown in Figure 10.

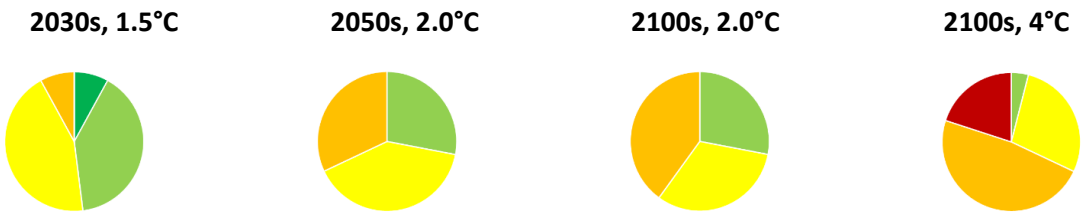

Figure 10. Proportion of risks to health and communities (including the built environment) for each risk rating across the four climate scenarios. Source: ADAS, 2025

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Key to Figure 22. Proportion of risks to the YNYCA constituent authority organisations for each risk rating across the four climate scenarios. Source: ADAS, 2025.

Colour	Risk scoring level
Dark green	Negligible
Light green	Minor
Yellow	Moderate
Orange	Major
Red	Severe

Key Findings

The Health, Communities and the Built Environment sector grouping faces a diverse range of risks in the 2030s, which require priority adaptive responses. The most critical of these relate to potential health and safety impacts from floods and extreme heat. The high cultural value of cultural and historic collections within the YNY region, which face degradation from shifting climate conditions, is also deemed to be a significant risk in the 2030s.

A large number of other risks were rated as *Moderate* for the 2030s, including potential health safety impacts for surface water, groundwater and coastal flooding, including coastal erosion. Climate change is likely to create more challenging conditions for educational services (e.g., heatwaves reducing student health and productivity), while changing weather patterns could disrupt the transport infrastructure and water supplies used by emergency services (e.g., floods could slow ambulance response times, leading to worsened health outcomes and avoidable mortalities).

Summary for policymakers

Climate change is expected to significantly increase risks to health, communities and the built environment in York and North Yorkshire during the 2030s, with several risks becoming more severe by the 2050s.

- Flooding and extreme heat present threats, with both rated as 'Major' risks in the 2030s due to their potential to cause excess deaths and significant disruption to communities. Policymakers are recommended to prioritise measures that reduce exposure and vulnerability to flooding and heat, particularly for vulnerable populations, critical infrastructure and high-risk locations, including care homes. Continued partnership with the Local Resilience Forum on emergency preparedness will be key to managing these risks.
- Historic assets and cultural collections are increasingly vulnerable, as many are housed in ageing buildings that are poorly equipped to withstand flooding, storms, and extreme heat. Policymakers are recommended to explore the retrofit existing buildings or construction of new assets that are resilient to the changing climate, given the significant cultural value of these assets.
- A range of other risks are rated as 'Moderate' for the 2030s, warranting attention by policymakers to understand their likely responsibilities.
- Risks are expected to escalate further by the 2050s, including flooding associated with the Humber Estuary and its tributaries, heat-related health impacts, and damage to green infrastructure.

Summary

Risks to Health, Communities and the Built Environment in the 2030s were rated as more significant than those faced by the Business & Industry sector grouping, with a majority rated as either 'Moderate' or 'Major'. The Major risk levels were driven by the risk of fatalities as a result of either flood events or extreme heat. Projection data indicates that one or more severe flood events could

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occur in the region in the 2030s. While this is subject to high uncertainty, as is the geographic location and spread of the floods, this could feasibly result in multiple fatalities. In recent years, extreme heat events have likely resulted in numerous excess mortalities in the YNY region (see Section 2.2.1. Observed impacts in the region). Given projected changes to the climate for the 2030s, multiple excess mortalities are likely to occur on a regular basis, and this represent a critical risk to manage.

A separate and distinct risk relates to climate change impacts to cultural collections such as those held by institutions making up the York Museums Trust. YNY stakeholders indicate that these are held in inadequate facilities, such as older buildings that are not resilient to extreme weather events; for example, they may have leaky rooves and windows, poor insulation, limited to non-existent humidity controls and no features to prevent flooding. As a result, stored collections are being damaged by increasingly extreme weather events. This risk emerged as a priority due to the high cultural and non-financial value of these collections.

A large number of other risks were rated as *Moderate* for the 2030s, including potential health safety impacts for surface water, groundwater and coastal flooding, including coastal erosion. As well as cultural collections, the risks to historic buildings themselves from extreme weather and climate change is also of concern; historic buildings may for example be damaged by increasingly intense rainfall and storm events and extremely hot, dry periods in the summer. Climate change is likely to create more challenging conditions for educational services (e.g., heatwaves reducing student health and productivity), while changing weather patterns could disrupt the transport infrastructure and water supplies used by emergency services (e.g., floods could slow ambulance response times, leading to worsened health outcomes and avoidable mortalities).

International climate change impacts to agriculture also pose a risk to health and communities in YNY. The UK is reliant on imports for 38% of its food supply (Defra, 2024). Key international commodities are already suffering due to climate change impacts. Where this coincides with negative impacts to the UK's agriculture sector, food security could be weakened and food prices may spike, reducing access to healthy food for YNY residents.

Diseases borne by vectors whose spread is enabled or enhanced by changing climate change conditions, were scored as a *Moderate* risk for the 2030s. However, determining the exact influence climate change has on the spread of these vectors is complex and this will be influenced by a range of other factors, including artificial pathways for spreading such as trade and air travel.

In the 2050s, most of the above mentioned risks escalate in severity. Safety issues resulting from tidal inundation along the Humber Estuary and affecting its tributaries in YNY may increase, while a range of climate change impacts could damage green infrastructure in both urban and rural areas. If this affects resident usage, it could reduce the associated nature-related health benefits. Attempts to pursue adaptation measures may have unintended consequences including negative impact on historic and cultural structures. For example, natural flood management could include the creation of wetlands in certain areas, which could damage historic buildings. This includes archaeological sites, including those not yet known to archaeologists.

By the 2050s, international migration into the UK as a result of climate effects and/or resulting conflicts may cause social disruptions in the YNY, though this is subject to significant uncertainty. For example, there may be increased criminal activity by refugee groups especially if they become deprived or are not well integrated into social systems. Anti-refugee behaviour may similarly cause negative effects, such as increased hate crime placing increased demands on police services. The degree to which climate change will fuel refugee movement into the UK and YNY is uncertain and depends on a broad range of as yet unknown socioeconomic conditions.

The full list of risks and risk rating scores are outlined in **APPENDIX 5 – YNY Regional CCRA Scores**.

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Opportunities

Opportunities related to Health, Communities and the Built Environment from a changing climate are limited. Winters are already milder than the 20th Century and are projected to become milder, leading to reduced health impacts from cold weather. However, NHS climate modelling indicates that future reductions in cold-related fatality events due to milder winters will be outweighed by increases in heat stress-related deaths (UK Health Security Agency, 2023). There may be some opportunities for water treatment and so water quality from changing rainfall patterns and temperatures.

The full list of opportunities and opportunity rating scores are outlined in **APPENDIX 5 – YNY Regional CCRA Scores**.

2.3.4 Infrastructure (including energy, water, transport and digital)

Risks

The proportion of risks to health and communities (including the built environment) assigned to each risk rating across the four climate scenarios (2020s, 2050s under 2°C of global warming, 2080s under 2°C and 2080s under 4°C) are shown in Figure 11..

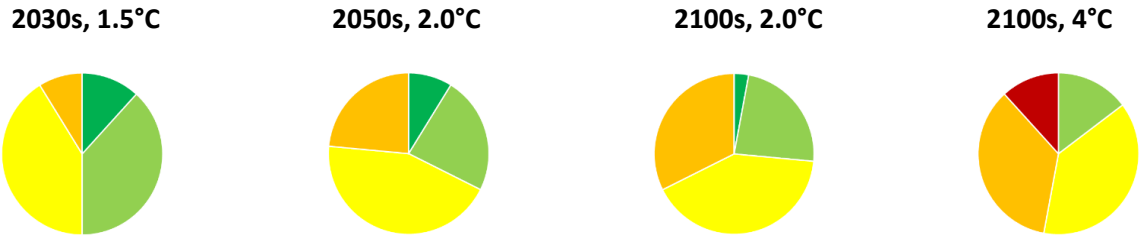

Figure 11. Proportion of risks to infrastructure for each risk rating across the four climate scenarios. Source: ADAS, 2025

Key to Figure 22. Proportion of risks to the YNYCA constituent authority organisations for each risk rating across the four climate scenarios. Source: ADAS, 2025.

Colour	Risk scoring level
Dark green	Negligible
Light green	Minor
Yellow	Moderate
Orange	Major
Red	Severe

Key Findings

Excluding the built environment and council-managed roads the infrastructure located in YNY is typically managed by large regional or national organisations that have their own climate change risk management programmes in place and are subject to statutory risk and emergency planning requirements. Statutory responsibilities will in some or many cases limit the ability of YNY to pursue interventions within these infrastructure systems. The Infrastructure CCRA section should serve as a tool to support engagement with these regional partners to understand how the identified risks can be suitably managed by the relevant responsible bodies and whether there is scope for collaboration with regional partners, such as the YNY authorities, on integrated resilience planning. This could include, for example, developing contingency planning for particular areas at risk from Infrastructure

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vulnerabilities and / or co-investment in natural flood management to protect certain elements of exposed infrastructure.

Summary for Policymakers

Climate change is expected to place growing pressure on critical infrastructure systems, with water, energy, transport and digital networks facing increasing disruption and interconnected risks.

- Water supply and wastewater systems face the most immediate risks from drought, rising demand and sewer overflows. Local authorities, as a risk management authority for flooding, are recommended to work closely with Yorkshire water regarding water infrastructure to help address these growing pressures.
- Infrastructure interdependencies increase vulnerability, with failures in one system likely to cascade across others. At present, power systems represent a critical dependency for most operational processes. Each system is managed by a particular entity or utility and the YNY authorities are recommended to continue engagement with these partners to ensure that material dependencies are suitably managed.
- Energy networks are increasingly exposed to extreme weather, capacity constraints and rising demand. Climate risks and vulnerabilities should therefore be integrated into Local Area Energy Plans and spatial development strategies.
- Digital infrastructure faces growing disruption from flooding, heat and storms. Regional organisations could review their current operations and critical dependencies on ICT systems.
- Many infrastructure risks intensify beyond the 2030s, highlighting the need for long-term adaptation and resilience planning. Policy makers are recommended to consider climate risks within their current and future infrastructure investments to help mitigate future vulnerabilities are future costs.

Summary

A large number of Infrastructure risks (50%) are already rated as 'Moderate' or higher levels in the 2030s, with a subset escalating rapidly to major or severe levels thereafter. The pattern is one of intensifying system-wide vulnerability, driven both by the increasing severity of climate hazards and by the growing interconnection of infrastructure systems.

The most acute risks in the 2030s are those already rated major or at least firmly moderate and on a steep upward trajectory. Water availability stands out as one of the highest and most immediate concerns. The risk of reduced public water availability due to drought is already rated major in the 2030s and remains so under higher warming scenarios, reaching severe levels in the most extreme future pathway. This reflects a well-established shift in UK climate patterns toward hotter, drier summers, which reduces reservoir recharge and base river flows while increasing evaporation. At the same time, demand pressures grow, as indicated by the parallel risk of increased customer demand for water during hot, dry periods, which also rises to major in the 2030s and becomes severe later in the century. The combination of reduced supply and increased demand creates a compounding pressure that is difficult to manage through incremental adaptation alone.

Private water supplies (i.e., houses that source their water from wells and do not utilise mains) were considered as part of this assessment (see Section 3.3.5). There are at least 2,576 private water supplies across the region, each likely supplying more than one household. At this juncture drought risks to these supplies are not considered a priority risk, though this is subject to uncertainty and analytical complexity, given the large number of supply locations and their heterogenous context.

Alongside these water resource pressures, risks associated with wastewater systems are also already high in the near term. The risk of sewer flooding and overflow driven by heavy rainfall is rated major

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from the 2030s onwards and remains persistently high across all scenarios. This reflects the intensification of short-duration rainfall events, which are increasingly overwhelming drainage and wastewater systems that were not designed for such extremes. The persistence of this rating reflects the insufficiency of current infrastructure capacity and adaptation measures to offset the increasing hazard. Water pollution may also increase during drought as there is less water to dilute pollutants, damaging ecosystems.

Interdependencies between infrastructure systems are another area of high concern early in the period. Risks from cascading failures are already rated moderate to major across energy, ICT, and transport systems in the 2030s, and rise to major or severe levels over time. For example, cascading failures in gas and electricity networks move from moderate to major, while ICT systems reach severe risk levels by the end of the century. Similarly, transport networks are already assessed as major risk in the 2030s and become severe under higher warming. This reflects the increasing likelihood that climate hazards—particularly storms, flooding, and heat—will not act in isolation but will trigger knock-on disruptions across interconnected systems. As infrastructure becomes more complex and reliant on digital connectivity, the potential for widespread disruption grows, especially if digital infrastructure is impacted.

During the Infrastructure risk validation workshop, it was noted that digital infrastructure and the risks posed to it from climate change is complex. Some organisations have their own data centres, while many rely on cloud services from data centres managed by third parties and located outside of the region and in some cases internationally. Digital connectivity cables are typically run adjacent to transport networks such as roads and bridges, which can be disrupted and/or knocked out by floods.

Energy system risks show a similar trajectory, though with a more pronounced escalation over time. Electricity supply disruptions from significant infrastructure damage (which includes renewable energy infrastructure) are already moderate in the 2030s and become major thereafter. The renewable energy sector is growing in the region, and efforts will therefore be required to ensure that new assets are not sited in areas at risk of key climate hazards, such as flooding. This could be achieved within the YNYCA's ongoing development of its Spatial Development Strategy.

Temporary outages due to extreme weather follow a similar pattern, increasing to major under higher warming. These trends are consistent with increasing exposure to extreme weather events, including more intense storms and flooding, as well as rising temperatures that can degrade the performance of generation and transmission assets. The emergence of demand-related risks later in the century—where hot weather drives increased electricity use at the same time as system capacity is reduced—illustrates how climate change introduces new forms of stress that current systems are not designed to accommodate.

In 2026, the Climate Change Committee's CCRA4 assessment indicated that cascading risks resulting from impacts to the UK electricity system are the most relevant to the UK, due to the national power system being a key dependency for a large number of other sectors (Climate Change Committee, 2026). When assessing cascading risks and potential adaptative responses, power systems should therefore be prioritised.

Transport infrastructure risks are also consistently moderate or higher throughout the period, with many reaching major levels beyond the 2030s. Temporary disruptions from extreme weather are already moderate and become major under more severe climate scenarios, while longer-term damage to both major roads and rail infrastructure follows a similar trajectory. These risks are driven by a combination of increased flooding, landslides, and heat impacts, such as rail track buckling and road surface degradation. The fact that cascading risks to transport are among the highest in the dataset reinforces the importance of interdependencies, particularly with the energy system, where power outages can directly disrupt rail services.

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ICT and communications infrastructure follows a comparable pattern, with both temporary and longer-term disruptions rated moderate in the 2030s but increasing significantly over time. The risk of cascading failures in ICT systems becomes particularly severe, reflecting the growing reliance of all other infrastructure sectors on digital connectivity. Climate hazards such as flooding and heat can directly affect physical assets such as data centres and cabling, while also indirectly affecting services through power supply disruptions.

A number of risks are scored as moderate in the 2030s but show steadier escalations thereafter, indicating areas where impacts are likely to become more pronounced over time. These include risks to offshore infrastructure from storms and high waves, and to coastal adaptation infrastructure from flooding and erosion, both of which reflect the effects of sea level rise combined with more energetic storm conditions. Similarly, subsidence risks increase as hotter, drier summers lead to greater soil shrinkage, affecting both surface and underground assets.

The full list of risks and risk rating scores are outlined in **APPENDIX 5 – YNY Regional CCRA Scores**.

Opportunities

The analysis did not identify climate-related opportunities for the Infrastructure sector during the CCRA process.

2.3.5 Natural environment (including agriculture, forestry and fisheries)

Risks

The proportion of risks to natural environment (including agriculture, forestry and fisheries) assigned to each risk rating across the four climate scenarios (2020s, 2050s under 2°C of global warming, 2080s under 2°C and 2080s under 4°C) are shown in Figure 12.

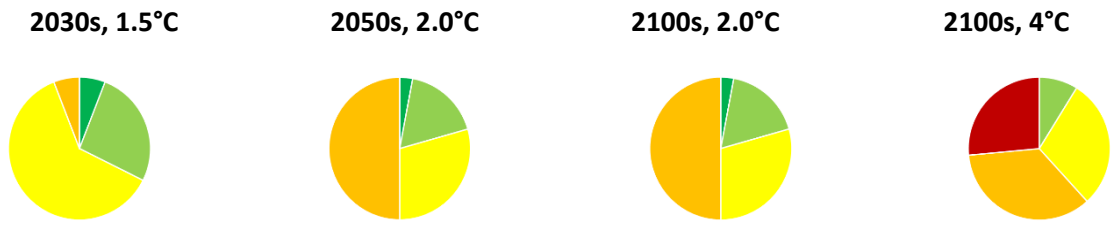

Figure 12. Proportion of risks to the natural environment (including farming, fishing, forestry) for each risk rating across the four climate scenarios. Source: ADAS, 2025

Key to Figure 22. Proportion of risks to the YNYCA constituent authority organisations for each risk rating across the four climate scenarios. Source: ADAS, 2025.

Colour	Risk scoring level
Dark green	Negligible
Light green	Minor
Yellow	Moderate
Orange	Major
Red	Severe

Key Findings

The Natural Environment and Assets sector grouping emerged as the most exposed to climate change risks during the YNY CCRA, facing both the joint highest number of risks across sector groupings and the most severely scored risks overall. This is likely to reflect an inherent vulnerability of agriculture

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and ecosystems to the effects of climate change relative to other sectors but may also reflect the fact that sectoral stakeholders are relatively knowledgeable of environmental risks and therefore score them higher than other stakeholder groups.

In line with the framing of the Climate Change Committee's CCRA4 (Climate Change Committee, 2026), the evidence suggests a widening gap between current levels of adaptation and the scale of the environmental risks faced in the YNY region. The UK is already considered a nature depleted country, with most ecosystems in a state of degradation due to a range of human activities. Climate change is emerging as a compounding risk to many of these existing ecosystem issues, for example, creating additional climate stressors for pollinator populations that have already been reduced by intensive farming techniques and habitat conversion .

Many of the most significant risks—particularly those relating to soils, water availability, ecosystem health, and biological threats—are already scored as material by the 2030s and are projected to intensify substantially thereafter. Without more ambitious and systemic adaptation measures, including landscape-scale restoration, improved water management, and stronger biosecurity, the natural environment is likely to experience increasingly severe and potentially irreversible impacts over the course of the century.

Summary for Policymakers

YNY is a region rich in natural assets and the YNY CCRA showcases many severe risks that the region is likely to face in the coming decades.

- There are escalating risks from pests, pathogens and invasive species that threaten terrestrial habitats, agriculture, forestry and freshwater ecosystems. Affected farmers and organisations may require local government support in their response.
- Wildfire risk is expected to increase significantly, particularly across heathlands, peatlands and forests, as hotter and drier conditions increase fuel aridity and reduce ecosystem recovery potential. This risk can cascade through to other sectors, such as tourism businesses affected by wildfires in popular tourist areas. Policymakers are encouraged to plan for the growing risk of wildfires across the region.
- Soil degradation, loss of natural carbon stores and increasing environmental drought are emerging as critical systemic risks, driven by more variable rainfall, prolonged dry periods and rising temperatures. This may disrupt policymaker plans to sequester carbon across the region, if not addressed.
- Water scarcity and environmental drought are becoming major drivers of ecosystem risk, with reduced summer rainfall, higher evapotranspiration and more frequent extreme weather placing increasing pressure on biodiversity, forestry and agriculture. Policymakers are encouraged to look to improve drought resilience of green infrastructure and encourage relevant entities to plan to protect ecosystems and forestry assets that are vulnerable to prolonged dry conditions.

Summary

The CCRA shows a clear and consistent pattern of escalating risk across the natural environment, with a number of categories already rated moderate or major in the 2030s and several progressing to severe levels by the end of the century. The trajectory is one of increasing systemic stress across ecosystems, reflecting both the direct impacts of climate change and the growing interaction between multiple environmental pressures.

Risks to terrestrial habitats from pests, pathogens and invasive species stand out as both immediate and severe in the longer term, remaining major across most scenarios and becoming severe under

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higher warming. This reflects the strong influence of rising temperatures and milder winters in the UK, which create more favourable conditions for the spread and survival of pests and diseases that were previously constrained by colder climates. The same underlying driver is evident in risks to agriculture, forestry and freshwater systems, where pest and pathogen pressures steadily increase and reach severe levels. The speed of climatic change is likely to outpace the ability of species and land management systems to adapt, leading to increasing mortality, reduced productivity, and long-term shifts in ecosystem composition.

Soil-related risks are also among the most significant in the near term. The risk to soils from changing climatic conditions is already rated major in the 2030s and escalates to severe later in the century. This reflects the increasing variability in precipitation, with more intense rainfall events driving erosion, alongside longer dry periods that reduce soil cohesion and increase susceptibility to degradation. These processes not only reduce soil health and agricultural productivity but also undermine wider ecosystem services, including water regulation and carbon storage. Closely linked to this, risks to natural carbon stores such as peatlands are moderate in the 2030s but become major and then severe, indicating the potential for substantial carbon release as soils dry out and degrade under warmer and drier conditions.

Water scarcity emerges as another critical driver of risk across terrestrial systems. Environmental drought is already assessed as moderate in the 2030s and rises to major and severe levels thereafter. This is consistent with projected reductions in summer rainfall and increased evapotranspiration, which collectively place sustained pressure on habitats that are not adapted to prolonged dry conditions. Furthermore, in drought conditions declining river and water levels mean there is less volume to dilute pollution that enters the system, causing additional ecosystem damages. These pressures are reflected across multiple categories, including risks to biodiversity, forestry productivity, and agricultural systems. In each case, the transition from moderate to major risk underscores the compounding effect of reduced water availability combined with increasing temperatures and more frequent extreme events.

Wildfire risk is also shown to be a significantly risk. This is initially a major risk in the 2030s, reflecting severe wildfires that are already burning thousands of acres of habitat per year, such as the 2025 Langdale Moor Wildfire. It later becomes a severe risk at the end of the century, reflecting the increasing likelihood of hotter, drier summers that increase fuel aridity across landscapes such as heathlands, peatlands and forests. The concern here is not only the immediate loss of habitat, but also the difficulty of recovery, particularly in sensitive ecosystems such as peatlands where fire can lead to long-term degradation and loss of carbon storage capacity.

Freshwater, coastal and marine environments show a similar trajectory of increasing risk. Freshwater habitats are already under moderate pressure in the 2030s from rising temperatures and changing hydrology, with risks increasing further due to water quality issues and the growing impact of combined sewer overflows during heavy rainfall events. The persistence of major risk ratings in these areas reflects the interaction between climatic drivers and existing infrastructure limitations. Coastal and marine systems are projected to experience some of the most severe long-term impacts, with risks to coastal habitats and marine species increasing from moderate in the 2030s to severe later in the century. Sea level rise, coastal erosion, ocean warming and acidification all contribute to these trends, alongside emerging hazards such as marine heatwaves, which are already being observed in UK waters.

The CCRA also highlights the increasing fragmentation and redistribution of species and habitats. Risks associated with changing species distributions and the inability of ecosystems to adapt quickly enough remain moderate but persistent, indicating a chronic and widespread pressure. Over time, these processes are likely to reduce biodiversity resilience and ecosystem coherence, particularly where habitats are already fragmented or degraded.

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Agricultural systems are shown to be particularly vulnerable, with risks to productivity already major in the 2030s and becoming severe under higher warming scenarios. This reflects the combined effects of water scarcity, extreme weather, soil degradation, and biological pressures from pests and diseases. While some risks such as river flooding of agricultural land remain relatively lower in the near term (due to the ability of agricultural land to recover from temporary flood events), they increase over time, illustrating the broadening range of climate impacts affecting food production systems.

Across the CCRA, there is also clear evidence of interdependencies amplifying risk. Water scarcity, for example, not only affects habitats directly but also interacts with infrastructure and agricultural systems. In droughts, Yorkshire Water and other users are more likely to abstract water from ecosystems, further intensifying water scarcity within freshwater ecosystems. While wastewater overflows contribute to declining water quality and ecosystem health. Similarly, urban trees and green spaces, which provide important cooling and wellbeing benefits, face increasing risk from heat and extreme weather, with implications extending beyond the natural environment into public health and urban resilience.

The overall pattern is one of steadily increasing risk across nearly all categories, with very few areas showing stability or reduction. The dominant drivers are rising temperatures, altered rainfall patterns, and the increasing frequency of extreme events, all of which are consistent with observed and projected climate trends in the UK. These climatic changes are interacting with existing environmental pressures, including land use change, habitat fragmentation, and biodiversity loss, resulting in a compounding effect that accelerates the transition from moderate to major and severe risks.

The full list of risks and risk rating scores are outlined in **APPENDIX 5 – YNY Regional CCRA Scores**.

Opportunities

The CCRA indicates that, in the 2030s, the most material opportunities for the natural environment are already assessed as moderate in scale for several sectors, particularly agriculture, forestry, land use diversification, and woodland expansion. Across these areas, the underlying driver of increasing opportunity is the progressive shift in the UK's climatic envelope, notably rising average temperatures, milder winters, and longer growing seasons. These changes are expected to enhance biological productivity, extend the viability of certain crops, and reduce cold-related constraints that have historically limited output.

Opportunities for agricultural productivity are consistently rated as moderate in the 2030s and remain so through the mid-century period, rising to major under higher warming scenarios by the 2080s. This reflects the increasing influence of warmer temperatures and elevated atmospheric CO_2 concentrations, which can stimulate crop growth and extend the growing season. In northern regions in particular, these changes may enable the cultivation of new crop varieties and increase yields for existing systems. The escalation of opportunity towards the 2080s is driven by the continuation of these trends, although it implicitly assumes that limiting factors such as water availability, soil health and extreme weather risks are effectively managed. Without such management, the theoretical productivity gains may not be fully or even partially realised.

Similarly, opportunities to diversify the agricultural economy are rated as moderate in the near term but increase to major by the end of the century under higher emissions scenarios. This reflects the increasing climatic suitability for a broader range of land uses, including new crops, agroforestry systems, and alternative land-based enterprises. As climate zones shift northwards, land managers may be able to respond to changing conditions by adopting more varied and resilient business models. The growing magnitude of this opportunity over time is closely linked to both market responses and the adaptive capacity of the sector, particularly the ability to invest in new skills, infrastructure and supply chains.

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Forestry productivity and woodland expansion are also identified as moderate opportunities from the 2030s onwards. Warmer temperatures and longer growing seasons are expected to enhance tree growth rates, particularly in areas that are currently temperature limited. This creates favourable conditions for increasing timber yields and expanding woodland cover. These opportunities remain consistently moderate across future periods, suggesting that while climatic conditions become more favourable, there are also constraints—such as pest and disease pressures, water stress, and the availability of suitable land—that may limit further escalation. Nonetheless, the relatively stable rating reflects a balance between improved growth conditions and increasing ecological risks. Again, it is worth noting that the potential risks to forests are likely to outweigh the opportunities.

In addition to these land-based sectors, there is a moderate opportunity emerging by the 2050s and beyond for terrestrial habitats through the colonisation of new species. While this is not a dominant feature of the 2030s, it becomes more significant as temperatures rise further. The gradual poleward movement of species ranges is expected to introduce new assemblages of flora and fauna, potentially enhancing biodiversity in some contexts. However, the delayed emergence of this opportunity reflects the time required for species migration and ecosystem adjustment, as well as the increasing likelihood of ecological disruption. This is a highly uncertain opportunity, the effects of which may be distorted or reduced by interactions between new species and existing species.

Across these areas, the increasing scale of opportunity over time is closely tied to the trajectory of climate change itself. Rising temperatures, changing precipitation patterns, and elevated CO_2 concentrations could theoretically all contribute to enhanced biological productivity and altered ecological conditions. However, these opportunities are contingent on effective adaptation. Without appropriate management of water resources, soils, pests and extreme weather risks, the benefits identified in the CCRA may be constrained or offset. As such, the progression from moderate to more substantial opportunity in later decades is not automatic, but dependent on the extent to which adaptation measures are implemented to enable the natural environment to respond positively to a changing climate.

The full list of opportunities and opportunity rating scores are outlined in **APPENDIX 5 – YNY Regional CCRA Scores**.

2.3.6 Interdependencies, compound and cascading risks

Climate change risks and opportunities are frequently related to, and interact with, one another. There are also often important interrelations between climate change risks and nature risks. For example, extreme precipitation influenced by climate change can overwhelm storm drainage and sewage systems resulting in heightened pollution in river systems. This can result in both damages to river ecosystems but also reduced water quality for human users including water utilities and commercial entities, requiring additional cost to remediate. Poor water quality can also negatively impact leisure uses of water bodies and coastal waters, in turn impacting associated tourism enterprises.

Infrastructure assets and economic sectors are also often highly interdependent (C40, 2022). For example, most sectors rely on functioning energy utilities to provide electricity and fuels such as natural gas. Critical digital infrastructure like data centres rely on significant supplies of electricity (BBC News, 2024c); in turn, power plants are increasingly connected to and reliant on the internet (Eurelectric, 2025).

Potential risks that may cascade through systems to produce amplified or unusual effects are inherently complex. As a result, these risks are difficult to measure and difficult to manage. Proper management of these risks in the YNY region will therefore require cross-sector collaboration and adaptive governance that is shared between different infrastructure managers and associated partners to manage systemic risks

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A range of interdependencies were identified during the YNYCA CCRA process, including the validation workshops, which are described in **Table 13** below.

Key term definitions are provided below:

Risk interdependency: the connections and links that can exist between risks that influence their overall impact in terms of either magnitude and / or likelihood (Sustainability Directory, 2024).

Infrastructure / sectoral interdependencies refers to situations where certain types of infrastructure / sectors are dependent on other types of infrastructure / assets / sectors to continue to function properly (C40, 2022). An example is rail infrastructure, which is reliant on the power sector to function.

Compound climate change risks: situations where a combination of multiple climate-related drivers and/or hazards contribute to overall risk, often causing higher damages than if a single hazard had occurred (Simpson et al., 2023) (Zscheischler et al., 2018). An example could include increasing sea levels that erode the coast and sea defences, combined with a storm surge whose magnitude has been exacerbated by climate change, together resulting in increased damages to coastal communities.

Cascading climate change risks: where an adverse climatic impact or trend triggers a set of risks. Risk cascades can occur through a unilinear chain – i.e., a 'domino' effect. They can also reinforce the original hazard impact (Kemp, 2021). An example could include drought and heatwaves which reduce crop yields, resulting in increased food prices and, due to these high prices, social unrest. Heatwaves and water stress can also result in increased water use by households and businesses (e.g., to water gardens given the lack of rain, extra crop irrigation), further exacerbating water stress.

Table 13 Identified interdependencies, cascading and compound risks

At risk asset / element	Interdependency	Risk factors	Risk mitigatory factors	Actions / recommendations
All sectors and social groups	Food production sector	• Extreme weather (e.g., extreme precipitation and drought, as seen in 2024 vs 2025 respectively in the UK) can reduce crop yields and livestock productivity, both domestically in the UK and globally.	• The UK is a food secure country and has access to global food supply chains, helping to partially mitigate the risk – though global climate impacts could constrain both domestic and international production.	• Pursue climate risk and adaptation upskilling for YNY farmers.
Transport, power, healthcare, agriculture, industry, other services, most business sectors	Dependent on: **internet infrastructure** and associated services, namely **data centres**.	• Data centres can be negatively impacted by a range of extreme weather events. • Location of data centres can be privately held due to security concerns; efforts to understand site level adaptation measures can be constrained.	• The majority of data centre capacity for data used in the YNYCA region is unlikely to be located in the region and potentially not even the UK. Data centres are often operated by large multinational corporations which claim well-developed risk management procedures. • It is standard practice for data centre operators to maintain availability, resilience and reliability to maintain commercial relationships. • Data centres that service government entities are required to maintain high levels of resilience and availability. • In 2024, the UK government designated data centres as Critical National Infrastructure, providing national level protections.	• None identified.

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At risk asset / element	Interdependency	Risk factors	Risk mitigatory factors	Actions / recommendations
Transport, power, healthcare, agriculture, industry, other services, most business sectors	Dependent on: **internet infrastructure** and associated services, namely **connective cabling** that runs underground.	• This cabling is often buried alongside road transport infrastructure. • Cabling will be integrated into bridges; previously, floods that have destroyed bridges in the YNYCA region have also disrupted cabling.	• None identified.	• Engage with telecommunications companies to understand the location of connectivity cabling and understand locational flood risk.
Transport, healthcare, agriculture, industry, other services, all business sectors	Dependent on: **power infrastructure**	• Power infrastructure can be affected by a range of extreme weather events including flooding, heatwaves, drought and storms. • This applies to both power plants, decentralised renewable power systems and connectivity infrastructure (e.g., power lines). • A common contemporary extreme weather risk is 'windthrow' where storms knock over trees and disrupt power supply lines.	• National grid is considered Critical National Infrastructure by UK government, providing national level protections. • The grid is an integrated, nationally managed system, managed by the National Energy System Operator (NESO). • The grid is closely managed to maintain power supply in the event of disruption. Therefore, any power disruption in the YNY area would likely only be temporary in nature.	• Improve understanding of effects from a potential disruption to a key power asset in the area, such as the Drax power station, for an extended period. • Engage with power companies and grid operators to ensure larger risks, such as cascading risks, are fully understood.
Freshwater ecosystems and natural environment	Dependent on: **drainage and sewage infrastructure** that does not release damaging pollutants.	• Quality of sea water decreases after heavy rainfall events and release of sewage. • Drainage and sewage systems are often not suitable for excess water, leading to overflows and ecological damages.	• A roadmap to improve performance in the water sector, including with respect to pollution incidents, was released in 2025 (Independent Water Commission, 2025). • However, the future efficacy of this roadmap in reducing pollution incidents is at present unknown.	• Continue to monitor water utility pollution performance. • Work with stakeholders to identify alternative solutions where possible (e.g., nature-based solutions for water treatment and water management).
Tourism sector	Dependent on: **drainage and sewage infrastructure** that does not release damaging pollutants.	• Sewage overflows following severe precipitation events can impact bathing water quality in both rivers and seas. • This can lead to negative press and result in reduced seaside tourism, causing economic damages to dependent businesses and communities.	• See response to line item above.	• See response to line item above.
Business / employee productivity	Dependent on: **range of infrastructure / service types**, including transport, healthcare, built environment	• Employee productivity is influenced by a range of dependencies, including transport networks, healthcare infrastructure and housing that is fit for future climate conditions. • Access to healthcare and mental health of communities can be negatively impacted by	• YNYCA stakeholders are seeking to ensure adaptations is integrated into its housing retrofit strategy.	• Pursue adaptation measures within transport plans and engage with healthcare operators to ensure assets are resilient. • Consider further efforts to improve adaptation of built environment,

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At risk asset / element	Interdependency	Risk factors	Risk mitigatory factors	Actions / recommendations
		climate hazards such as flooded roads, reducing employee productivity. • These dependencies could be negatively affected by a range of climate hazards.		including residential buildings.
Business and public sector supply chains	Dependent on: **transport infrastructure**	• Infrastructure and public transport can be negatively impacted during extreme weather events. This can lead to disruptions in supply chains for a range of businesses and public services, especially in more remote areas.	• Siting for new assets considers extreme weather risks, e.g., flooding. • Various maintenance programs in place for new roads.	• Ensure climate change risks and adaptation are considered during the YNYCA 2026 transport plan,

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3 VULNERABILITY MAPPING

Vulnerability refers to the propensity of exposed elements such as social groups, their livelihoods, and assets to suffer adverse effects when impacted by hazard events. Vulnerability is related to predisposition, susceptibilities, lack of capacities or other attributes that favour adverse effects on the exposed social groups or assets (IPCC, 2012).

In a climate change risk context, vulnerability is closely related to the **adaptive capacity** of the social group or asset. Adaptive capacity is the ability of systems, institutions, humans, and other organisms to adjust to or reduce potential damages, to take advantage of opportunities or to respond to consequences resulting from a hazard event. A group or asset with reduced adaptive capacity will be more vulnerable to climate change hazard events.

Exposure, a separate component of climate change risk, refers to the inventory of people and assets (or other elements like habitats) in an area in which hazard events may occur. Exposure is a precursor to vulnerability; an element can only be vulnerable if it is exposed to the hazard.

3.1 Introduction - vulnerable groups and assets

Certain social groups are typically more vulnerable than others to the effects of climate change and extreme weather. In addition, when exposed to an occurrence of a given hazard, an individual or group's socioeconomic status will often determine how severely they are impacted. This can be referred to as their 'social vulnerability', i.e., their capacity to handle and react to natural disasters such as heatwaves and floods. The most vulnerable individuals and groups in society are those who face several sources of vulnerability. Climate Just (Climate Just, n.d.a) indicates that social vulnerability's primary causes are associated with:

- Personal characteristics that influence an individual's susceptibility to climatic impacts, such as age and health.
- Certain aspects of the environment, such as the quantity of green space, the standard of the housing stock, or the building's elevation, can either increase or decrease exposure to heat or flooding.
- People's capacity for adaptation is influenced by a variety of social and institutional factors, including income and inequality levels, the strength of social networks, the cohesiveness of neighbourhoods, and the routines of institutions like nursing homes.

In the YNY region and more broadly, social groups that may be more adversely affected by climate change include:

The elderly: The elderly are more vulnerable to flooding and heatwaves than other age groups. The reasons for this include (Climate Just, n.d.b):

1. Their sensitivity to extreme heat. People over 65, and more so people over 75, are not able to adjust as well as other adults to sudden changes in temperature and are also more likely to have a long-term health condition or take medication that changes their body's ability to respond effectively to heat.
2. More commonly living in certain types of housing, e.g. bungalows, that are more susceptible to flooding.
3. A reliance on friends, neighbours and relatives for aspects of their care.
4. Their limited adaptive capacity perhaps because of reduced mobility and consequently a restricted access to help.

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However, not all older people are equally vulnerable. There are huge differences between people in the same age group as a result of varying biological, socioeconomic and psychological factors.

Physical or mental health conditions: Those with existing health conditions can be more at risk due to potentially weakened physical systems, an ongoing dependence on local healthcare services and their increased sensitivity e.g. extreme heat can exacerbate asthma and cardiovascular diseases.

There is limited evidence on the links between climate change and mental health, but the literature reports that people who are experiencing poor mental health are more vulnerable to the effects of climate change on their physical as well as mental health. One reason given is that the climate crisis threatens to disrupt the provision of care for people with a mental illness diagnosis (Lawrance et al., 2021).

Disabilities: Some people living with disabilities can be more vulnerable due to on average lower incomes, an unawareness of emergency protocols (due to relative cognitive impairment, warning and preparedness systems not being accessible to people with low vision or blindness or hearing loss, for example), reduced mobility to leave at risk areas and separation from carers and any assistive devices relied upon (Clarke, 2022).

Children and young people: This group can be affected disproportionately by heat related impacts because their bodies create more heat, they sweat less and dehydration affects them more quickly than in the case of healthy adults. Younger children are dependent on adults to adapt their behaviour and actions to climate impacts, e.g. in the case of higher temperatures - taking shade in the peak sun, wearing appropriate clothes and hats, and applying suncream etc.

Their development can also be affected due to having experienced traumatic events, which can cause aggressive behaviour, mental health issues and the disruption of their schooling (Climate Just, n.d.c).

Low-income groups: A person's income is often closely tied to other causes of vulnerability such as due to being a lone parent, being in ill-health or having a disability. People in these groups tend to have fewer employment opportunities than others and so tend to be on lower incomes. Households with low-incomes and those who are unemployed are less able to adapt to climate impacts as they have reduced financial capability to invest in adaptation and/or manage, cope, or respond to extreme weather events and associated hazards. Low-income households are also more likely to be employed in professions that have a higher exposure to heat due to working outdoors or confined spaces (Climate Just, n.d.d).

Minority communities: Minority communities can be disproportionately vulnerable to the impacts of climate change due to potential language barriers, a higher likelihood of living in dense urban environments (subject to a greater 'heat island' effect) with less access to green space (Climate Just, n.d.e), a greater occurrence of asthma exacerbated by living in areas of poor air quality, and systemic inequalities meaning that diverse voices are under-represented in professions generating solutions to the climate crisis (Chapman, 2022).

Tourists and new residents: May be unaware of local risks like flooding and eroding cliffs. Tourists may also be staying in vulnerable accommodation like campsites, caravans and camper vans.

Homeless people: Homeless people are more likely to be in suffering from health conditions than others and clearly more exposed to climate impacts by the very nature of having inadequate shelter; they also suffer from reduced financial resources to respond to climate effects and may suffer from reduced social support networks (Climate Just, n.d.f).

Outdoor/field workers: These workers are inherently more exposed to extreme weather conditions than those who work indoors, representing exposure and potential vulnerability to climate change risks.

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Most types of infrastructure can be vulnerable to different types of extreme weather, including:

- Power plants
- Power lines
- Key roads
- Rail networks
- Public water supplies
- Private (i.e., non-public utility) water supplies
- Urban areas / residential housing
- Natural capital and green infrastructure (e.g., National Parks, National Nature Reserves, SSSIs).

3.2 Approach

The objective of this work package was to identify where climate risks intersect with vulnerable populations and assets to prioritise adaptation. Climate change vulnerability within a large and diverse geographic area like YNY is a subject to complexity and is influenced by a range of factors. RSK designed an approach to understand critical areas of vulnerability within the YNY region, including both infrastructure assets (across natural and manufactured capital categories) and social groups.

To determine critical areas of vulnerability we adopted the following, geographic information system-(GIS) based approach:

1. Research into potential areas of vulnerability, including experience from previous climate adaptation projects, a review of public materials and engagement with YNY stakeholders to understand what types of infrastructure assets and social groups they saw as a) potentially vulnerable and b) material to the objectives of YNY authorities and maintaining/enhancing regional prosperity.
2. Research into the types of datasets available to support the analysis of vulnerable social groups and assets. This included both publicly available datasets and data held by the constituent authorities of the YNY and other stakeholders.
3. Once suitable datasets for analysis were confirmed, data was manipulated using GIS software to produce a range of statistics and vulnerability maps. GIS was used to overlay hazard data (e.g. flood zones) with vulnerability datasets (e.g. deprivation, infrastructure?
4. Produced data was validated with a group of stakeholders via two vulnerability workshops.
5. Outputs include spatial maps and datasets highlighting vulnerability hotspots.

Potentially vulnerable assets / social groups identified by desk-based research and stakeholder engagement, and where suitable data existed for analysis, included:

- Transport infrastructure (rail, motorway, A road, B road).
- Power substations, electricity cables, overhead electricity lines.
- Built up areas at flood risk.
- Protected areas (including protected areas outside the four protected YNY landscapes, such as SSSIs and Special Areas of Conservation).
- Older (65+) social groups.
- Relatively deprived social groups (measured by geographic deprivation indexes).

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- Population at flood risk by Lower layer Super Output Areas (LSOAs).[1]

Hazards included within this vulnerability assessment included:

- Summer and winter precipitation levels.
- Summer and winter temperature levels, including extreme heat.
- Flooding (rivers and sea, and surface water).
- Coastal erosion.
- Temperature shifts.

Due to project resource constraints this vulnerability mapping exercise was not exhaustive, instead representing a preliminary analysis of regional vulnerability to support initial adaptation planning and further analysis where required. The analysis has been inherently high-level as a result, but has sought to understand the key vulnerabilities of the region based on the most material climate risks it faces. For example, flood risk hotspots across the region have been identified, combined with measures of population exposure vulnerability including population at risk of flooding. This provides a tool to prioritise further analysis or targeted adaptive interventions, including investment and local planning.

A full list of datasets reviewed is provided within APPENDIX 7 - Vulnerability Assessment Datasets

Due to the size and diversity of the YNY region, a range of datasets were utilised, which enabled multiple graphics/maps to be produced. The data and spatial mapping outputs were diverse and were made available to the Council GIS teams to enable further analysis and development of bespoke maps.

3.3 Findings and spatial maps of key vulnerabilities

Various hazards were analysed to assess the vulnerability of different systems.

3.3.1 Key findings

In terms of flood risks, the modelling indicates that Selby represents a key risk hotspot in terms of built-up area (see Table 15). Built up area can be seen as an approximation of population concentration and a concentration of supporting infrastructure and economic activity that may be disrupted by flood events. This is supported by mapping of estimated populations at risk of flooding, which shows large risk concentrations in the southern part of the YNY region and in the Pickering Vale, plus more localised risk exposure corridors along river network flood plains (see Figure 15). Analysis of population deprivation also highlights key areas of socioeconomic deprivation within the Selby area that are subject to present day flood risk that escalates into the future (see Figure 16). These more deprived populations may suffer from a range of factors that reduce their capacity to adapt to climate change without societal support; for example, they likely have reduced economic resources to install flood reduction measures and may have relatively lower education levels, reducing their knowledge of climate change risks and mechanisms to access associated information sources.

Flood risk to other types of infrastructure including transport (see Figure 17) and energy (See) are concentrated in a similar area. This area therefore represents a logical priority for more targeted analyses and adaptation interventions.

[1] LSOAs are small statistical consistent population units used by the Office for National Statistics (ONS) various statistical analysis and data collection. They comprise between 400 and 1,200 households and have a usually resident population between 1,000 and 3,000 persons: https://www.ons.gov.uk/methodology/geography/ukgeographies/censusgeographies/census2021geographies

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It is worth noting that the analysis also indicates that, in terms of rivers and sea flooding, the increase in risk primarily relates to increased likelihood within areas that are already at risk of flooding, rather than new areas becoming exposed to flood risk (see Figure 14). Therefore, adaptation can be targeted to areas known to be at risk of flooding today, based on Environment Agency flood risk modelling (Defra and Environment Agency, 2025).

Scarborough, Selby and parts of York feature concentrations of socioeconomic deprivation where vulnerabilities to climate change may be exacerbated. These areas of deprivation should be prioritised for further analyses and adaptation interventions, considering the range of risks posed to health and communities (see Section 2.3.3), such as flooding (where relevant) and extreme heat.

The analysis of drought and water stress vulnerability indicates that water supply systems in YNY are vulnerable, though less so than the south and east of the country where water stress is already hampering economic growth. Effective stewardship of water resources in YNY including mitigation of risks could therefore represent a relative economic opportunity for the region and is recommended for prioritisation during adaptation planning. Yorkshire Water should be engaged by YNY partners to understand and prepare for water scarcity in the future and to promote enhanced stewardship and resilience across the region and its economy.

3.3.2 Population vulnerability

The YNY region is home to intermixed areas of high and low socioeconomic deprivation. The Index of Multiple Deprivation (IMD) dataset (Office for National Statistics, 2021) was utilised to understand areas of heightened deprivation. IMD reflects a range of factors in addition average household income. More deprived populations are likely to have fewer financial resources to respond to the negative effects of climate change. They may also have other categories of adaptative capacity that are reduced relative to less deprived populations and their socioeconomic environment may be less resilient to these effects. For example, their homes may be more susceptible to flooding or overheating.

Figure 13 below highlights IMD at the LSOA level for the YNY region.

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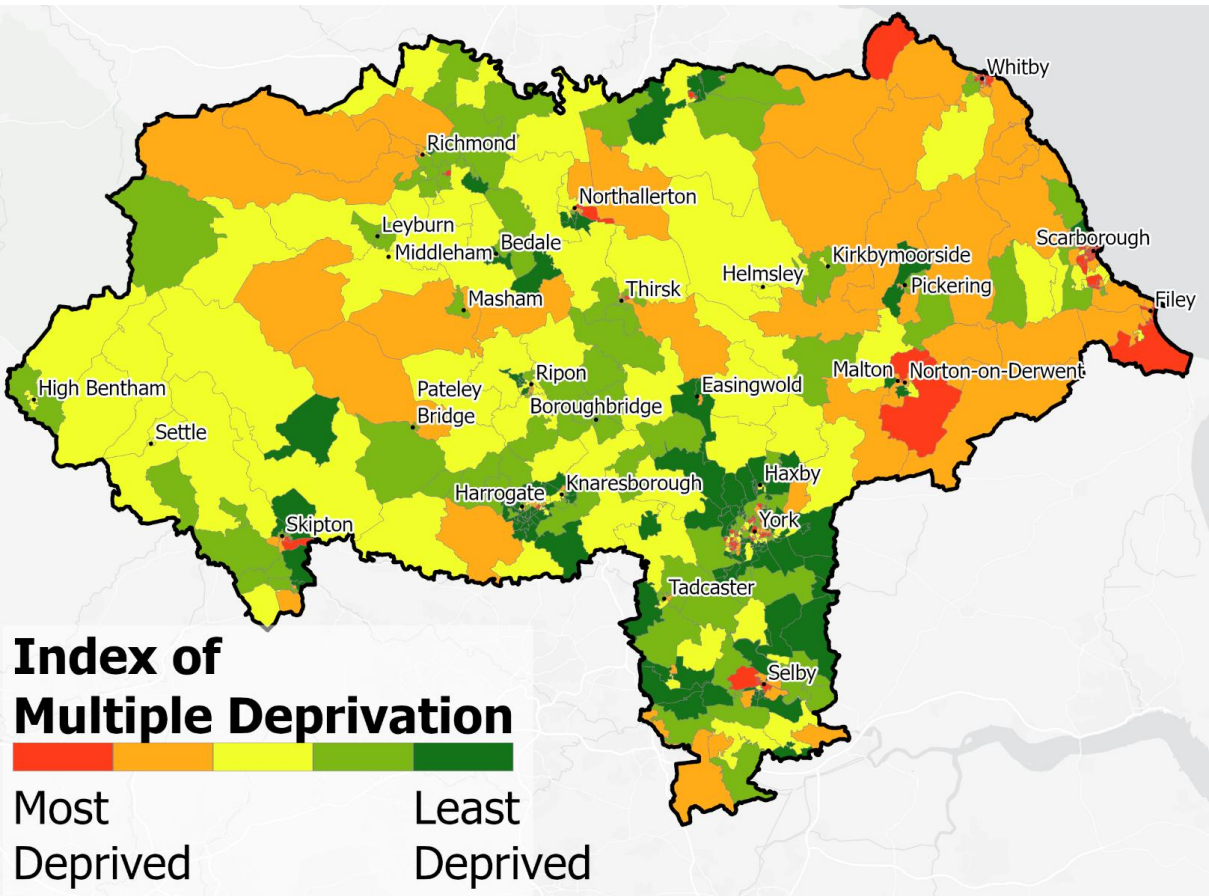

Figure 13 A map illustrating Index of Multiple Deprivation at the ONS Lower Layer Super Output Area within the York and North Yorkshire region. Deprivation levels are defined relative to the overall region. Source: Office for National Statistics, 2021.

As with the rest of the climate change vulnerability mapping analysis, these datasets have been provided to the YNY authorities to form the basis for future analysis. The most deprived LSOAs within the YNY are provided below:

- Scarborough 012B
- Scarborough 007D
- Scarborough 006B
- Scarborough 006D
- Scarborough 010A

The IMD mapping illustrated in Figure 13 indicates that Scarborough, Selby and parts of York can be considered as primary hotspots of deprivation as measured by the ONS IMD; these particular areas are likely to be more vulnerable to climate change effects than less deprived parts of the region. These communities may therefore warrant priority support during adaptation planning during the YNY region.

Rural vulnerability

Most of YNY is rural in character. Large parts of the population live in small rural villages, many of which have poor transport connections and are remote from services that could help to mitigate the impacts of climate change, and as such are likely vulnerable to its impacts. Figure 15 highlights the

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location of rural populations at risk of river and sea flooding. Further analysis is recommended to understand which rural populations are most exposed and vulnerable to climate change.

3.3.3 Flood risk (from rivers and sea)

The Environment Agency (Defra, 2025) risk of Flooding from Rivers and the Sea (RoFRS) shows the chance of flooding from rivers and the sea considering the presence and condition of flood defences. RoFRS is a probabilistic product, meaning that it shows the overall risk, rather than the risk associated with a specific event or scenario. This risk is displayed as one of four likelihood bandings:

- **High** - greater than or equal to 3.3% chance in any given year (1 in 30)
- **Medium** - less than 3.3% (1 in 30) but greater than or equal to 1% (1 in 100) chance in any given year
- **Low** - less than 1% (1 in 100) but greater than or equal to 0.1% (1 in 1,000) chance in any given year
- **Very Low** - less than 0.1% chance in any given year (1 in 1,000)

While flood defences reduce the level of risk, they do not completely mitigate it (e.g. water can flow over the top of the defence, or they can fail in extreme weather conditions or if they are in poor condition). As a result, the RoFRS tool may show that there is risk to areas behind some flood defences.

The Environment Agency's risk flooding data relates to present day risk and an estimate of future 'medium-term' risk, analysing the flood risk that would materialise under if emissions and temperatures follow an RCP 8.5 scenario within the 2040-2069 period, described by Defra as the "2050s epoch" (Defra and Environment Agency, 2025). All use of Defra flood risk data for the RCP 8.5 scenario within this report section relates to this epoch.

Data source considerations

All of the flood risk data used in this analysis was created in October 2024 and accessed in early 2025 (Defra and Environment Agency, 2025). Further updates to flood risk data after early 2025 have not been integrated nor have flood risk modelling related to certain flood alleviation schemes. Crucially, the data utilised had not integrated updates to modelling to reflect flood risk reduction benefits provided by the York Flood Alleviation Scheme, including the Foss Barrier upgrades. These updates had not been publicly released by the Environment Agency at the time this report was produced.

Built up areas

Built up areas at risk from flooding from rivers and the sea show a small increase in the total area at risk between current and future projections (2055). However, there are large changes seen in the level of risk, with the percentage of built-up areas at low or medium flood risk decreasing in the future, and the area at high flood risk increasing, shown in Figure 14.

Under the 4˚C GWL, the region could see 3,373 hectares of built-up areas at risk of flooding from rivers and the sea by 2055, of which 63% could have a high flood risk rating.

The risk exposure profile for properties within the YNYCA in the 1 April 2023 to 31 March 2024 period is provided in Table 14 below.

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Table 14 The number of properties within the YNYCA considered exposed to different river and sea flood risk levels in the period 1 April 2023 to 31 March 2024. Environment Agency, 2025.

Authority	High Risk Residential	High Risk Non-residential	Medium Risk Residential	Medium Risk Non-residential	Low Risk Residential	Low Risk Non-residential	Very Low Risk Residential	Very Low Risk Non-residential	Total Residential	Total Commercial
North Yorkshire	8,334	3,826	6,823	2,293	18,889	5,515	2,486	769	**36,531**	**12,402**
York	1,186	370	2,196	963	3,974	1,097	1,141	99	**8,497**	**2,529**
Total	9,520	4,196	9,019	3,256	22,863	6,612	3,626	867	**45,028**	**14,931**

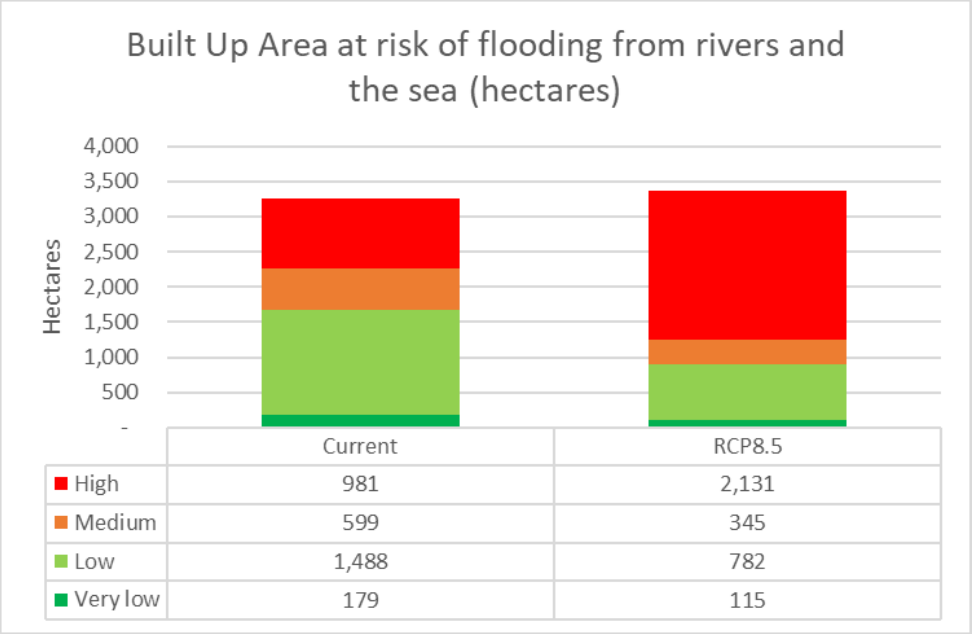

Figure 14. Built up areas within the YNYCA at risk of Flooding from Rivers and the Sea (RoFRS) under two climate change scenarios including RCP 8.5 2040 to 2069, broken down by Environment Agency risk level (measured in hectares). Source: ADAS manipulation of Environment Agency flood risk mapping, 2025

As built-up areas represent concentrations of population and economic activity, understanding which built up areas are at most risk of flooding could help to prioritise adaptation planning with resource allocation to population and economic centres most at risk. Built up areas for the largest settlements in the YNY region as defined by population reported in the 2021 census (Office for National Statistics, 2023) were combined with Environment Agency flood risk data to understand the built-up areas most at risk from flooding in the YNY region. The results of this analysis are displayed in Table 15 below. Note, this analysis is high level and does not indicate the severity of the flooding and associated damage that would occur at each location. Furthermore, built up areas are heterogenous and provide an indication only of concentration of population and / or economic activities.

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Table 15 Built up areas at risk of river and sea flooding for the present day and an RCP 8.5 scenario in the 2040 - 2069 period for the 10 largest Built-Up Areas in the York and North Yorkshire region.

		Present Day Flood Risk (hectares of area at risk)					RCP 8.5 Flood Risk (2040-2069 period) (hectares of area at risk)				
Built Up Area Name	**Total Area (ha)**	**High**	**Medium**	**Low**	**Very low**	**Total high and medium risk area**	**High**	**Medium**	**Low**	**Very low**	**Total high and medium risk area**
Catterick Garrison	629	1.8	0.7	1.9	0	2.5	2.1	0.7	2.1	0	2.8
Northallerton	414	8.7	8.7	16.7	0.8	17.4	14.1	4.6	25.5	0.8	18.7
Scarborough	1,470	22	6.3	14.8	1.47	28.3	28.5	4.9	14.5	1.47	33.4
Ripon	553	12.3	6	55.8	7.2	18.3	15.8	24.8	39.1	3.3	40.6
Norton-on-Derwent	208	2.5	0.5	34.2	0	3	2.8	14.6	22	0	17.4
Knaresborough	533	24.8	7.4	14.2	0	32.2	30.5	8.7	10.9	0	39.2
Harrogate	2,004	5.6	1.5	7.5	0	7.1	6.5	3.2	6	0	9.7
York*	2,904	78.4	63	119.3	52.3	*141.4**	142.6	54.2	112.9	46.5	*196.8**
Skipton	475	46.1	26.7	35.4	6.7	72.8	64.6	16.5	32.5	4.8	81.1
Selby	564	150.9	76	301.8	26.5	226.9	526.6	1	28.5	1.1	527.6

**Note, the figures for York have not integrated updated flood risk modelling that reflects the benefits provided by the new Foss Barrier upgrades, completed in 2022. It is unknown the degree to which this upgrade would affect the figures provided for York this table, given that the original Foss Barrier also provided protection for parts of York against certain levels of flooding.*

Key for Table 15:

	100 or more hectares are risk (medium and high flood risk total)
	200 or more hectares at risk (medium and high flood risk total)
	500 or more hectares at risk (medium and high flood risk total)

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Population

Identifying concentrations of population at risk from flooding was estimated using the proportion of the area of LSOAs at risk from flooding multiplied by the population of that LSOA.

The LSOA areas with the highest levels of flood risk by population, under the RCP 8.5 scenario are centred around Selby and York, illustrated in Figure 15.

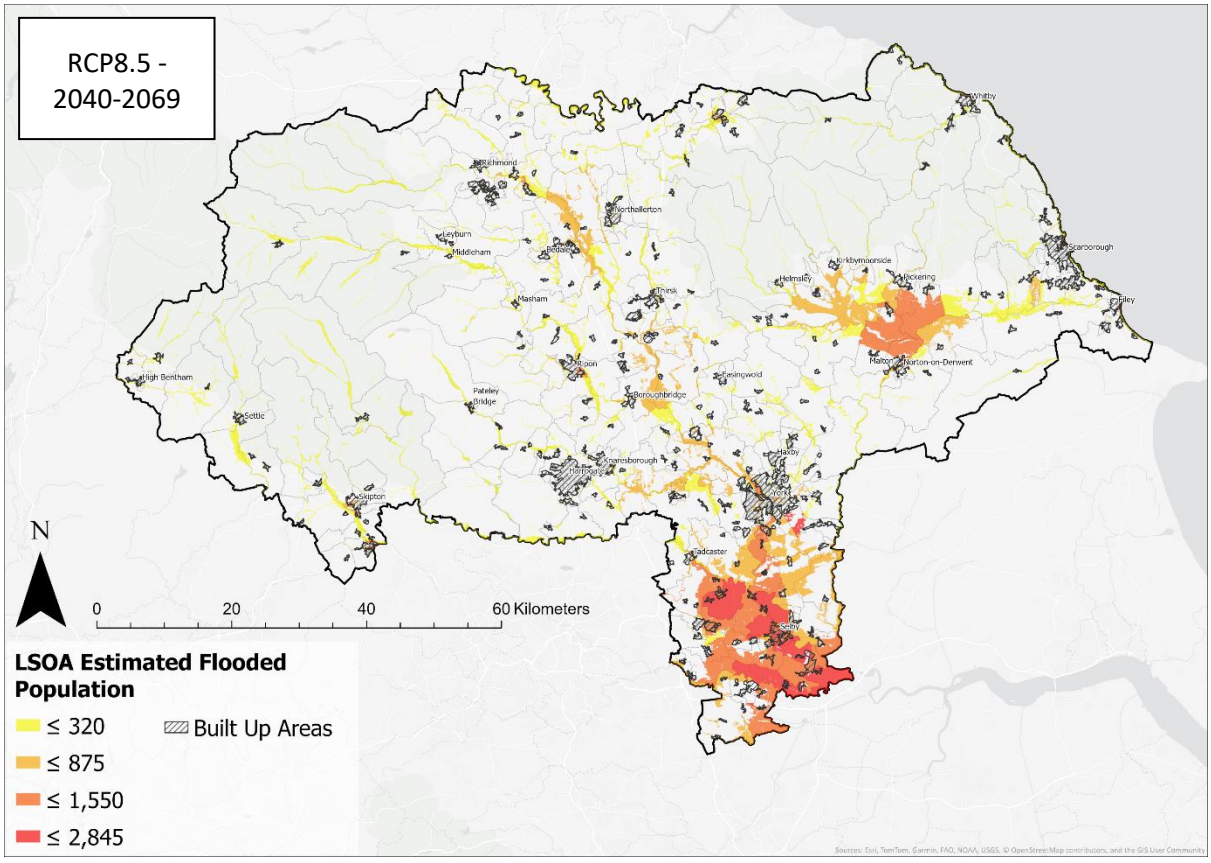

Figure 15. Map indicating estimated flooded population in LSOAs at risk of Flooding from Rivers and the Sea (RoFRS) under the RCP 8.5 scenario. Source: ADAS, 2025.

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Within the Selby area in particular, there are LSOAs with a high level of deprivation (as measured by the Index of Multiple Deprivation[2] (IMD)) that are modelled to face increasing flood risk in more pessimistic scenarios, noting that the total area subject to any level of flood risk is not projected to increase significantly (see **Figure 16**).

More deprived communities are likely to be more vulnerable to flooding impacts (for example, poorer quality of housing may be more susceptible to flood damages) and will likely have reduced financial resources to recover once a flood event has occurred (i.e., reduced financial adaptive capacity).

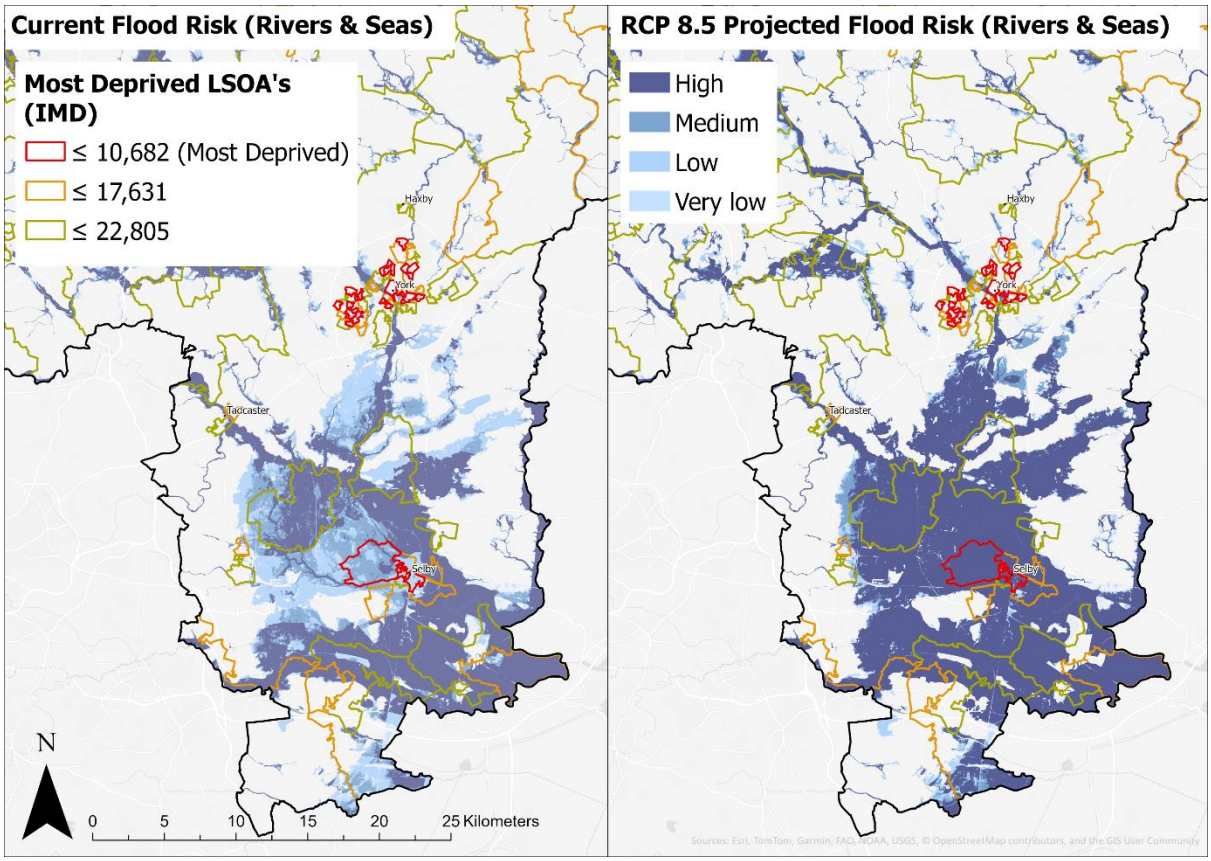

Figure 16. Map showing risk of Flooding from Rivers and the Sea (RoFRS) (as measured by the Environment Agency) overlaid with most deprived LSOAs in the Selby and York region (measured by Index of Multiple Deprivation or IMD) under present day conditions and an RCP 8.5 scenario projection. Source: ADAS, 2025.

As the above maps show, flood risk levels are highly heterogenous across the YNY region. Built up areas typically represent concentrations of population and economic activity. Floods occurring in built up areas are therefore likely to have more material impacts across a range of categories such as economic damage and safety.

[2] Index of Multiple Deprivation (IMD) is complex measurement of deprivation incorporating various metrics (not just income); see Geographic Data Service for further information.

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Transport infrastructure

Transport links were analysed to calculate the percentage of the network at risk from flooding from rivers and the sea. Whilst there is a small increase in the total length of the network at risk, the main changes are seen in the level of risk, with the percentage of the network at low or very low risk decreasing in the future, and the area at high risk increasing, shown in Table 16, Figure 17 and Figure 18.

Table 16. Percentage of road and rail network at risk of Flooding from Rivers and the Sea (RoFRS) (as measured by the Environment Agency) under different climate change scenarios.

Scenario	High flood risk	Medium flood risk	Low flood risk	Very low flood risk	Total length at risk
Rail					
Current	10.82%	2.56%	7.33%	1.41%	22.12%
RCP8.5 (2055)	15.44%	2.50%	5.34%	0.90%	24.18%
Motorways, A Road and B Road					
Current	7.16%	3.74%	9.17%	2.40%	22.46%
RCP8.5 (2055)	12.48%	3.74%	7.53%	1.19%	24.94%

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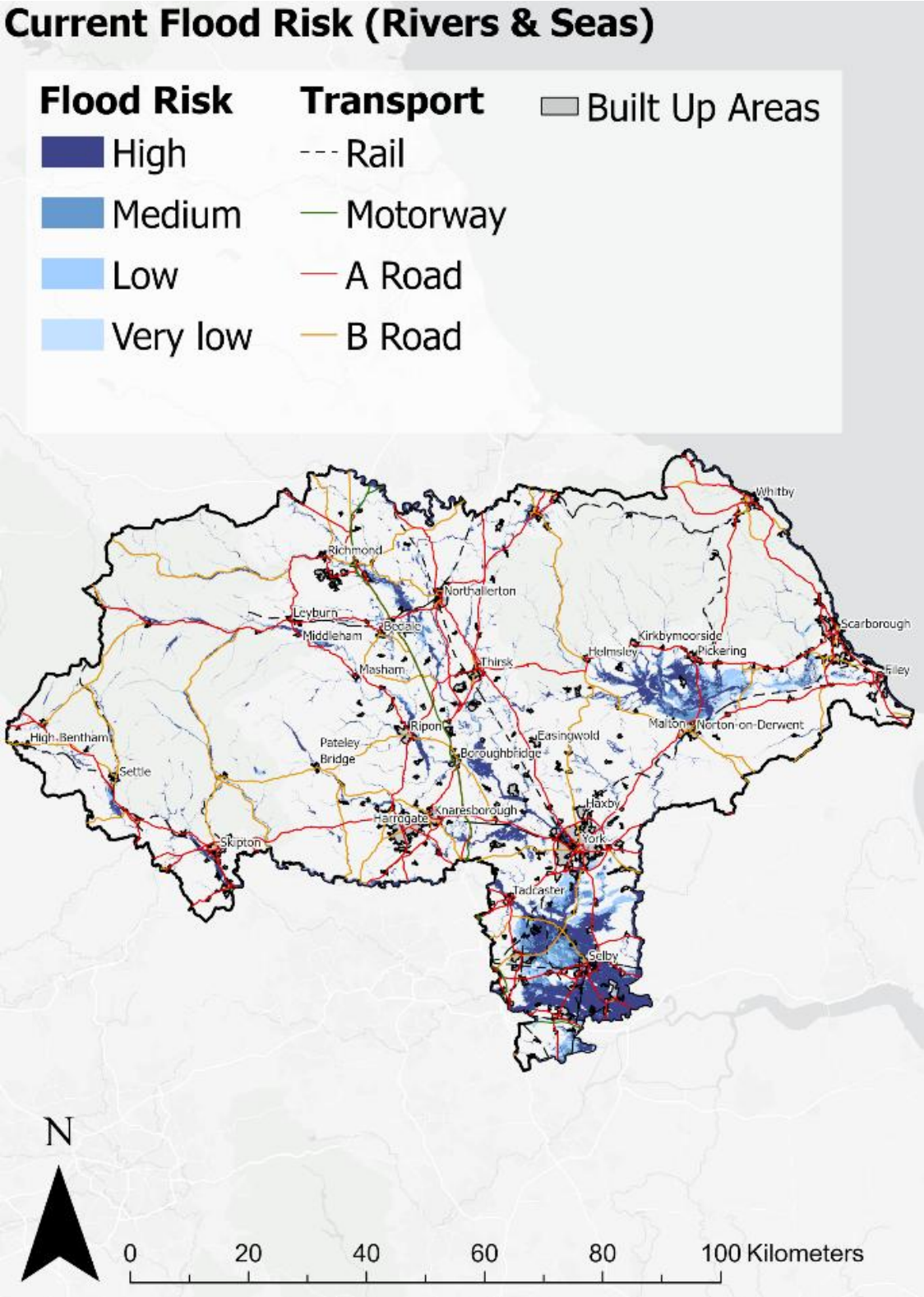

Figure 17. Map overlaying current spatial risk of Flooding from Rivers and the Sea (RoFRS) (as measured by the Environment Agency) overlaid with key transport infrastructure. Source: ADAS, 2025

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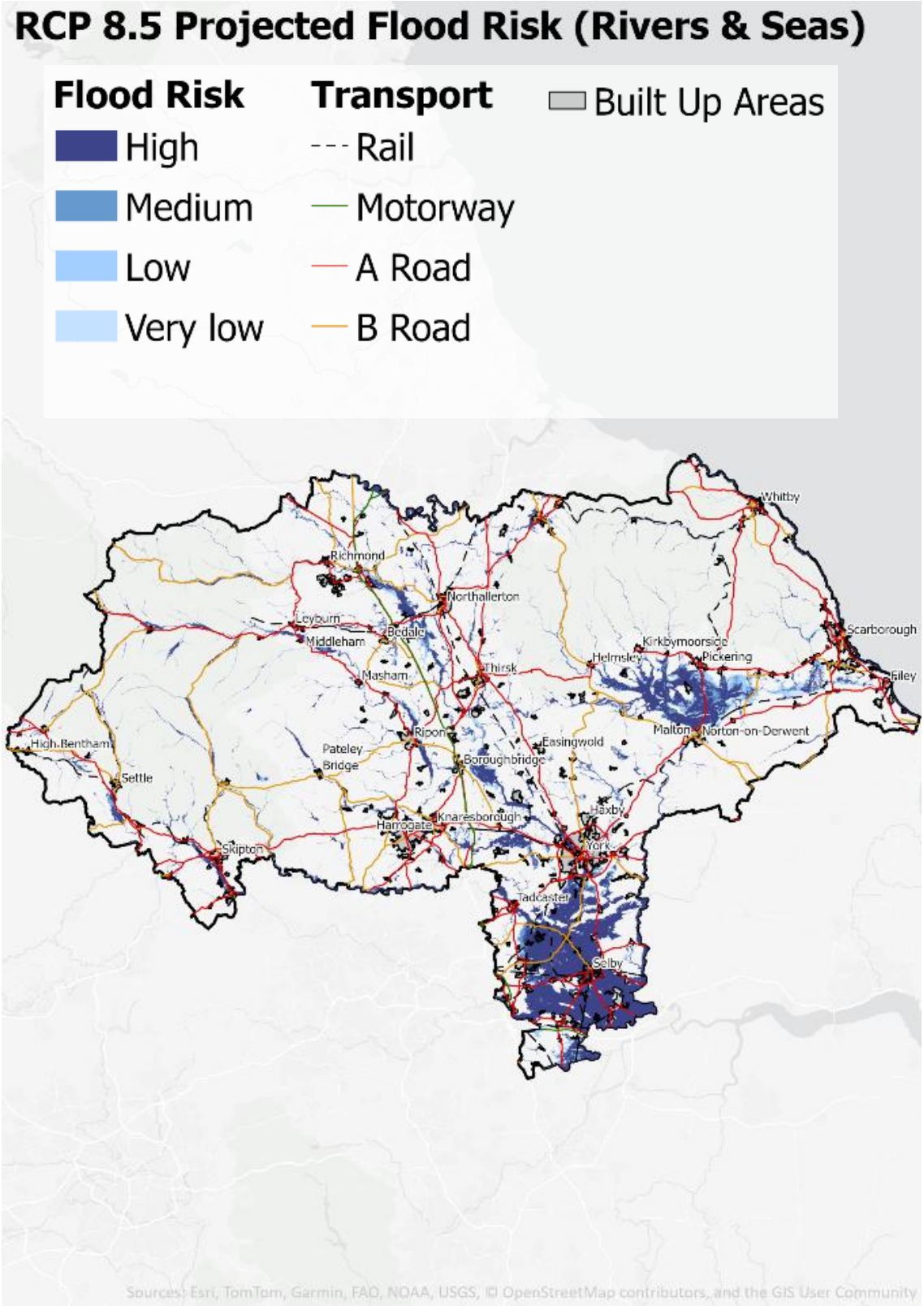

Figure 18. Map overlaying spatial risk of Flooding from Rivers and the Sea (RoFRS) (as measured by the Environment Agency) under an RCP 8.5 scenario overlaid with key transport infrastructure. Source: ADAS, 2025

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3.3.4 Sea level rise and coastal erosion

Under typical erosion rates and current sea levels, coastal built-up areas at risk of erosion are projected to be 13.5 hectares by 2055 and 21.48 hectares by 2105. Under the RCP8.5 Moderate Sea Level Rise 70th percentile scenario, the area at risk of erosion would increase to 16.9 hectares by 2055 and 36.9 hectares by 2105, whilst under the RCP8.5 Extreme Sea Level Rise 95th percentile scenario, the risk area would be even greater at 17.7 hectares by 2055 and 41.4 hectares by 2105.

However, other properties and assets may be threatened by other issues related to coastal erosion, such as loss of access routes for remote areas.

The area at risk from coastal erosion is therefore relatively small compared to the area at risk from river and surface water flooding (see Figure 14), and the volume of properties and infrastructure at risk is also lower. Over longer-term time horizons, however, key coastal settlements such as Scarborough may be threatened, while key tourism assets, such as beaches, are also vulnerable.

Figure 19 illustrates the erosion risk by 2055 and 2105, under the RCP8.5 Extreme Sea Level Rise 95th percentile scenario, for a stretch of the North Yorkshire Coast.

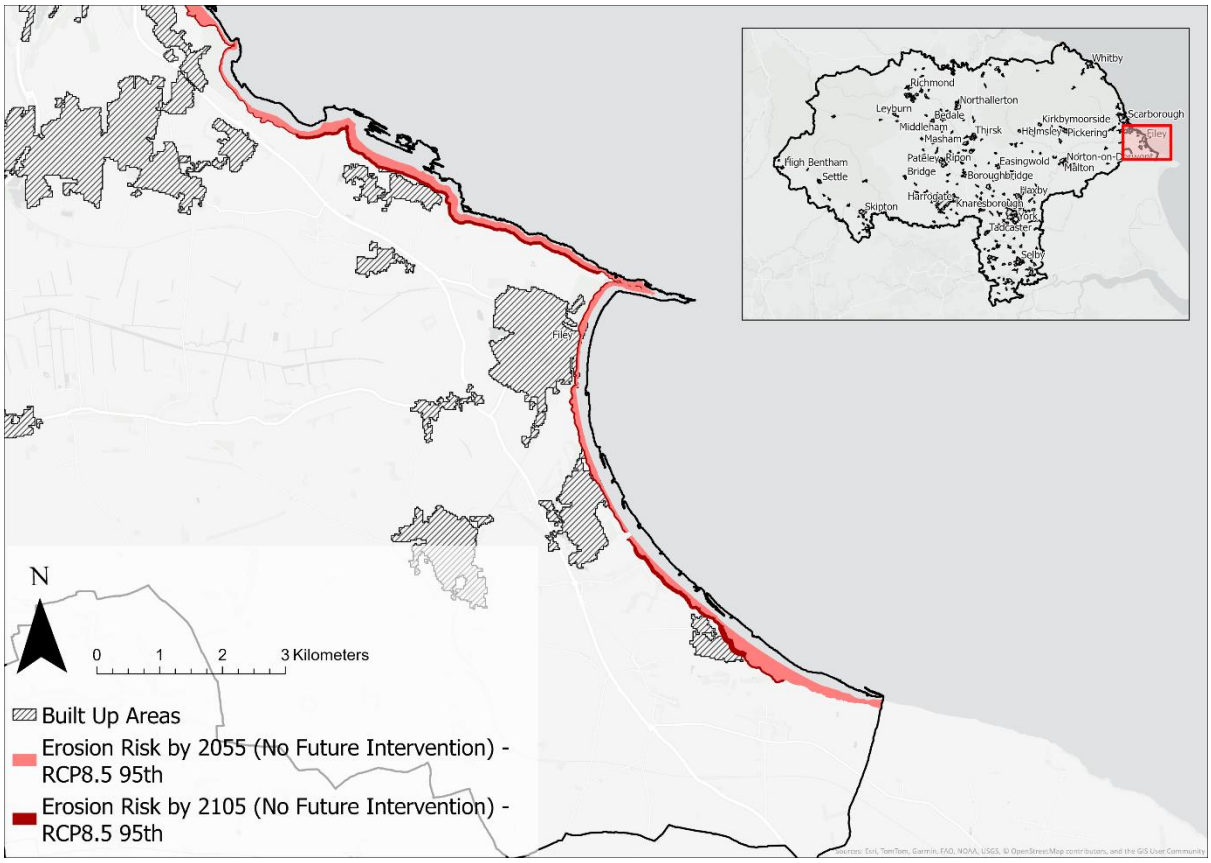

Figure 19. Future erosion risk projections for part of the North Yorkshire coast, focused on Filey (considered an at-risk location by YNYCA stakeholders). Source: Environment Agency National Coastal Erosion Risk Mapping (NCERM) - National (2024); analysed by ADAS, 2025.

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3.3.5 Water supplies and infrastructure

Public water supplies

Public water supply for the YNYCA region is provided by Yorkshire Water. A drought occurred in 2025 that was described as the worst since 1893, causing water stress in the region and resulting in a hosepipe ban in early July through December 2025 (December saw above average rainfall which replenished water levels (Yorkshire Water, 2025a)).

If reservoir levels decline significantly, they meet specific thresholds (Drought Control Limits, or DCLs) measured by Yorkshire Water which then prompts a range of escalating water stewardship measures that are developed through collaboration with the Environment Agency, as per p. 38 of the Yorkshire Water Drought Plan (Yorkshire Water, 2022). DCLs differ by the time of year and by reservoir.

Table 17 indicates that drought conditions are becoming both more frequent and more severe. In the forty years between 1960 and 2000, droughts were observed in three years. In the twenty-year period between 2000 and 2020 five droughts were observed (albeit none requiring hosepipe bans). In the five-year period between 2020 and 2025 two hosepipe bans were observed, which almost equals the number of hosepipe bans implemented during the previous century. It remains to be seen whether these events are indicative of a future trend or are anomalous, however the projection data has long predicted that summer periods will become increasingly dry and hot (see Section 2.2).

Table 17. An illustration of years where drought conditions and hosepipe bans were observed or enacted between 1920 and 2025 with the Yorkshire Water infrastructure network. Hosepipe bans are implemented if certain water supply thresholds, such as declining reservoir storage levels, are met during drought conditions and indicate more severe and / or prolonged drought events. Source: Yorkshire Water Drought Plan 2022 (Yorkshire Water, 2022).

1920 - 1940	1940 to 1960	1960 to 1980	1980 to 2000	2000 to 2020	2020 to 2025
1920	1940	1960	1980	2000	2020
1921	1941	1961	1981	2001	2021
1922	1942	1962	1982	2002	2022
1923	1943	1963	1983	2003	2023
1924	1944	1964	1984	2004	2024
1925	1945	1965	1985	2005	2025
1926	1946	1966	1986	2006	
1927	1947	1967	1987	2007	
1928	1948	1968	1988	2008	
1929	1949	1969	1989	2009	
1930	1950	1970	1990	2010	
1931	1951	1971	1991	2011	

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1932	1952	1972	1992	2012
1933	1953	1973	1993	2013
1934	1954	1974	1994	2014
1935	1955	1975	1995	2015
1936	1956	1976	1996	2016
1937	1957	1977	1997	2017
1938	1958	1978	1998	2018
1939	1959	1979	1999	2019

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Key:

	Drought conditions reported by Yorkshire Water.
	Hosepipe ban enacted.

These recent trends combined with projections for reduced summer rainfall expected for the YNYCA region in future time horizons indicate that public water stress represents a potential vulnerability for the region, especially if no adaptation action is taken. One potential impact could include hampered economic and business growth if supply curtailments are required. For example, the Essex & Suffolk service region has been designated by the Environment Agency as a 'seriously water stressed area' and as a result a moratorium on new connections for commercial entities has been established for part of the region (BBC, 2024d). Activities included within the moratorium are broad but include manufacturing and processing, livestock production, irrigation and cooling (Essex & Suffolk Water, n.d.).

Other potential vulnerabilities include loss of water supplies to agriculture, disrupting crop and livestock productivity, and loss of water within ecosystems. The latter can damage freshwater and terrestrial ecosystems, reducing ecosystem services and creating drier conditions that are more conducive to wildfires, such as the 2025 North York Moors Wildfires.

Yorkshire Water has not been defined as a 'seriously water stressed area', to date, whereas other UK regions have (Environment Agency, 2021). It is also worth noting that the World Resources Institute Aqueduct Water Risk Atlas Tool indicates that the YNY region is projected to face lower water stress ('Low to medium' water stress) than much of the rest of England, especially the southeast (World Resources Institute, n.d.). This can be seen in Figure 20. An economic analysis of the cost of water scarcity in the UK by Public First corroborates this, noting that the vast majority of negative economic impacts through 2030 will occur in the south and east of the country with minimal effects in YNY (Public First, 2025). While the YNY region may face lower relative water stress vulnerability than the rest of the country, this does not preclude damaging water stress events from occurring in the region.

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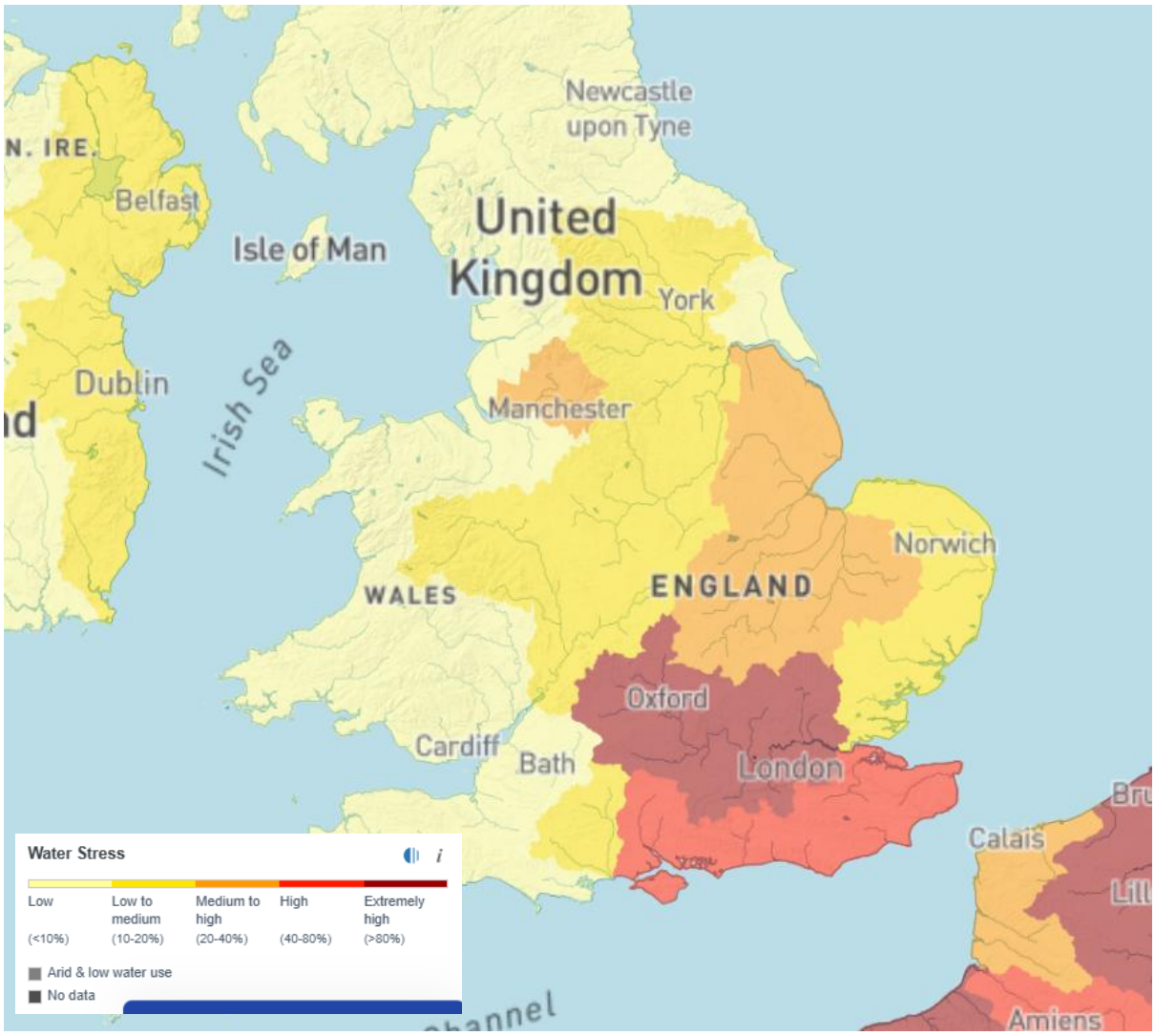

Figure 20. Water stress projected for 2050 under a pessimistic scenario. Water stress is an indicator of competition for water resources and is defined informally as the ratio of demand for water by human society divided by available water. The "pessimistic" scenario (SSP5 RCP8.5) represents a future where temperatures increase up to 3.3°C to 5.7°C by 2100. Note that WRI modelling is completed at a high-level and indicative only and does not preclude water stress events occurring the YNY region. Source: World Resources Institute, n.d.

No major new reservoirs are planned for the region, with resources allocated to areas considered at higher risk of water stress (Environment Agency, 2024). Yorkshire Water published a Climate Adaptation Report in January 2025 which provides an overview of its approach to adaptation (Yorkshire Water, 2025b). Potential adaptation pathways that could help to reduce water scarcity-related risks are described in Section 5.4.

Private water supplies

Properties with a private water supply (i.e., where they are not supplied by a water utility via the mains water supply and are instead supplied by a well, borehole, etc.) may be more vulnerable to the effects of climate change, namely drought and declines in groundwater levels due to reduced rainfall and/or excess water use during hotter months and extreme heat events. YNYCA provided a partial dataset for 2,576 private water supply locations (note this is not the number of properties connected to private water supplies – single wells/boreholes may supply multiple properties).

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An insignificant number were located within the City of York. In the event that water supply is lost, North Yorkshire Council is not legally required to maintain water supply to these properties unless there are additional health risks (e.g., household members require social care services), however, YNYCA stakeholders indicated that they would likely be expected to support these households in the event of water supply losses.

3.3.6 Energy Infrastructure

A partial dataset of energy infrastructure and assets (including key powerlines and substations only) was obtained from the National Grid (2025) 'Energy - Network route maps' dataset. Combining these locations with Environment Agency flood risk data indicates the risk exposure provided in the table below. However, this does not include power generation assets or other energy-related assets such as less significant substations and transmission lines.

Table 18. Proportion of National Grid (2025) 'Energy - Network route maps' dataset assets at risk of flooding in current conditions and in a future climate change scenario (RCP 8.5) for the 2040-2069 period. Source; ADAS analysis, 2026.

Infrastructure type	Total flood risk exposure (current)	Total flood risk exposure (RCP 8.5; 2040-2069 period)
Substations	0%	0%
Cables / Lines	19.73%	22.32%

A geospatial overview of this vulnerability is provided in Figure 21.

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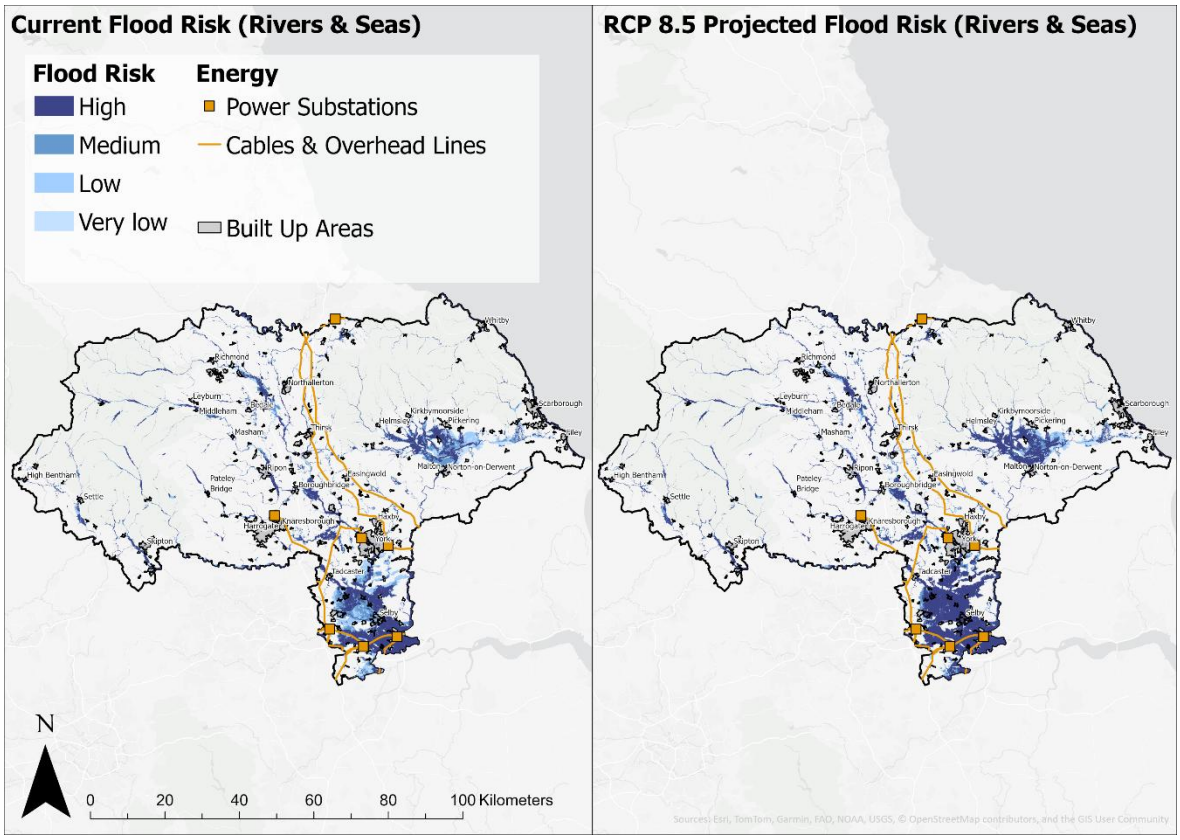

Figure 21. A geospatial overview of power infrastructure exposure to river and sea flooding in the York and North Yorkshire region, including key substation and powerline assets only, as included within the National Grid (2025) 'Energy - Network route maps' dataset. Source: ADAS analysis of National Grid power infrastructure and Environment Agency flood risk datasets.

A further five assets were reviewed for flood risk exposure:

- Drax Power Station;
- Allerton Waste Recovery Park;
- Skeeby Solar Farm (55MW of ground mounted solar just outside of Richmond);
- Knabbs Ridge Wind Farm (16 MW onshore wind farm west of Harrogate); and
- Monk Fryston Battery Storage (320MW of battery storage, and substation and HV cable upgrades currently under construction west of Selby).

Of these, only the Drax Power Station faces material flood risk exposure, with the site surrounded by higher risk zones both today and in the 2040-2069 period. This may result in temporary logistics disruptions for the site. Drax has its own climate change risk management policies. Further engagement with the company is recommended to ensure its procedures are adequate to maintain its power generation services, which are critical at the national level. A broader climate change risk assessment for these assets went beyond the scope of this assessment, and would include, for example, understanding the resilience of energy generation processes to extreme heat projections and the materiality of any resulting damages.

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4 ORGANISATIONAL RISKS AND ADAPTIVE CAPACITY

4.1 Organisational Risk Assessment

This section translates regional climate risks into organisational risks for YNYCA, City of York Council, North Yorkshire Council and protected landscape authorities. It focuses on the ability of these organisations to maintain services, manage assets and protect communities under increasing climate stress. Organisational risks are defined as risks to: (1) assets, (2) service delivery, (3) workforce, and (4) governance/decision-making. The most significant organisational risks relate to flooding, extreme heat and cascading infrastructure disruption, all of which directly affect service continuity and operational resilience.

This section provides an indicative assessment to support organisational reflection and further analysis. It is not an audit of compliance or performance.

Note: the risks and opportunities detailed in this section relate to the to the operations and services provided by the constituent authorities of the YNYCA and exclude risks relating to the Y&NY region. Risks relating to the broader Y&NY region are detailed in Section 2 Climate Change Risk and Opportunity Assessment.

Scoring the risks & opportunities

The risk scoring process is described Section 2.1 Approach to the CCRA and involves assigning a score for the magnitude of the potential consequences of a risk and a score for the likelihood or probability of that risk occurring. By multiplying the magnitude by the likelihood, a risk score was obtained for each of the impacts, which was then assigned a risk rating based on a five-point scale (See Table 19)

$$Risk\ Score = Magnitude\ Score \times Likelihood\ Score$$

Table 19. Risk rating matrix.

Risk Rating Matrix		**Magnitude of potential consequences**				
		Very Low	Low	Medium	High	Very High
Likelihood (levels of probability)	Very Likely	Moderate	Major	Major	Severe	Severe
	Likely	Moderate	Moderate	Major	Major	Severe
	Possible	Minor	Moderate	Moderate	Major	Major
	Unlikely	Minor	Moderate	Moderate	Moderate	Major
	Highly Unlikely	Negligible	Minor	Minor	Moderate	Moderate

The descriptions of each risk rating are shown in Table 2 in Section 2.1. A benefit rating system was used for the opportunities, to recognise that for these impacts a higher score reflects a greater opportunity.

The Likelihood and Magnitude scoring thresholds used in this assessment are available in **APPENDIX 3** and **APPENDIX 4**.

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4.1.1 Overview of risks

The proportion of risks to the operations of the YNYCA authorities assigned to each risk rating across the four climate scenarios (2020s, 2050s under 2°C of global warming, 2080s under 2°C and 2080s under 4°C) are shown in Figure 22.

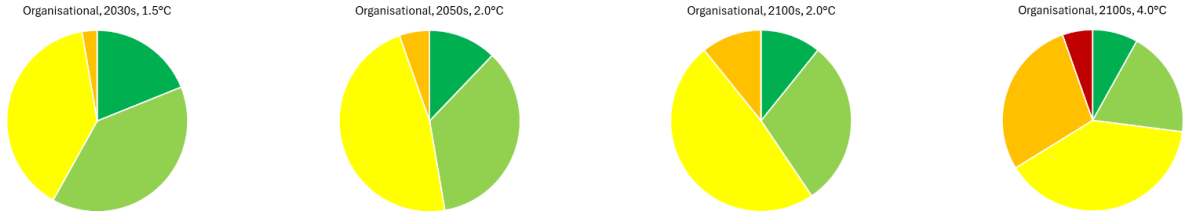

Figure 22. Proportion of risks to the YNYCA constituent authority organisations for each risk rating across the four climate scenarios. Source: ADAS, 2025.

Key to Figure 22. Proportion of risks to the YNYCA constituent authority organisations for each risk rating across the four climate scenarios. Source: ADAS, 2025.

Colour	Risk scoring level
Dark green	Negligible
Light green	Minor
Yellow	Moderate
Orange	Major
Red	Severe

4.1.2 Risks to assets (including buildings and infrastructure)

Assets include buildings, infrastructure, and other physical items of value, such as vehicles, that are owned or operated by YNYCA constituent authorities. The proportion of risks to YNYCA constituent authorities' assets assigned to each risk rating across the four climate scenarios (2020s, 2050s under 2°C of global warming, 2080s under 2°C and 2080s under 4°C) are shown in Figure 23 .

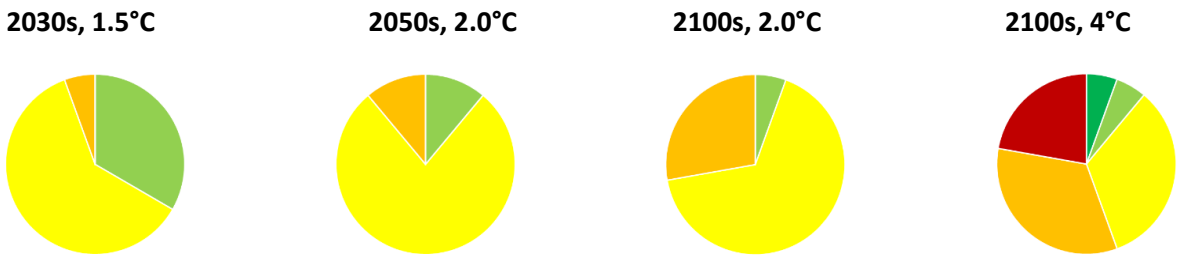

Figure 23. Proportion of risks to YNYCA constituent authority assets for each risk rating across the four climate scenarios. Source: ADAS, 2025

Key to Figure 22. Proportion of risks to the YNYCA constituent authority organisations for each risk rating across the four climate scenarios. Source: ADAS, 2025.

Colour	Risk scoring level
Dark green	Negligible
Light green	Minor
Yellow	Moderate
Orange	Major
Red	Severe

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The CCRA indicates that a wide range of climate-related hazards already present at least moderate risks to buildings, infrastructure and assets in the 2030s, with several projected to intensify markedly through the mid- and late-century under higher warming scenarios. The risk landscape is characterised by both the persistence of already material hazards, particularly flooding, and the growing influence of compound and coastal processes as climate change accelerates.

Flood-related risks are already among the most significant in the near term and remain consistently high across all time horizons. Fluvial flooding is assessed as a major risk from the outset and persists at this level across all scenarios, reflecting both the UK's exposure to river catchments and the projected increase in winter precipitation intensity. Surface water flooding and coastal flooding are also assessed as moderate in the 2030s, rising in severity in later decades, particularly under higher warming scenarios. This pattern reflects the growing likelihood of short-duration, high-intensity rainfall events, which overwhelm drainage systems and increase pluvial flood risk in urban areas, alongside rising sea levels that exacerbate coastal inundation and storm surge impacts.

The most pronounced escalation in risk is associated with compound hazards and coastal processes. Damage arising from compound flooding interactions, such as coincident river and surface water flooding, is already moderate in the 2030s but increases to major and then severe levels by the 2080s under higher warming pathways. This reflects a critical shift towards more complex hazard interactions, driven by saturated catchments, intense rainfall, and constrained drainage. Similarly, risks linked to sea level rise and coastal change intensify significantly over time. The loss of assets due to sea level rise and the impacts of coastal erosion both increase from moderate or minor levels in the near term to major or severe levels by the end of the century. This trajectory is consistent with accelerating sea level rise around the UK coastline, which increases baseline water levels and reduces the effectiveness of existing coastal defences, leading to greater exposure and more frequent exceedance of protection thresholds.

In low-lying and estuarine areas, risks associated with inundation and changing groundwater conditions also become more pronounced. While initially assessed as minor, these risks increase to major or severe levels by the 2080s. This reflects the combined influence of sea level rise, which can elevate groundwater tables, and prolonged wet periods, increasing the likelihood of subsurface water intrusion and structural instability. These processes are often less visible than surface flooding but can lead to chronic damage to foundations and buried infrastructure. Tipping points such as ice sheet collapse could cause catastrophic sea level rise though this is subject to significant uncertainty regarding environmental thresholds and time horizons.

Temperature-related risks are also evident but evolve differently. High temperature damage is already assessed as moderate and increases to major levels under higher warming scenarios. This reflects increasing summer temperatures and more frequent heatwaves, which can degrade materials such as asphalt, rail tracks and building components. By contrast, risks associated with extreme cold and freeze–thaw processes remain moderate in the near term but decline in severity under higher warming scenarios by the 2080s, reflecting a high likelihood of reduced frequency of cold extremes.

Other hazards demonstrate more stable or transitional risk profiles. Storms and high winds remain a consistent moderate risk, increasing to major under higher warming, suggesting a possible intensification of extreme weather systems. Drought-related risks to infrastructure are assessed as moderate across all time periods, highlighting the persistent challenge of soil desiccation, ground movement and water scarcity, particularly in regions with shrink–swell clay soils. Subsidence risk follows a similar pattern, increasing from minor to moderate and reflecting the interaction between prolonged dry periods and soil conditions.

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Overall, the CCRA points to a future in which the most significant increases in risk are driven not only by the intensification of individual hazards but by the growing interaction between them, particularly in coastal and flood-prone environments. The persistence of moderate to major risks across multiple hazard types in the 2030s indicates that adaptation is an immediate priority, while the escalation to severe risks later in the century underlines the importance of long-term, system-wide resilience planning that accounts for compounding and cascading climate impacts.

4.1.3 Risks to council operations/services

The proportion of risks to YNYCA constituent authority operations and services assigned to each risk rating across the four climate scenarios (2020s, 2050s under 2°C of global warming, 2080s under 2°C and 2080s under 4°C) are shown in Figure 24.

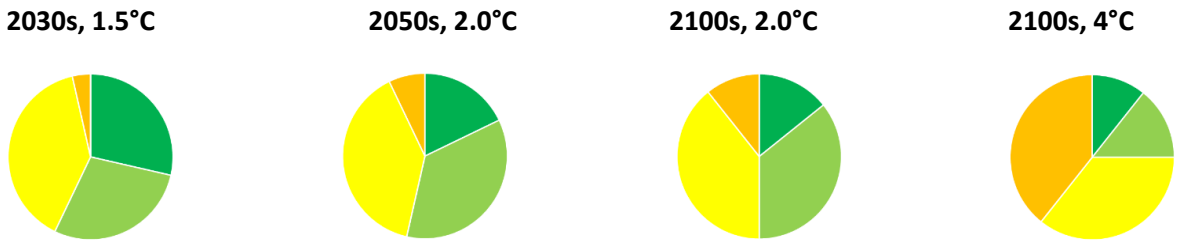

Figure 24. Proportion of risks to YNYCA constituent authority operations and services for each risk rating across the four climate scenarios. Source: ADAS, 2025

Key to Figure 22. Proportion of risks to the YNYCA constituent authority organisations for each risk rating across the four climate scenarios. Source: ADAS, 2025.

Colour	Risk scoring level
Dark green	Negligible
Light green	Minor
Yellow	Moderate
Orange	Major
Red	Severe

The CCRA indicates that climate-related risks to the delivery of Council services are already material in the 2030s, with a wide range of hazards assessed at moderate or major levels. The near-term risk profile is dominated by acute weather events, particularly flooding, alongside emerging system-wide pressures linked to supply chains, workforce disruption and increasing service demand. Even at this early stage, the breadth of moderate risks suggests that climate impacts are not isolated, but already affecting multiple service areas simultaneously.

Flooding stands out as the most significant and immediate driver of disruption, with major flood events assessed as a major risk in the 2030s and remaining so across all future time horizons. This reflects the central role of flooding in disrupting Council services, as it can affect buildings, transport networks, and critical infrastructure simultaneously, while also increasing demand for emergency response and recovery services. In the UK context, this is linked to observed and projected increases in winter rainfall intensity and the growing likelihood of events that exceed drainage and river capacity, resulting in widespread and prolonged disruption.

Alongside flooding, several other risks are already rated as moderate in the 2030s, particularly those linked to interconnected systems and indirect impacts. Disruption from acute cascading risks is notable, reflecting the increasing likelihood that single weather events trigger broader system failures. For example, storms or floods can simultaneously disrupt transport, power, communications and supply chains, amplifying their impact on service delivery. This growing interdependence between

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systems is a key feature of climate risk in the UK, where infrastructure networks are tightly coupled and often vulnerable to common hazards.

Supply chain disruptions are also already evident as a moderate risk in the near term. Both food supply chains, which underpin services such as schools and care provision, and wider non-food supply chains are vulnerable to climate impacts. These risks are driven not only by UK weather events but also by global climate disruption, affecting production, logistics and costs. The increasing frequency of extreme events internationally means that even local service provision is exposed to global climate volatility, with implications for reliability and affordability.

Workforce-related disruption is another important feature of the 2030s risk landscape. Moderate risks are identified where staff are unable to travel due to storms or snowfall, reflecting the continued potential for extreme weather to disrupt commuting and operational mobility. At the same time, risks to specific service functions, such as education transport and social care access, are also assessed as moderate, highlighting the sensitivity of frontline services to relatively short-term disruptions in transport and accessibility. Extreme heat has the potential to cause further workplace disruptions during summer as risks to staff are interlinked with council operations.

A number of risks relating to financial stability and service demand are already present in the 2030s. Loss of income due to extreme weather, for example through reduced use of council assets or business disruption, is assessed as moderate. Similarly, broader disruption to services including social care, education and public health is also moderate, reflecting both direct impacts and secondary pressures arising from extreme weather events. Disruption could relate to a range of hazards such as flooding causing damage to access routes or extreme heat limiting working hours of key personnel, etc. Extreme heat can cause discomfort and reduced productivity within care homes, schools and offices. Mortality in care homes also increases during extreme heat events, where appropriate cooling measures have not been implemented These effects point to an early emergence of financial and operational strain linked to climate variability.

Looking beyond the 2030s, many of these risks intensify through the 2050s and into the 2080s, with a shift from moderate to major severity becoming increasingly common. This escalation is particularly evident in areas where climate change amplifies underlying vulnerabilities or introduces new pressures. Supply chain risks, for example, increase as global climate impacts become more pronounced, while financial risks such as insurance costs and loss of revenue also rise as extreme events become more frequent and costly.

Demand-led pressures become more significant over time. Risks to public health services increase as heatwaves, changing disease patterns and extreme weather events place additional strain on systems. Similarly, climate-induced migration emerges as a significant driver of demand by the later decades, reflecting both domestic displacement and international population movements linked to climate impacts. These trends indicate a transition from managing discrete disruption events to addressing sustained increases in service demand.

Workforce risks also evolve. While disruption from cold-related hazards such as snowfall declines over time, reflecting a warming climate, risks associated with heat and unsafe working conditions increase. This shift highlights the changing nature of climate constraints on labour, with high temperatures affecting productivity, health and safety, particularly for outdoor and manual roles. Over time, this has implications for how services are delivered and resourced.

Infrastructure and transport-related service risks also grow in importance. Disruption to public transport provision increases from moderate in the near term to major in later decades, reflecting both direct damage to infrastructure and the increasing frequency of weather conditions that exceed operational tolerances. This has knock-on effects for accessibility, workforce mobility and the continuity of essential services.

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The full list of risks and risk rating scores are outlined in **APPENDIX 6 – YNY Organisational CCRA Scores**

4.1.4 Risks to staff

The proportion of risks to YNYCA constituent authority staff assigned to each risk rating across the four climate scenarios (2020s, 2050s under 2°C of global warming, 2080s under 2°C and 2080s under 4°C) are shown in Figure 25.

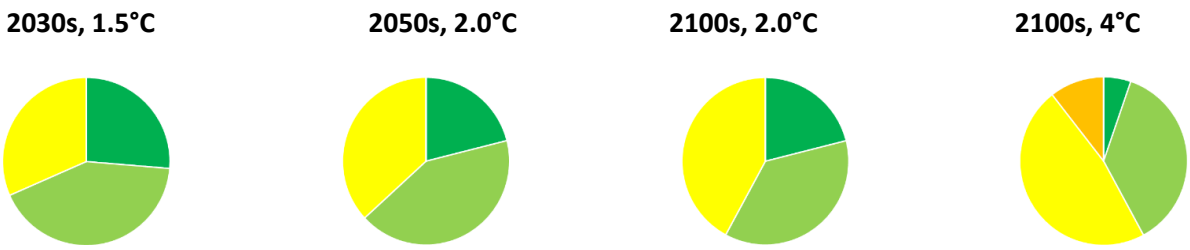

Figure 25. Proportion of risks to YNYCA constituent authority staff for each risk rating across the four climate scenarios. Source: ADAS, 2025

Key to Figure 22. Proportion of risks to the YNYCA constituent authority organisations for each risk rating across the four climate scenarios. Source: ADAS, 2025.

Colour	Risk scoring level
Dark green	Negligible
Light green	Minor
Yellow	Moderate
Orange	Major
Red	Severe

The CCRA indicates that climate-related risks to staff health, safety and wellbeing are already present in the 2030s, with several hazards assessed as moderate at this early stage. The near-term profile is characterised by exposure to cold conditions, flooding, and travel-related risks, alongside emerging pressures from a warming climate. While many risks are not yet severe, their breadth highlights that staff are already operating within a changing climate context that affects both day-to-day activities and emergency response conditions.

In the 2030s, cold-related risks remain among the most prominent. Both temporary and prolonged cold conditions are assessed as moderate risks for non-office staff, reflecting continued exposure to low temperatures, particularly for those working outdoors or in poorly insulated environments. This aligns with the UK's continued experience of winter cold spells, even as the overall climate warms. In addition, risks associated with snow and ice affecting staff travel are also moderate, indicating that winter hazards will continue to disrupt commuting and operational mobility in the near term. These risks are important because they directly affect workforce availability and safety, particularly for essential services that require physical presence.

Flood-related risks to staff are also already material in the 2030s. Direct health risks from river flooding are assessed as moderate, alongside risks associated with working near coastal environments. These findings reflect the increasing likelihood of high-flow events and coastal inundation, which can place staff in hazardous conditions, particularly during emergency response or maintenance activities. The persistence of these risks in the near term underscores the continued need for robust safety procedures and preparedness measures.

Beyond these more immediate hazards, a number of other moderate risks highlight the diverse ways in which climate affects staff. Risks associated with rockfalls and erosion, particularly in coastal or

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elevated environments, are already assessed as moderate, reflecting the influence of weather extremes on ground stability. These risks are likely linked to increased rainfall intensity and coastal erosion processes, both of which are projected to worsen under climate change. Similarly, risks to staff travelling for work, particularly due to icy conditions, demonstrate how climate hazards can affect not only work environments but also the journeys required to access them.

Looking forward, there is a clear shift in the nature of risks as warming progresses. Cold-related risks generally decline or stabilise, while heat-related risks increase in significance. Although heat stress is assessed as minor in the 2030s, it becomes moderate or major in later decades, particularly for more intense heat thresholds. This reflects the increasing frequency of hot days and heatwaves in the UK, alongside the limited prevalence of cooling infrastructure such as air conditioning in many workplaces. The result is a growing challenge to staff health, productivity and safety, particularly for outdoor roles or buildings not designed for high temperatures. Extreme heat could result in commuting disruption for staff (e.g., due to buckled rails and melted asphalt) and/or result in mandated school closures.

Flood-related risks to staff also intensify over time. Direct health risks from river flooding increase to major levels by the end of the century under higher warming scenarios, while surface water flooding risks also rise to moderate levels. This escalation reflects projected increases in the intensity of rainfall events and the likelihood of flash flooding, which can develop rapidly and pose significant risks to individuals in exposed locations. These changes suggest that flooding will become an increasingly important determinant of staff safety and operational planning.

Other emerging risks include those linked to wider environmental and health changes. Risks to staff mental health, negligible in the 2030s, become moderate by the 2080s, indicating the cumulative impact of repeated extreme weather events and associated stressors. Similarly, risks from climate-sensitive diseases and ecological changes increase over time, reflecting the northward spread of vectors such as ticks and the changing distribution of wildlife hazards. These risks illustrate how climate change affects not only immediate physical safety but also longer-term health and wellbeing.

Not all risks increase significantly. Some, such as those associated with extreme heat at the highest thresholds or wildfire exposure, remain relatively low across all time periods. However, their presence still indicates a broadening hazard profile that may become more relevant under specific local conditions or extreme scenarios. The persistence of moderate risks across multiple categories suggests that staff will face a complex mix of hazards rather than a single dominant threat.

Overall, the CCRA suggests that the 2030s represent a period in which heat and health-related pressures emerge. Over time, the balance shifts towards risks associated with higher temperatures, more intense rainfall, and broader environmental change. This evolution highlights the need for adaptive workforce planning and health and safety measures that can respond to both existing hazards and those that are expected to become more prominent as the climate continues to change.

The full list of risks and risk rating scores are outlined in **APPENDIX 6 – YNY Organisational CCRA Scores**

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4.1.5 Risks to protected landscape authority services/operations

Risks specific to services and operations of protected landscape authorities are provided in the relevant Appendix sections: APPENDIX 12 – Yorkshire Dales National Park and Nidderdale National Landscape Subsection and APPENDIX 13 – North York Moors National Park and Howardian Hills National Landscape Subsection.

4.2 Adaptive capacity assessment

4.2.1 Introduction

Adaptive capacity is the ability of systems, institutions, humans, and other organisms to adjust to or reduce potential damages, to take advantage of opportunities or to respond to consequences resulting from a hazard event. Adaptive capacity, therefore, refers to both the ability to a) plan and implement adaptation interventions based on expected future risks and b) to recover (and/or maintain existing operations) if and when damaging climate change events occur.

Understanding the existing adaptive capacity of an organisation is a critical area of knowledge to develop prior to developing an adaptation plan, as it highlights areas of existing strengths and weaknesses. This assessment sought to identify strengths and gaps in current capacity to inform future adaptation planning.

The adaptive capacity assessment undertaken in this study followed the principles of ISO 14091:2021, the international standard for adaptation to climate change.

4.2.2 Key findings

The assessment indicates that while organisations across York and North Yorkshire recognise the importance of climate adaptation, current adaptive capacity is insufficient to address the scale of projected risks. Key gaps remain in governance, funding, integration into decision-making and delivery capability. Without strengthening these areas, adaptation is likely to remain reactive rather than strategic, limiting the region's ability to build long-term resilience.

4.2.3 Adaptive capacity assessment approach

The ISO 14091:2021 standard identifies four key themes within adaptive capacity, which are described below. Understanding the adaptive capacity of the YNY authorities in the context of these four themes provides a useful breakdown of their relative adaptive capability.

1. **Organisational capacity**: the extent to which an organization can factor adaptation to climate change into their decision-making processes, identify and deliver meaningful responses, and monitor, update and improve responses over time. Organizational capability is a product of a number of interconnected factors.
2. **Technical capacity:** the extent to which existing or new technologies can contribute to enhancing the adaption to climate change in future. Technical capacity can be viewed as a component of organizational capability (above), but in some cases it is better to view these separately.
3. **Financial capacity:** the extent to which financial resources are available (and can readily be allocated without trade-offs) to fund the necessary adaptation actions. Financial capacity can be viewed as an integral component of organizational capability. However, it can be valuable to assess it separately.

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4. **Ecosystem capacity:** Ecosystem capacity refers to the ability of natural and managed ecosystems to adapt to the impacts of climate change. Human actions can either further strengthen or undermine ecosystem capacity. Ecosystem capacity is particularly relevant to organizations involved in natural resource management such as the agriculture, fishery, tourism and forestry sectors. Ecosystem capacity affects the provision of key ecosystem services on which humans depend (e.g. clean water, food, clean air, medicine). Enhanced ecosystem capacity can also mitigate climate change risks for organizations, for example through water retention in wetlands that can function as a natural barrier to floodwater. Adaptation can be facilitated through management (e.g. changes in crop species or variety) or occur without intervention (e.g. changes in length of growing period or wetland migration).

RSK adapted these themes based on our experience of adaptive capacity surveys and the specific requirements of the YNYCA Adaptation Study. As a local government entity that includes a large land area, a diverse and diffuse range of communities and several protected landscape authorities, stakeholder engagement will be a key element of adaptive capacity. This was therefore added as a theme to the adaptive capacity survey.

The themes adapted to the adaptive capacity survey included:

1. **Organisational capability:** to what extent is the necessary human capital available to achieve adaptive capacity.
2. **Governance:** To what extent do organisational governance systems and processes either increase (or reduce) adaptive capacity.
3. **Stakeholder partnerships:** to what extent are stakeholders available to support with adaptation and to what extent are they being engaged sufficiently to do so.
4. **Financial capacity:** to what extent are sufficient financial resources available for the required adaptation.
5. **Ecosystem:** to what extent are ecosystem services being maintained to support adaptation objectives.

The scope of the adaptive capacity assessment was aimed at a strategic level only. The assessment focused on the overarching governance processes, systems and other factors that influence adaptive capacity at the organisational level only. This adaptive capacity assessment was not focused on the adaptive capacity of the YNYCA constituent authorities to specific hazards, but rather to all climate-related impacts that are expected to negatively impact their organisation and objectives. The assessment did not assess capacity at the level of specific communities, localised areas or assets.

4.2.4 Adaptive capacity survey results

The RSK adaptive capacity survey included 21 questions related to understanding the adaptive capacity of the constituent authority organisations within the YNY region. These questions provided a qualitative assessment of components related to capacity survey and are referred to as 'capacity survey components' throughout this section. Please note that the survey responses reflect perceptions of adaptive capacity instead of a formal measurement of actual adaptive capacity.

Note: the AC components included within the survey do not all have the same influence on overall AC. As such the numeric figures provided to summarise these components do not provide a quantitative measure of AC. However, the AC components can provide a qualitative indicator of AC across the five themes.

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YNYCA

The YNYCA response indicated that its current governance system provides sufficient adaptive capacity across many of the 21 AC-related components included within the survey by RSK, based on present day climate change impacts and adaptation requirements. Of these questions, YNYCA rated itself as having at least 'Moderate' AC across 18 of the questions. However, of these 18 AC factors, YNYCA indicated that for 14 (77.78%) its current adaptive capacity programs could be augmented to maintain resilience under future climate change scenarios.

Areas to potentially enhance AC include accessing human resources regarding responses to unexpected climate events, growing internal adaptation expertise within the organisation, strategy-level commitments and stakeholder engagement with local Non-Governmental Organisations (NGOs). It is expected that these components will be enhanced through completion of the Adaptation Study.

The YNYCA has a range of statutory requirements and engages in other non-statutory activities. Statutory requirements such as the Office for Policing, Fire, Crime and Commissioning would mandate direct responses to some types of climate-related hazards (e.g., extreme weather resulting in emergency events). In other cases or types of hazards, the responsibility to respond to climate events may lie with other entities, such as central government. These factors affect the resources required by YNYCA with respect to adaptation responses.

City of York Council

The City of York Council (CYC) response indicates mixed AC across the five themes relative to present day climate impacts and indicates that changes are required to manage future risks. CYC indicated that their knowledge of flooding risks is higher than other climate-related hazards. This is particularly the case with respect to understanding when key climate hazards/risks could impact their operations

They also highlighted that a change in statutory responsibilities to include climate change adaptation would help to a) prioritise adaptation within the organisation and b) prioritise funding for adaptive interventions.

North Yorkshire Council

Based on present day climate change impacts and adaptive requirements, NYC indicates that it has 'Moderate' or 'High' adaptive capacity across all of the AC components within the Organisational Capability and Governance themes. NYC has at least 'Moderate' available support for adaptation from stakeholder groups including other government bodies, farmers/landowners, local NGOs and local communities. However, further engagement with local utility and business stakeholders to understand potential collaboration on climate adaptation objectives could be considered.

NYC indicated its organisation could benefit from further resource to accurately evaluate the benefits of adaptation measures against the costs. The organisation has the ability to mobilise adaptation funding once this budget has been allocated. In terms of ecosystem capacity, NYC has participated in river catchment management to reduce flooding and further investment in natural capital is being considered as part of the Local Investment in Natural Capital (LINC) programme (YNYCA, n.d.(b)).

The Howardian Hills and Nidderdale authorities are hosted by the NYC administration, though with separate management systems and committees. As a result, the adaptive capacity of these organisations is interlinked, and broader organisational resources could be shared.

National Landscape – Howardian Hills

The Howardian Hills authority notes that its capacity is broadly constrained due to a small team of just two full time employees. The authority indicated that further knowledge of future climate change impacts and updated governance processes are likely required to build out future adaptive capacity.

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The authority is engaging a range of stakeholders to help achieve resilience in the present day, including other government entities, farmers/landowners, NGOs and local communities. Further engagement with local utilities and business may yield further adaptive capacity. The authority expects that new models of stakeholder engagement will be required as climate change becomes more severe.

Ecosystems within the protected landscape are continuing to provide key ecosystem services under current climate change conditions and are being managed to enable resilience. However, it is likely that further management of ecosystems will be required to maintain and augment adaptive capacity in the face of worsening climate change.

National Landscape – Nidderdale

The Nidderdale authority believes its current governance models and processes can provide sufficient adaptive capacity given current climate change conditions. It relies on a range of different stakeholders to support its objectives, including farmers and local NGOs. However, a range of new knowledge and governance systems, plus additional resources, will be required to maintain this capacity as climate change worsens.

Ecosystems within the protected landscape are continuing to provide key ecosystem services under current climate change conditions and are being managed to enable resilience. However, it is likely that further management of ecosystems will be required to maintain and augment adaptive capacity in the face of worsening climate change.

National Park - North York Moors

The North York Moors authority's governance system is well placed to achieve its adaptation requirements, particularly for present day climate change impacts. However, it noted a need to collaborate with other stakeholders, especially other governmental bodies. Ecosystems are being managed to achieve present day adaptation requirements, though the authority believes it can further enhance ecosystem management to help alleviate future adaptation pressures as well.

National Park – Yorkshire Dales

The Yorkshire Dales authority indicates its organisational capabilities and governance systems are well designed to meet present day climate risk and adaptation pressures, though future risks will have to be carefully tracked to understand future adaptive capacity requirements. The authority indicates that further engagement could be required with key stakeholder groups to fully realise adaptation-related synergies and shared objectives.

Ecosystems are being managed to achieve suitable adaptive capacity relative to present day climate change impacts, however the scale of ecosystem management required to mitigate projected climate change impacts in the future is at present unknown.

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5 Adaptation

5.1 Adaptation progress

Adaptation activity is already underway across York and North Yorkshire, with a range of programmes being delivered by North Yorkshire Council, the City of York Council, the North York Moors National Park Authority and a range of partner organisations. Existing activity demonstrates a growing recognition of climate risks and provides an important foundation for future resilience-building. However, current efforts have largely evolved through individual organisational priorities, funding opportunities and sector-specific programmes rather than through a coordinated regional adaptation framework.

The region benefits from several established initiatives, particularly in relation to flood risk management, natural flood management, peatland restoration, woodland creation and wider nature recovery. North Yorkshire Council has embedded adaptation within its Climate Change Delivery Pathway, while the City of York Council has undertaken preliminary climate risk assessment work and invested significantly in flood resilience measures. Protected landscapes and environmental partnerships are also contributing to adaptation outcomes through landscape-scale restoration programmes. While these initiatives provide important resilience benefits, our review suggests that adaptation activity remains uneven across climate hazards and sectors with existing programmes concentrated on flooding, nature-based solutions and ecosystem restoration. At the regional level, there is currently no overarching adaptation strategy that aligns priorities, investment and delivery across administrative boundaries, river catchments and critical infrastructure systems. As a result, adaptation activity is best characterised as developing but fragmented, with varying levels of maturity across sectors and geographies. This creates a risk that adaptation responses remain reactive, project-based and insufficiently scaled to address future climate risks.

5.2 Sufficiency of Current Adaptation Programmes

The climate risk assessment for York and North Yorkshire identifies a diverse range of climate hazards affecting communities, businesses, infrastructure and the natural environment, with the severity and frequency of impacts projected to increase significantly over coming decades. To understand the region's current level of preparedness, existing adaptation programmes and initiatives have been assessed against the highest-priority climate risks identified within the Climate Change Risk Assessment (CCRA). The adaptation activities identified have been mapped against the key regional risks identified for 2030 to rate the sufficiency of current adaptation activity against the region's highest-priority climate risks

Ratings:

Good – comprehensive programme in place, evidence of delivery at scale, strategic coordination evident.

Moderate – some programmes and projects in place, but coverage is partial, localised, or not yet strategic.

Low – limited evidence of adaptation activity relative to the scale of risk.

Very Low – little or no evidence of adaptation-specific actions.

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Table 20 Sufficiency assessment

Key Regional Risk (2030s, 1.5°C GWL)	Existing Adaptation Activity	Sufficiency Rating	Commentary
Flood risk to people, communities, buildings and businesses	Foss Barrier upgrade, Ousewem, Slowing the Flow at Pickering, Long Preston Floodplain Project, York flood defence schemes, NYC Natural Flood Management (NFM) programme, NYC Strategic Flood Risk assessment, White Rose Forest activities	Moderate	Flooding is the most mature adaptation theme across the region. There is strong evidence of both engineered and nature-based interventions, partnership working, catchment-scale approaches and significant investment. However, future climate projections indicate increasing flood risk, suggesting continued expansion and maintenance will be required.
Wastewater and sewer flooding / pollution due to **heavy rainfall**	Green Infrastructure Policy, Sustainable Drainage integration in planning, NFM schemes reducing runoff	Moderate	Some indirect measures contribute to reducing peak runoff, but there is limited evidence of adaptation programmes specifically addressing wastewater network resilience, sewer capacity upgrades, or overflow reduction. Responsibility also sits largely with water companies.
Risk to finance, investment and insurance risks to businesses	Limited references to resilience planning; adaptation considered within council strategies	Low	There is little evidence of targeted programmes addressing climate-related insurance affordability, business continuity planning, investment resilience, or adaptation finance. This remains a significant gap given its Major risk rating.
Risk of **soil degradation, erosion and loss of ecosystem services**	Peatland restoration, Great North Bog, Ousewem, Long Preston Floodplain Project, Catchment Sensitive Farming links, woodland creation	Moderate to Good	Significant landscape-scale initiatives are underway that improve soil structure, water retention and ecosystem resilience. However, activities remain project-based and there is no overarching regional soil resilience strategy despite soil risk being identified as a major future concern.
Health and wellbeing impacts from extreme heat	York Green Streets, urban tree planting, Green Infrastructure Policy	Low to Moderate	Existing measures provide co-benefits through urban cooling and shading, but there is limited evidence of a coordinated regional

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Key Regional Risk (2030s, 1.5°C GWL)	Existing Adaptation Activity	Sufficiency Rating	Commentary
			heat adaptation strategy, heat-health action plans, cooling infrastructure, healthcare resilience planning, or identification of vulnerable populations. Given increasing future temperatures, this is a notable adaptation gap.
Transport disruption from cascading infrastructure failures	Some resilience benefits from flood management schemes	Low	There is little evidence of adaptation programmes specifically targeting transport network resilience, interdependencies between infrastructure systems, energy resilience, or climate-related service disruptions. This risk appears under-addressed relative to its significance.
Reduced public water availability due to drought	Peatland restoration, wetland creation and catchment management provide indirect benefits	Moderate	Existing programmes help retain water in landscapes, but there is little evidence of regional catchment planning or drought-resilient infrastructure. Yorkshire Water has a comprehensive statutory Water Resources Management Plan and Drought Plan. WRMP24 plans for resilience to a 1-in-500-year drought. However, at the regional level future drought risk appears insufficiently addressed.
Pests, pathogens and invasive species affecting habitats and biodiversity	Peatland restoration, habitat creation, biodiversity net gain, protected landscape restoration programmes	Moderate	Habitat restoration improves ecosystem resilience and adaptive capacity. However, there is limited evidence of regional targeted monitoring, surveillance or management programmes specifically focused on climate-driven pests, diseases and invasive species.

The sufficiency assessment becomes less favourable when viewed against future climate scenarios. While current programmes address many of today's risks, Table 2.12 shows that the proportion of risks rated Major or Severe increases from 8% in the 2030s to 55% by the 2100s.

Current adaptation activity is heavily concentrated on:

- Flood risk management;

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- Nature-based solutions;
- Habitat restoration;
- Green infrastructure.

These provide important "no-regret" or “low-regret” measures that deliver multiple benefits across flood management, biodiversity, water quality, soil health and carbon storage. However, there is comparatively limited evidence of long-term action planning for:

- Extreme heat and overheating;
- Water scarcity and drought;
- Infrastructure interdependencies and cascading failures;
- Economic resilience and business continuity;
- Climate-related insurance and finance risks;
- Public health preparedness;
- Supply chain disruption;
- Workforce resilience;
- Climate-driven pests and diseases;
- Wildfire risk (particularly relevant for moorland and peatland landscapes under higher warming scenarios).

Conclusion: While YNYCA draws on existing CYC and NYC climate strategies, the authority is looking to pursue greater integration, coordination and formalisation which would enhance the region’s overall adaptation framework. In particular, there is a need for an overall strategy that aligns activity across administrative boundaries, river catchments and other environmental systems. Without clear regional oversight, there is a risk of duplication, fragmented decision-making and inconsistent responses to shared challenges. Developing a YNYCA Climate Adaptation Strategy aligned with the work of catchment partnerships, National Parks, infrastructure providers, and the Authority’s own planning and drainage functions would strengthen resilience and address cross-boundary risks more effectively.

The assessment suggests that while current adaptation activity addresses some of today's climate risks, its sufficiency becomes less certain under future climate scenarios. The proportion of climate risks assessed as Major or Severe is projected to increase significantly, rising from 8% in the 2030s to 55% by the 2100s. Much of the current adaptation effort is concentrated on flood risk management, nature-based solutions, habitat restoration and green infrastructure. This highlights the need for a broader, multi-hazard adaptation approach. In addition, further work may be required to strengthen the social dimension of resilience, including more detailed mapping of vulnerable populations and their exposure to climate impacts. Enhancing community preparedness, public health planning, workforce resilience, and the understanding the of the affordability of insurance and financial protection mechanisms which would support the authority and local communities moving forward.

The following case studies highlight practical examples of how various partnerships in the YNY region are already putting climate adaptation and resilience into action. They demonstrate an ongoing programme covering a range of approaches to the key risks identified. Together, these examples show how both councils, now operating within the Combined Authority, are already delivering measurable benefits while building the foundations for a more climate-resilient region.

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5.3 Adaptation project case studies

These case studies have been grouped into three broad adaptation themes. The majority of current activity is focused on flood risk management and catchment resilience, reflecting the region's most mature area of adaptation practice. A second group demonstrates how nature-based solutions and green infrastructure are being used to improve urban resilience. A smaller number of projects focus on the resilience of critical infrastructure and vulnerable coastal communities. Together, these examples illustrate both the strengths of current adaptation activity and its concentration around a relatively narrow range of climate hazards.

5.3.1 Flood Risk Management and Catchment Resilience

Projects focused on enhancing green infrastructure, ecosystem services and climate resilience in urban environments.

Ousewem – Nature-Based Flood Management

The Ousewem project is an innovative partnership in York and North Yorkshire that uses nature-based solutions to reduce flood risk while supporting farming, biodiversity and climate resilience. Working across the Swale, Ure, Nidd and Ouse catchments, the initiative brings together farmers, landowners and organisations including Natural England, Yorkshire Dales Rivers Trust, JBA Consulting and the Environment Agency. Funded through Defra's £200 million Flood and Coastal Innovation Programme, the project focuses on holding and slowing water in the landscape by restoring natural processes rather than relying solely on engineered flood defences.

Through extensive landowner engagement and targeted mapping, Ousewem has identified priority areas for natural flood management (NFM) interventions. Completed and ongoing projects include wetland scrapes, tree and hedge planting, buffer strips, runoff-attenuation features and 'leaky dams' all of which slow the flow of water, increase storage capacity, and improve soil resilience. These measures not only help manage extreme rainfall but also create valuable habitat for species such as curlew, snipe and white-clawed crayfish.

Value creation:

Farmers have embraced the programme, with more than 20 schemes now in development. One example is in Wensleydale, where a newly created wetland scrape captures rainfall, reduces downstream flood risk and enhances wildlife habitat. Another project delivered 317m³ of additional water storage while improving soil structure and supporting sustainable grazing. In both schemes the works are fully funded and managed by the OUSWEM delivery team, reducing barriers for landowners. Ousewem also aligns closely with Catchment Sensitive Farming objectives, helping improve water quality and improving soil health and infiltration. The team are looking to expand the work and are exploring long-term funding options such as Countryside Stewardship Higher Tier to embed NFM within farm business models (Ousewem, n.d.)

Foss Barrier

The Foss Barrier is a key flood defence structure on the River Foss in York, England, designed to protect the city from flooding caused when high water in the River Ouse pushes water back up the Foss. The barrier consists of a retractable flood gate and a pumping station: when Ouse levels rise, the gate is lowered and high-capacity pumps transfer Foss water around the barrier into the Ouse to prevent water levels backing up and flooding urban areas.

On Boxing Day 2015, extreme rainfall and river flows overwhelmed the system. All pumps worked at full capacity, but water continued to rise. To avoid even greater flooding, staff raised the barrier, which

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did reduce risk but still resulted in over 600 properties flooding. An independent investigation was commissioned to understand how water entered the barrier building and to identify improvements.

Following this, the Environment Agency led a major £38 million upgrade, completed in 2022, boosting pumping capacity and improving resilience. As a result, around 2,000 homes and businesses in York are now better protected against future floods, and the facility is significantly more resilient to climate change-related risks (Environment Agency, 2016).

Value creation:

The upgrade represented one of the most significant climate adaptation investments in York and demonstrates the importance of adapting critical infrastructure to manage increasing climate-related flood risk. The £38 million enhancement programme substantially increased pumping capacity and improved the operational resilience of the barrier under newer more extreme river flow conditions. The enhanced protection reduces the likelihood and consequences of flooding in some of York's most vulnerable urban areas. Strategically, this project highlights the need for continual reassessment and upgrading of existing infrastructure as climate risks evolve.

Long Preston Flood Plain Project

Since 2004, a partnership of organisations including Natural England, Yorkshire Dales Millennium Trust, Ribble Rivers Trust, the Environment Agency, RSPB, North Yorkshire Council, and the North Yorkshire & York Local Nature Partnership has been working with local farmers and landowners to restore the historic Long Preston floodplain. Although the project area is entirely privately owned, the initiative has successfully integrated wetland and river habitat restoration into a productive and resilient farming landscape. This collaborative approach has created high quality habitats for wildlife while supporting a sustainable farm economy.

The project has also enhanced public access, enabling local communities to learn about grassland ecosystems, wildlife, and modern land management practices. Notably, 165 hectares of the floodplain are designated as the River Ribble (Long Preston) Site of Special Scientific Interest (SSSI), underscoring its ecological importance. (Yorkshire Dales Millennium Trust, n.d.)

Value creation:

Although a formal benefit-cost ratio has not been published, the Long Preston Floodplain Project demonstrates the long-term value of floodplain restoration as a multi-benefit adaptation measure. Over twenty years, the project has restored hundreds of hectares of wetland habitat while enhancing flood storage, supporting sustainable farming. The restoration of natural floodplain function, allowing water to be temporarily stored during high-flow events and slowing the movement of floodwaters through the catchment is not intended to prevent flooding entirely it helps reduce peak flows which can contribute to reducing downstream flood risk

Slowing the Flow at Pickering

The Slowing the Flow at Pickering project was a pioneering natural flood risk management initiative in the Pickering Beck and River Seven catchments in North Yorkshire. It was developed after repeated flooding in Pickering (notably in 2007) caused significant damage and aimed to reduce flood risk by working with natural processes rather than relying solely on conventional engineered defences. A multi-agency partnership the project was led by Forest Research and supported by Forestry Commission England, the Environment Agency, Durham University, Natural England, North York Moors National Park Authority, and local stakeholders. It was primarily funded by Defra as one of three pilot natural flood management initiatives. Key measures introduced were:

- Low-level bunds (to retain floodwater)

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- Tree planting (particularly along riparian zones and floodplains to enhance infiltration and intercept runoff)
- Restoration of woody debris dams in headwater streams
- Wetland restoration and other soil/vegetation measures that delay runoff movement.

Project impact was evaluated through the implementation and monitoring of these measures using mathematical modelling to forecast effects on flood frequency, alongside ongoing river flow monitoring to validate performance. The measures were found to be most effective when placed in the upper half of a catchment (with the exception of flood storage bunds).

Using central estimates for all assessed ecosystem services over a 100-year timeframe, benefit cost ratios in the Pickering Beck catchment ranged from 5.6 for woodland measures alone, to 3.8 for a combination of woodland, moorland and farm interventions, and 1.5 for the flood storage bunds. (Forest Research, n.d.)

Value creation:

The Pickering project was regarded as one of the UK's most influential natural flood management (NFM) demonstration schemes building the evidence base for catchment-scale adaptation. The strong benefit-cost ratios and partnership-led delivery model have made it a frequently cited example of how nature-based solutions can complement conventional flood defences while providing additional environmental benefits

5.3.2 Nature-Based Adaptation and Urban Green Infrastructure

Projects focused on enhancing green infrastructure, ecosystem services and climate resilience in urban environments.

York Green Streets

The York Green Streets initiative is a long-term programme designed to increase urban tree canopy cover and strengthen climate resilience across the city. With canopy cover measured at 10.8% in 2022, the City of York Council has set an ambitious target to raise this to 13% by 2050, including a commitment to plant 4,000 new trees in the urban area by 2028.

Trees planted through the initiative provide a wide range of environmental and community benefits. Beyond absorbing and storing carbon, new street and neighbourhood trees play a key role in helping York adapt to climate change. They cool the city through shade and transpiration, reducing the intensity of urban heat, and help manage surface-water flooding by intercepting rainfall and increasing infiltration into soils. The programme also boosts biodiversity, improves local wellbeing, and enhances the attractiveness of streets and public spaces.

Delivery has accelerated in recent years. During the 2023/24 planting season, 2,500 trees were planted across 13 sites including 10 schools, supported by external grant funding that also covers aftercare. A further 2,800 trees were added in 2024/25, with a strong focus on street trees and the creation of two 200-square-metre micro-woods to mark the coronation of King Charles III. (City of York Council, n.d.).

During the hot, dry summer of 2025, a number of trees planted as part of this programme died, highlighting the vulnerability of green infrastructure itself to climate change.

Value creation:

York Green Streets demonstrates how relatively low-cost, incremental interventions can deliver long-term adaptation benefits across an urban area. Although the benefits of individual tree planting schemes can be difficult to quantify in isolation, studies consistently show that urban trees provide high benefit-to-cost ratios when their full range of ecosystem services is considered, including reduced

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flood damages, lower heat-related impacts, improved public health and enhanced amenity value. Strategically, the programme illustrates how adaptation can be embedded within everyday urban management, delivering cumulative resilience benefits while supporting wider environmental and community objectives.

Green Infrastructure Policy

York Council is embedding green infrastructure in new developments in its approach to adapting to more intense rainfall events and rising urban temperatures. Green infrastructure is understood as a planned network of natural and semi-natural spaces that delivers multiple ecosystem services from improved air and water quality to climate regulation and enhanced biodiversity. In practice, this network includes woodlands and street trees, rivers and streams, parks and playgrounds, highway verges, allotments, farmland, private gardens, and the landscaped grounds of schools, hospitals and business parks.

By expanding and improving these assets, the council is strengthening the city's natural ability to cope with climate pressures. Trees and green spaces help cool overheated urban areas through shade and transpiration, reducing heat-stress risks during hotter summers. At the same time, permeable soils, vegetation and wetland features capture and slow water movement, lowering the likelihood of flooding during extreme storms.

To secure these benefits over the long term, York's Local Plan includes strong policies for protecting, enhancing and delivering green infrastructure as part of new development. The approach focuses on creating a connected, multifunctional network that supports wildlife, provides accessible green space for residents, and reflects the character of local places.

A key part of this strategy is the requirement for Biodiversity Net Gain (BNG). Under policy GI2 and the Environment Act 2021, new development must deliver at least a 10% measurable increase in biodiversity compared to pre-development conditions. This ensures that growth results in more — and better quality — habitat, contributing to resilient ecological networks that can buffer the city against climate impacts.

Through this combined approach, the council is using green infrastructure not only to enhance nature, but also to manage flood risk, cool the urban environment, and improve community wellbeing, creating a more climate ready city.

Value creation:

Strategically significant because it embeds climate adaptation within the planning system, ensuring that resilience is incorporated into future development rather than delivered solely through standalone projects. Unlike individual interventions, the policy has the potential to influence development across the entire city over the long term, creating a cumulative and lasting adaptation benefit. Cost-effective form of adaptation because many resilience benefits are secured through the development process itself, reducing the need for future retrofit.

5.3.3 Infrastructure and Coastal Resilience

Projects focused on protecting assets, communities and infrastructure from coastal climate impacts.

Runswick Bay

The coastline around Runswick Bay (9 miles north of Whitby, within the NYMNP) is underlain by soft Jurassic bedrock and glacial sediments, making it highly susceptible to coastal erosion and slope instability. Historical slope failures and wave action had increasingly undermined aging sea defences, notably the seawall constructed in the 1970s. Without intervention, an estimated 96 residential and 17 non-residential properties were at significant risk of loss due to erosion and structural failure of the

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seawall. A scheme was designed involving comprehensive works to strengthen existing structures and enhance their resilience, including:

- Repairs and concrete strengthening of the old seawall.
- Construction of a rock armour fillet at the toe of the seawall using over 10,000 tonnes of Norwegian granite boulders, designed to dissipate wave energy and reduce erosion.
- Innovative ecological features such as man-made rock pools and grooves carved into the armour to encourage colonisation by marine species and improve biodiversity.

Completed in early 2019 at a cost around £2.2 million, the coastal defence scheme now provides protection projected to last at least 100 years for homes, businesses, and infrastructure that would otherwise have been vulnerable to coastal retreat. It has also been recognised with an innovation award for its combined engineering and ecological design. (YORhub, 2019)

Value creation:

A significant long-term resilience benefit relative to the scale of investment, helping to avoid future property losses, infrastructure damage and disruption to the local economy. Strategically, the project illustrates the need for proactive adaptation in locations where climate change is expected to accelerate coastal erosion and highlights the value of combining engineered resilience measures with nature positive design.

5.4 Adaptation pathways

The York and North Yorkshire Combined Authority (YNYCA) and its constituent authorities recognise that building long-term climate resilience requires an understanding not only of current risks, but also how those risks may change over time and when existing policies, infrastructure and management approaches may no longer be sufficient. As part of this study, YNYCA and RSK have applied an adaptation pathways approach to support the early stages of adaptation planning for the region.

Adaptation pathways provide a structured approach to sequencing adaptation actions over time, allowing decision-makers to respond flexibly to uncertain climate futures. Rather than relying on a single fixed plan, adaptation pathways identify actions that can be implemented now, alongside decision points that indicate when additional measures may be required as climate risks increase or new information becomes available. This approach enables the region to avoid lock-in and maladaptation, while prioritising actions that remain effective across a range of future climate scenarios.

For decision-makers, adaptation pathways provide a practical framework for linking climate risk assessment with investment and policy decisions. They help identify where current approaches are likely to remain effective, where additional adaptation measures may be required in the future, and the conditions under which more significant intervention or transformational change may become necessary. This supports more informed long-term planning while retaining flexibility to respond to changing evidence and evolving climate risks.

The adaptation pathways approach has become increasingly established in climate adaptation planning internationally and is now being promoted for use by local authorities in England. In 2025, the Environment Agency and the Association of Directors of Environment, Economy, Planning and Transport (ADEPT) developed the Rapid Adaptation Pathway Assessment Toolkit (ADEPT, 2025), providing a practical framework for local authorities and partnerships to assess adaptation options and develop pathway-based approaches to resilience planning. For York and North Yorkshire, adaptation pathways provide a means of exploring how adaptation responses may need to evolve over time under different climate scenarios. They will help support decision making helping ensure that actions taken today do not constrain future options and remain aligned with the scale of future climate risks.

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5.4.1 RAPA Toolkit

This project utilised the Rapid Adaptation Pathways Assessment (RAPA) Toolkit, developed by the Association of Directors of Environment, Economy, Planning and Transport (ADEPT) in partnership with the Environment Agency (ADEPT, 2025), to explore how climate adaptation in York and North Yorkshire may need to evolve over time as risks increase.

As illustrated in Figure 26. The five steps required to develop rapid adaptation pathways highlighted

Figure 26. The five steps required to develop rapid adaptation pathways highlighted in dark purple, adapted from the British Standard on Adaptation Pathways' (BS8631) nine steps for developing full adaptation pathways. The full nine steps are available within the ADEPT RAPA toolkit. Source: ADEPT, 2025.

in dark purple, adapted from the British Standard on Adaptation Pathways' (BS8631) nine steps for developing full adaptation pathways. The full nine steps are available within the ADEPT RAPA toolkit. Source: ADEPT, 2025.the adaptation pathways process begins with an understanding of current and future climate risks before identifying adaptation options, evaluating thresholds and interdependencies. The process is iterative, allowing the pathways developed to be reviewed and adjusted as conditions change and new information becomes available. Applied at a regional scale, the assessment identified where existing adaptation measures are likely to remain effective, where additional intervention may be required, and where more transformational responses could become necessary under higher warming scenarios. It also highlighted opportunities for collaboration across

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local authorities, infrastructure providers, environmental organisations and other regional stakeholders, reflecting the cross-sector nature of climate risks.

Further information on the RAPA process is available in **APPENDIX 10 – Rapid Adaptation Pathways – Further Information**.

5.4.2 Thresholds

A key output of the adaptation pathways assessment was the identification of indicative thresholds and trigger points that can support future adaptation decision-making. Within this context, thresholds represent conditions under which climate impacts become significant enough that existing policies, infrastructure, services or management approaches may no longer provide an acceptable level of resilience. They provide a mechanism for determining when adaptation actions may need to be accelerated, expanded or replaced by more substantial interventions. The value of this approach is that it links climate risk monitoring directly to decision-making. Rather than implementing all adaptation measures immediately, organisations can monitor changing conditions and respond when predefined trigger points are reached. This supports more efficient investment, helps avoid maladaptation and enables adaptation actions to be scaled over time as risks increase. Indicative thresholds.

The RAPA approach developed as part of the YNY study was developed around high-level pathways at the regional and sectoral level. As they were not developed around specific assets or locations, and given the constraints of this assessment, it was not possible to develop specific and fixed thresholds. This is due to the heterogeneity of YNY in terms of geographic climate change risk exposure and vulnerability; a threshold which is relevant to one part of the region would likely not be relevant at different locations. There are also significant information gaps across the region which impedes the ability to accurately set pathway thresholds. Accurately setting regional or sectoral level thresholds would require detailed anaysis that goes beyond the scope and constraints of this study.

Indicative thresholds for each sector and impact covered in the RAPA workshops are outlined below each RAPA diagram in Section 5.6.

5.4.3 Approach

The YNY RAPA workshops applied a structured adaptation pathways methodology to support strategic planning for climate change across multiple sectors. The approach was designed to identify, prioritise and sequence adaptation actions over time, recognising uncertainty in future climate impacts and the need for flexible, proportionate responses. Each workshop was designed to focus on one thematic sectoral area:

- Infrastructure & Transport,
- Natural Environment and Farming;
- Business & Industry;
- Built Environment;
- Health & Communities; and
- An additional Interconnected workshop to explore cross-sector dependencies and synergies.

These were selected to align to national level climate risk and adaptation reporting programmes, and they approximately align to the YNYCA's priority sectors within its sustainability reporting.

The workshops focused on hazards that are already affecting the region and are expected to become more significant in future:

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- Flooding (all sectors);
- Drought (Infrastructure & Transport);
- General extreme weather (Natural Environment and Farming – relating to reduced agricultural productivity)
- Extreme heat (Business & Industry, Built Environment, Health & Communities); and
- Wider interconnected risks (standalone workshop focussing on a range of hazards and sectors).

Workshops focused on reviewing risks identifying actions and followed up with discussions on thresholds and triggers for action. Participants were asked to explore the conditions under which existing assets, services, policies or behaviours may no longer perform effectively, such as increasing flood frequency, prolonged drought conditions, extreme heat impacts on health and buildings, or capacity limits within infrastructure and emergency services.

importantly, this assessment highlighted that while regional indicators are valuable for strategic planning and prioritisation, adaptation decisions will also need to be informed by local circumstances. Regional measures of flood risk, drought severity or heat vulnerability can mask significant risks faced by individual communities, assets or infrastructure networks. As a result, future local adaptation plans should build upon these regional pathways by developing place-specific evidence, thresholds and actions that reflect local vulnerabilities and priorities.

Together, the pathways and associated thresholds provide a practical framework for guiding adaptation over time. They help translate the climate risk assessment into a phased programme of action, enabling decision-makers to prioritise investment, monitor emerging risks and adjust adaptation responses as conditions change.

5.5 Summary of RAPA workshops

A summary of the Rapid Adaptation Pathway Framework, which underpins the YNY Rapid Adaptation Pathways, is provided in APPENDIX 10 – Rapid Adaptation Pathways – Further Information.

5.6 Indicative rapid adaptation pathways and action plans

5.6.1 Introduction

The indicative actions set out below are built on the adaptation pathways identified during the RAPA workshops. When brought together within a strategy and action plan, they will define a high-level, indicative multi-hazard climate-adaptation programme for YNYCA. As a first step, the development of actions was guided by a review of general categories of action available (see Figure 27. An indicative overview of key adaptation action , helping to prompt a comprehensive and balanced suite of measures. This approach is particularly valuable when considering hazards such as flooding, biodiversity loss and strong winds, ensuring that the full range of potential responses is explored.

The actions identified through the workshops drew on participants' knowledge of current risks, observed impacts, and future scenarios. Participants were supported with guidance on the adaptive pathways approach and action types, enabling the identification of ongoing and future adaptation activity. It should be noted that several key actions recur across the sector workshops and do not align to a single sector alone. This repetition reflects the cross-cutting nature of adaptation, with many actions delivering multiple benefits and strengthening resilience across several sectors simultaneously.

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The adaptation pathways identified in the RAPA workshops provide indicative guidance only on the potential adaptive pathways that could be pursued by actors in the region across a range of sectors and hazards, with high-level estimates of adaptation benefits, timeline for implementation and costs. They include high-level estimates of potential adaptation benefits, indicative implementation timelines, and broad cost considerations. However, these pathways have not been subject to detailed feasibility assessments. Further technical and economic studies will therefore be required before formal adaptation pathways can be agreed for specific communities or assets.

The pathways below are indicative only and are intended to be updated by YNY stakeholders through as information changes and impacts materialise.

As the Council sets out and develops its key aims and objectives in preparing its adaptation strategy, these indicative pathways will help inform priorities and direction of travel.

The actions outlined below should be read in conjunction with the **Rapid Adaptation Pathway Framework** document that has been provided to the YNYCA separately.

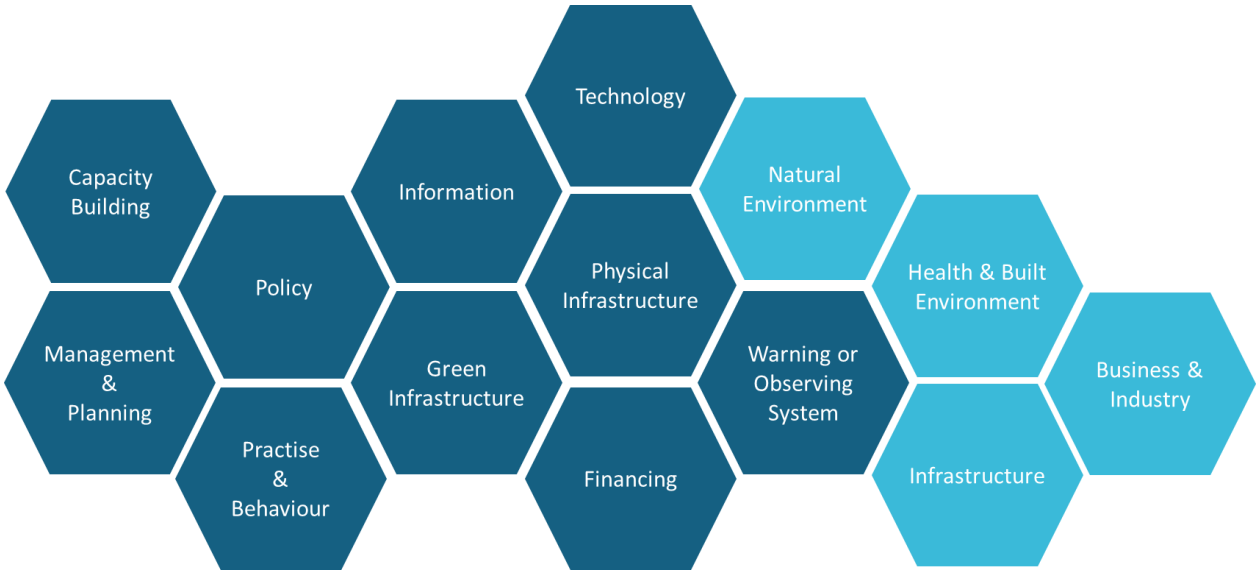

Figure 27. An indicative overview of key adaptation action categories or typologies.

5.6.2 Action planning summary

The York Climate Change Risks and Vulnerabilities Assessment (City of York Council, 2023c) identified actions to strengthen the integration of mitigation and adaptation within the Council's climate response. This included updating the action plan (City of York Council, 2024c) to clearly distinguish which actions address carbon reduction, climate adaptation, or both, ensuring that climate adaptation remains a core consideration in planning and delivery.

The RAPA outputs were incorporated alongside the York Climate Change Action Plan (City of York Council, 2024c), to create a consolidated list of adaptation and resilience actions. Based upon the workshop and carbon action plan priorities the immediate priorities focus on putting in place shared risk metrics and public-facing resources, strengthening Local Resilience Forum contingency arrangements, supporting and expanding community flood action groups, improving routine maintenance of drainage and critical assets, and driving early water-efficiency measures such as leakage reduction, behaviour change, rain/greywater reuse, permeable surfaces and Sustainable Urban Drainage Systems (SuDS).

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In the medium term, the emphasis shifts to scaling delivery through major flood defence schemes, updating strategic planning tools and policies (including SFRAs, development frameworks and mandatory SuDS), strengthening business continuity guidance and communications (including "York is open" messaging), and deepening catchment collaboration with farmers, landowners and partners to expand nature-based approaches such as hedgerows, agroforestry, soil improvement, upland storage, peatland restoration, river restoration and blue-green infrastructure.

Later-stage actions respond to higher levels of risk by progressing wider infrastructure and water network upgrades such as transfers, mains replacement and treatment capacity expanding both farm and public reservoir capacity, embedding updated climate allowances more consistently into planning and investment decisions, and strengthening critical infrastructure through mapping, redundancy and protection of key assets, including underground networks.

Final-stage measures are intended for situations where risks become unacceptable, and may include managed retreat or relocation from the most exposed locations, protection of high-value business assets, and more transformational water supply options such as large-scale transfers, new groundwater sources, or desalination where appropriate.

Across all phases (timescales), the Rapid Adaptation Pathway Framework includes multi group ownership of actions. There is a need for coordinated governance and delivery across the groups YNYCA, the Environment Agency, Yorkshire Water, Local Resilience Forum, local authorities, catchment partnerships and relevant sectoral organisations.

A summary of the Rapid Adaptation Pathway Framework, which underpins the YNY Rapid Adaptation Pathways, is provided in APPENDIX 10 – Rapid Adaptation Pathways – Further Information.

5.6.3 Natural Environment and Farming

The natural environment session focused on how climate change is already placing pressure on habitats and ecosystems. Stakeholders discussed issues such as increased wildfire risk during drought periods, declining river levels, and the vulnerability of certain species to changing conditions. The group highlighted the importance of nature-based solutions, better soil and water management, and coordination between existing environmental programmes. Key thresholds were linked to ecosystem degradation and loss of habitat functionality. Opportunities included expanding natural flood management, improving landscape connectivity and embedding ecological resilience into Local Nature Recovery Strategies.

Summary for Policymakers

The Rapid Adaptation Pathway Assessment highlights the need for early, coordinated action to strengthen the resilience of York and North Yorkshire's natural environment and farming systems as climate impacts intensify. A range of actions can be implemented as indicative trigger points and thresholds are reached.

- Drought is expected to have an increasing impact on agriculture due to rising temperatures, changing rainfall patterns, and growing water scarcity. These changes will place greater stress on both ecosystems and farming systems. Support programmes will primarily be developed by national level governments, however, YNY policymakers are recommended to lobby central government for further support, given the importance of farming and natural capital to the regional economy.
- To adapt to drought and support agricultural productivity, a range of pathway actions can be implemented when specific triggers or thresholds are reached. Monitoring indicators such as seasonal soil moisture levels and farm income can help initiate progressively stronger responses, ranging from low-cost resilience measures and knowledge sharing to large-scale water storage, irrigation infrastructure, and coordinated water abstraction planning.

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- Farmers and land managers are well-positioned to pursue nature-based solutions that can help the broader region to adapt to flood risks. This could include measures such as natural flood management, peatland restoration and tree planting (SuDS). The scale and extent of these interventions can be expanded as flood risk thresholds are reached, responding to the increasing risk to properties and infrastructure.
- Successful delivery will depend on coordinated planning, long-term investment, policy reform, and collaboration between stakeholders, including landowners, water companies, and local authorities. Clear monitoring frameworks and well-defined metrics and trigger points will be essential to ensure timely and effective action.

Agricultural Productivity

Strategic workshop insights

The workshop highlighted that climate risks to agricultural productivity are increasingly being driven by changes in the timing, intensity and distribution of rainfall, alongside rising temperatures and growing pressure on water resources. Stakeholders identified that both excess water and water scarcity are already affecting farm operations, reducing opportunities for planting and harvesting, increasing irrigation demand and creating uncertainty for long-term business planning. There was broad agreement that improving soil health, increasing soil organic carbon, enhancing on-farm water storage and adopting more resilient farming systems can strengthen resilience to both flooding and drought while supporting long-term productivity. However, barriers relating to planning policy, funding, skills and knowledge continue to constrain implementation. The discussion emphasised the need for greater collaboration between farmers, water companies, regulators and supply chains to support the transition towards more climate-resilient agricultural systems. Capacity building, demonstration projects and knowledge exchange were identified as important enablers, alongside integrated water resource planning and more flexible approaches to water storage and abstraction.

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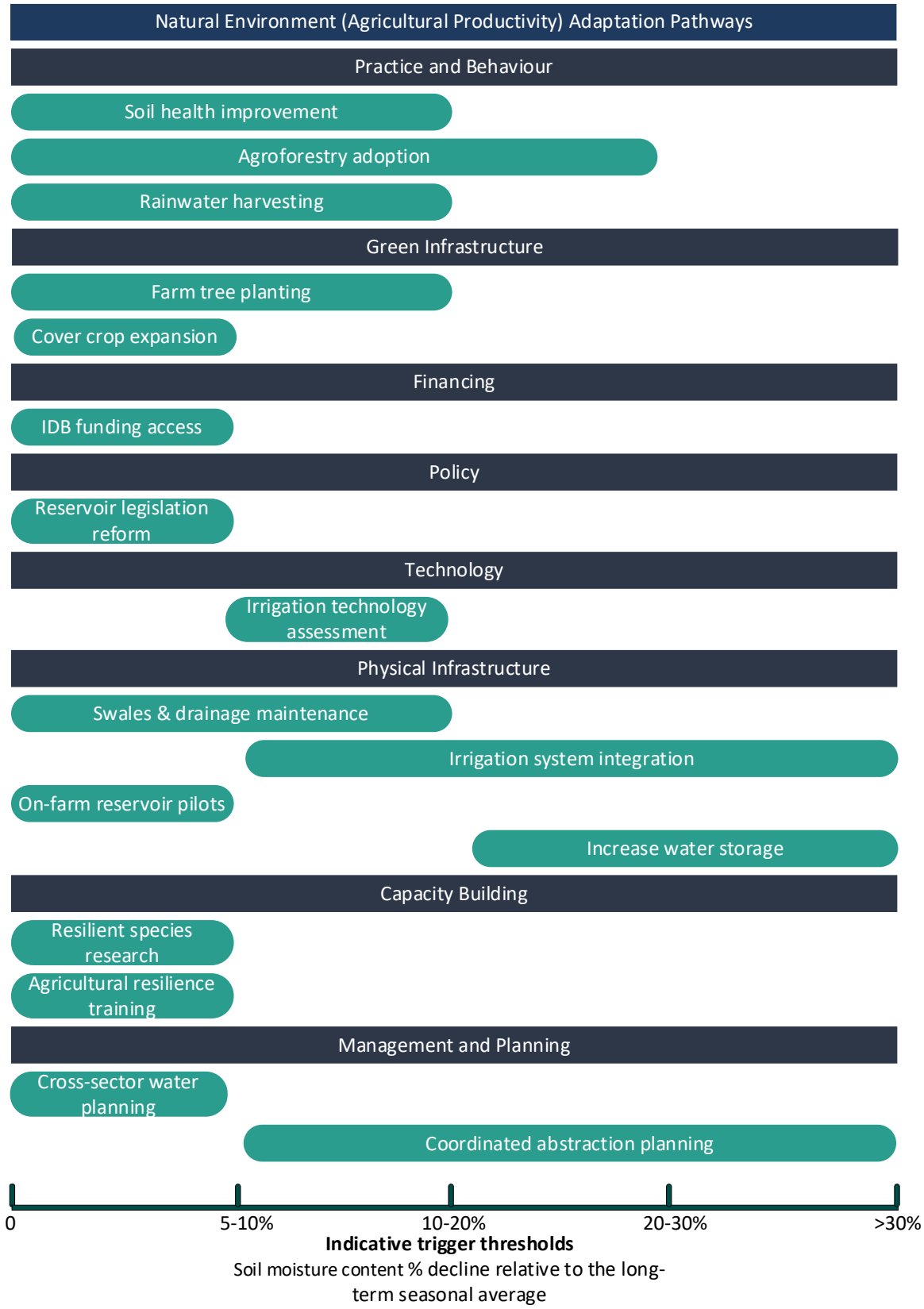

Figure 28 An indicative adaptation pathway for agricultural productivity in York and North Yorkshire. Developed through a Rapid Adaptation Pathway Assessment (RAPA) workshop, the pathway illustrates potential adaptation actions that could be implemented as climate pressures on farming increase. Actions are grouped by theme and positioned along an indicative adaptation scale based on increasing indicative threshold, representing escalating climate stress and the

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corresponding level of adaptation response required. The pathway is intended to support discussion and strategic planning and does not represent agreed policy or investment commitments. Priorities, trigger thresholds and implementation pathways will be refined through future adaptation strategies, monitoring of environmental indicators, and stakeholder engagement.

A range of measures can be pursued in the short-term to provide protection against climate impacts to agricultural productivity. Agroforestry adoption can help to shade farms from extreme heat and reduce evapotranspiration. Cover crops can enhance soil nutritional profile and structure, increasing the amount of water that can be stored in the soil. Planning and licensing restrictions around on-farm reservoirs at the national level are restrictive, both in terms of constructing the reservoirs and allowing farmers to sell water from their reservoirs to other farmers with water shortages. YNY stakeholders could therefore join lobbying campaigns that are pressuring national government to ease these restrictions. It is important these restrictions can be eased in the near-term so that reservoir construction can begin where they are needed to increase water storage during increasingly wet winters that can then be used during hotter, drier summers.

Capacity building will also be critical in the near term, to help cascade climate change resilience knowledge among farmers and their advisors at a relatively low cost. The identification of climate change resilient species that can thrive in the YNY region is also recommended, representing a relatively low-cost intervention that can quickly help farmers to continue to operate in an increasingly hostile condition. In the medium-term, if productivity continues to decline, enhanced irrigation technologies will need to be utilised and promoted while coordinated abstraction planning is also likely to be required.

Over the longer-term, the pathway switches to costly measures, which would only be required in the event that productivity declines severely. This includes a comprehensive roll-out of on-farm reservoir systems, potentially supported by larger reservoirs and a network of irrigation are potential options.

Indicative metrics / thresholds

Key thresholds for the sector were discussed, and later research indicated the monitoring of agricultural productivity and climate resilience could be supported through the tracking of key environmental and economic indicators, including long-term seasonal soil moisture trends and regional farm income.

Soil moisture data, such as volumetric water content from the COSMOS-UK monitoring network (COSMOS-UK, n.d.), could be used to identify emerging drought stress thresholds for example, sustained seasonal declines. These could trigger actions such as irrigation support, soil management interventions, or water resource planning.

DEFRA's regional Total Income from Farming datasets may also provide an economic indicator of the sector performance and resilience. Significant or sustained reductions in farm income relative to baseline averages may signal climate-related productivity impacts and the need for targeted support, adaptation programmes, or infrastructure investment.

Indicative soil moisture metrics for the pathway are shown in Table 21.

Table 21 Indicative seasonal soil moisture thresholds for agricultural adaptation pathway triggers in York and North Yorkshire thresholds and implementation pathways will be refined through future adaptation strategies, monitoring of environmental indicators

Position	Seasonal soil moisture threshold (example thresholds only for reference)	Interpretation

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Baseline conditions	Within ±5% of long-term seasonal average	Routine resilience measures
Emerging stress	5–10% below average	Early preventive action
Moderate stress	10–20% below average or repeated deficits for 2+ years	Expanded adaptation
Severe stress	20–30% below average	Storage / abstraction and irrigation planning
Extreme stress	More than 30% below average and outside historic variability	Large-scale water storage and irrigation systems

Flooding

Strategic workshop insights

The workshop highlighted that land management has an important role to play in reducing flood risk and enhancing resilience across catchments. Stakeholders identified significant opportunities to slow the flow of water through measures such as improving soil condition, increasing tree and hedgerow cover, restoring peatlands and wetlands, rewetting landscapes and implementing natural flood management interventions. These measures can deliver multiple benefits, including reduced downstream flood risk, improved water quality, enhanced biodiversity and increased resilience to drought. However, the discussion also highlighted challenges associated with aligning incentives, funding and decision-making across catchments, particularly where the costs of adaptation are incurred by land managers while many of the benefits are realised elsewhere. Delivering effective adaptation will therefore require greater coordination between landowners, farmers, water companies, local authorities and environmental organisations, supported by catchment-scale planning and long-term investment.

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Natural Environment (Flooding) Adaptation Pathways
Practice and Behaviour
Rainwater harvesting
Soil aeration
Improve livestock impact
Financing
Joint funding
Policy
Updated land-use policy
Green Infrastructure
Increase soil carbon
Landscape rewetting
Natural flood management
Peatland restoration
River restoration
Upper-catchment tree cover
Adopt agroforestry
Expand hedgerows
Capacity Building
Catchment partnership support
Agricultural training
Landscape partnerships
Farming collaboration
Physical Infrastructure
SuDS implementation
0 –2%
2–5%
5–10%
10 – 20%
> 20%
Indicative trigger thresholds
% increase in properties at higher risk

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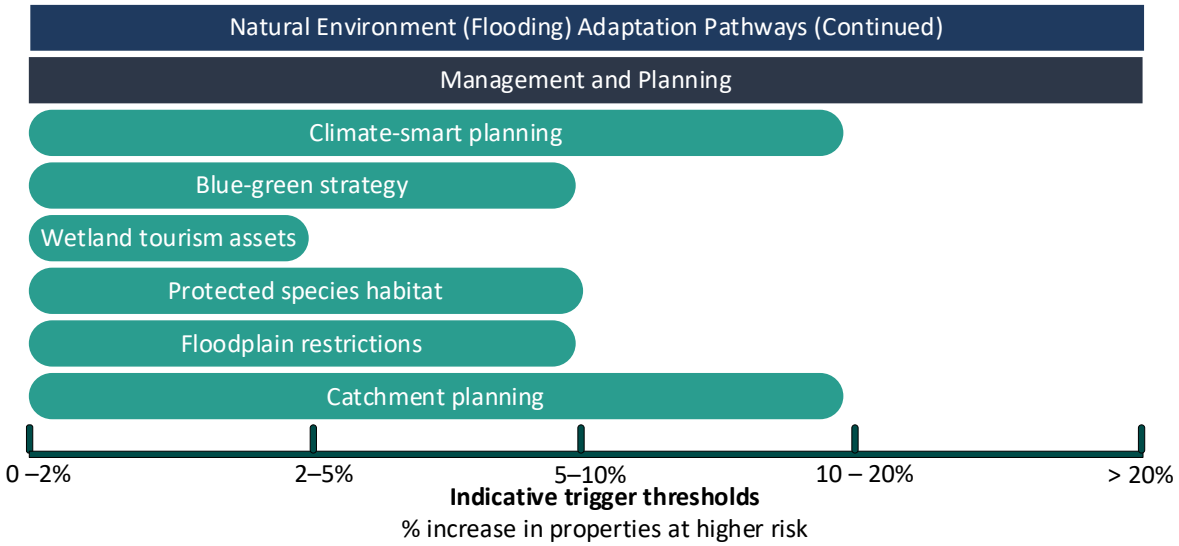

Figure 29 Indicative adaptation pathway for flooding resilience in the natural environment of York and North Yorkshire. Developed through a Rapid Adaptation Pathway Assessment (RAPA) workshop, the pathway illustrates potential adaptation actions that could be implemented as flood risk increases. Actions are grouped by theme and positioned along an indicative adaptation scale based on the increasing number of properties at higher flood risk relative to a baseline year representing escalating flood risk and the corresponding level of adaptation response required. The pathway is intended to support discussion and strategic planning and does not represent agreed policy or investment commitments. Priorities, trigger thresholds and implementation pathways will be refined through future adaptation strategies, monitoring of flood risk indicators, and stakeholder engagement.

Increasingly, land management decisions (such as rainwater harvesting, soil aeration and improved livestock management) are recognised as central to improving flood resilience across national and local policymakers. The use of nature-based solutions to reduce flooding is relatively low cost. Most interventions can therefore proceed in the short-term, though these have differing levels of effectiveness and utility as future thresholds are crossed.

As agricultural land dominates the YNY region, farmer-led measures are particularly relevant. Improved soil structure and reduced compaction can enhance infiltration and reduce rapid runoff during intense rainfall, which is expected to increase in frequency under climate change. To achieve their full impact this would need to be led and supported by incentive and advisory systems to help cascade knowledge and best practice across the region. The reliance on fully voluntary behavioural change risks under-delivery without clearer signals from policy and markets.

Financing and policy are identified as key enabling conditions, with joint funding mechanisms and the creation of a regional land-use framework featuring early in the pathway. This reflects an understanding that financing remains a barrier to large-scale natural flood management. In practice, delivering meaningful reductions in flood risk across YNY will require coordinated investment between environmental land management schemes, local authorities and flood risk management bodies. A land-use framework and flood conscious spatial development strategy, if effectively implemented, could help steer development away from flood-prone areas, while also supporting multifunctional land use in upland and rural areas that achieves a progress toward a range of objectives, including biodiversity and flood risk reduction. The pathway would benefit from a clearer articulation of how rapidly such policy reforms can be enacted and enforced, given the current pressures on the planning system.

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Green infrastructure forms the core of the pathway, with measures such as peatland restoration, river restoration, upper catchment tree planting, agroforestry and hedgerow expansion extending into the medium to longer term. This reflects the scale of transformation required across catchments such as the Derwent and Esk. Peatland restoration in the North York Moors and surrounding uplands is likely to be particularly important, given its potential to slow water flow, store carbon and improve water quality simultaneously. Similarly, river restoration and re-meandering can reduce flow velocities and reconnect floodplains, helping to attenuate peak flows before they reach vulnerable urban areas like York, which has experienced repeated flooding in recent decades. The pathway also includes landscape rewetting and natural flood management. The clustering of many of these actions at the same part of the pathway highlights the diversity of tools available to YNY stakeholders to reduce flood risk, but also highlights that further analysis is required to ensure the most effective are pursued where funding constraints exist.

Capacity building is recognised as a cross-cutting tool: catchment partnerships, agricultural training and landscape collaboration will likely be required as enablers. This reflects the reality that effective flood adaptation in this region depends on coordination across multiple landowners and institutions. Existing partnerships, such as Ousewem, provide a strong foundation, but scaling up delivery will likely require investment in skills, advisory services and local governance. The inclusion of farming collaboration is particularly important given the need to align economic viability with environmental outcomes; however, the pathway does not fully articulate how barriers such as short-term tenancy arrangements or market pressures will be addressed.

The role of more artificial infrastructure is limited to sustainable drainage systems (SuDS). These will be important in urban and built-up areas such as York in managing surface water flooding, which is likely to intensify with heavier rainfall events.

Overall, the pathways reflect a credible and increasingly accepted direction of travel, centred on catchment-scale management and nature-based solutions. However, their success in YNY will depend on the pace of policy reform, the scale and coordination of funding, and the ability to move from pilot-scale interventions to widespread adoption. Without stronger delivery mechanisms and clearer prioritisation, there remains a risk that the pathway will not keep pace with the accelerating impacts of climate change, leaving communities exposed to increasing flood risk.

Indicative metrics / thresholds

Key thresholds for the sector were discussed, with further research identifying the number of properties at risk from flooding as a key indicator of regional flood resilience. Data from the Environment Agency's flood risk assessments (Environment Agency, 2024a) can be used to monitor changes in the number of residential and commercial properties exposed to flood risk over time, providing an indication of when progressively more substantial adaptation measures may be required.

Table 22 Indicative number of properties at higher risk as thresholds for agricultural adaptation pathway triggers in York and North Yorkshire. Thresholds and implementation pathways will be refined through future adaptation strategies, monitoring of environmental indicators, and stakeholder engagement.

Position	Number of properties at higher risk (relative to baseline year)	Interpretation
Baseline conditions	0–2% increase in properties at higher risk	Routine resilience measures and continued monitoring
Emerging stress	2–5% increase in properties at higher risk	Early preventative action and catchment-based interventions

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Moderate stress	5–10% increase in properties at higher risk or multiple neighbourhoods newly classified at risk	Expansion of natural flood management, policy measures and partnership working
Severe stress	10–20% increase in properties at higher risk or repeated flooding across multiple communities	Major catchment restoration, widespread SuDS implementation and strategic investment
Extreme stress	More than 20% increase in properties at higher risk or widespread systemic flood risk across the catchment	Large-scale integrated flood risk management and transformative infrastructure investment

5.6.4 Business and Industry

Summary for Policymakers

The Rapid Adaptation Pathway Assessment for business and industry specifically looks at two climate hazards of flooding and high temperatures. There is a range of actions that range from practice and behaviour, infrastructure upgrades, and financing.

- There are thresholds of non-residential flooding which can trigger specific actions. This can range from early investment in property-level resilience, business support and flood protection schemes, and major infrastructure upgrades.
- Rising temperatures, drought, and wildfire risks are expected to cause increasing disruption to businesses, tourism, infrastructure, and cultural assets across the YNYCA region.
- The threshold for certain actions on high temperatures is shown to be number of days above 28°C. There are corresponding actions such as low-regret measures such as urban greening, water efficiency, and passive cooling.
- Adaptation pathways for businesses and industry should be monitored against clear trigger thresholds and embedded within long-term planning, investment and partnership working to enable adequate responses as climate risks intensify.

Flooding

Strategic workshop insights

The workshop identified that current flood risks are driven not only by exposure to flooding, but also by the vulnerability of businesses, communities and cultural assets to wider disruption. Economic impacts are often experienced through reduced accessibility, supply chain disruption, loss of visitors and prolonged recovery periods, highlighting the importance of considering indirect and cascading impacts alongside direct flood damages. Stakeholders highlighted challenges for historic buildings and cultural assets, where adaptation measures can be costly and difficult to implement. Improving resilience will require a shift from a predominantly response-led approach towards one that places greater emphasis on preparedness, adaptation and recovery. This includes strengthening community resilience, improving access to risk information, supporting businesses to understand and manage climate risks, and ensuring that resilience considerations are embedded within long-term planning and investment decisions. Such measures can help reduce future flood-related losses and support the resilience of local economies and communities under a changing climate.

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Business & Industry (Flooding River & Coastal) Rapid Adaptation Pathways
Practice and Behaviour
Flood action groups
"York Is Open" messaging
Financing
Funding guidance support
Property flood resilience
LRF adaptation support
Policy
Strategic adaptation planning
Flood protection schemes
Physical Infrastructure
Roads & bridges upgrades
Historic building maintenance
Gutter/drainage upgrades
Transport resilience measures
Infrastructure maintenance
Resilient storage facilities
Relocation (Managed Retreat)
Information
Flood Risk Adaptation Metrics
Real-time flood info
Inclusive communication
Capacity Building
Resilience investment partnerships
Business forum collaboration
Supply chain contingency
Extreme-weather planning
Resilience innovation support
Business recovery guidance
Flood-response Training
Contingency Planning
Guidance Packs
~2,700
~3,500 – 4,000
~5,000
~7,500
~10,000
Indicative trigger thresholds
Increase in high-risk non-residential properties

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Figure 30 Indicative adaptation pathway for flooding resilience within the business and industry sector in York and North Yorkshire. Developed through a Rapid Adaptation Pathway Assessment (RAPA) workshop, the pathway illustrates potential adaptation actions that could be implemented as the number of high-risk non-residential properties increases under a changing climate. Actions are grouped by theme and aligned with these indicative adaptation stages to support discussion of when different responses may become appropriate. The pathway is intended to inform long-term planning and does not represent agreed policy or investment commitments. The thresholds are indicative and should be refined through future climate risk assessments, adaptation planning and stakeholder engagement.

Most categories of adaptive intervention can be implemented in the near term to reduce flooding risk to business and industrial sites. Investing early in property flood prevention measures, such as on-site SuDS, is an important first step where a site is exposed to surface water flood risk, with the potential to achieve biodiversity co-benefits. Enabling finance will be key for businesses looking to invest in the resilience of their sites, which may be sourced from LRF funding or by developing guidance for businesses on other funding streams, such as central government grants.

Flood protection schemes will likely be required in the near-term for the most at risk areas, continuing into the medium-term as flood conditions worsen. This will require lobbying of government and regulators and engaging stakeholders who may block local measures, such as local landowners. With time, the pathway will transition to more significant physical infrastructure interventions, including linkages to Infrastructure and Transport in order to protect business access routes and ensuring suitable maintenance schedules for buildings, including clearing gutters and maintaining drainage. If conditions worsen beyond this point, managed relocation of business sites may be required, though this is a last resort due to the costs and disruption involved.

Indicative metrics / thresholds

Key thresholds for the sector were discussed and reviewed, including the point at which insurance becomes unaffordable, and flood depths disrupt business activity, together with the frequency of these events. The number of high-risk non-residential properties identified through the Environment Agency flood risk assessment (Environment Agency, 2024a) was selected as an indicative regional resilience metric. Indicative trigger thresholds for the pathway are shown below.

Table 23 Indicative number of high-risk non-residential properties used as thresholds for flood adaptation pathway triggers within the business and industry sector in York and North Yorkshire. These indicative thresholds represent progressively increasing flood risk, from routine resilience measures and monitoring under baseline conditions to transformational adaptation where flood risk becomes widespread and systemic. Thresholds and implementation pathways will be refined through future flood risk assessments, adaptation planning, monitoring of flood impacts, and stakeholder engagement.

Adaptation stage	Number of high-risk non-residential properties	Interpretation
Baseline conditions	~2,700	Routine resilience measures and monitoring
Emerging stress	~3,500–4,000	Early adaptation and targeted property-level resilience

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Moderate stress	~5,000	Expansion of flood resilience programmes and catchment interventions
Severe stress	~7,500	Major investment in flood protection and business resilience
Extreme stress	~10,000	Transformational adaptation and widespread systemic flood risk

High Temperatures

Strategic workshop insights

The second session examined the impacts of high temperatures, with the discussion widening to consider associated risks from drought and wildfire that have recently affected the region. Participants agreed that increasing temperatures pose an escalating risk to business and industry, leading to both immediate disruption such as recent wildfire incidents, road closures, and heatwaves experienced over recent summers and longer-term challenges, especially the severe. While the short-duration heatwave in 2022 had relatively limited impacts, the 2025 wildfire season required active management and placed stress on local resources; more frequent and prolonged heat events are expected to cause substantially greater disruption, worsening existing vulnerabilities. Over time, additional pressures including ecosystem degradation, water scarcity, and infrastructure damage are also likely to pose significant risks to business operations.

Water scarcity and increasing temperatures represent emerging economic and operational risks for businesses, communities and cultural assets, despite often receiving less attention than flooding. Stakeholders emphasised that resilience will depend not only on securing water supplies, but also on improving water literacy, managing urban heat, protecting green infrastructure and supporting businesses to adapt to changing environmental conditions. A key insight was that many adaptation measures deliver multiple benefits, including tree planting, rainwater harvesting, cool spaces and improved water management, which can simultaneously enhance business resilience, reduce urban heat island effects, improve public wellbeing and support environmental outcomes. However, the workshop also highlighted significant barriers, including limited funding, low awareness of adaptation opportunities and the tendency for businesses to prioritise immediate operational pressures over longer-term climate risks. The discussion reinforced the need for stronger communication, targeted business support and collaborative investment models that help organisations understand their climate risk exposure and implement practical adaptation measures.

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Figure 31 Indica Indicative adaptation pathway for managing high temperature, drought and wildfire risks within the business and industry sector in York and North Yorkshire. Developed through a Rapid Adaptation Pathway Assessment (RAPA) workshop, the pathway illustrates potential adaptation actions that could be implemented as the average annual number of days

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exceeding 28°C increases under a changing climate. Actions are grouped by theme and aligned with these indicative adaptation stages to support discussion of when different responses may become appropriate. The pathway is intended to inform long-term planning and does not represent agreed policy or investment commitments. The thresholds are indicative and should be refined through future climate observations, climate projections, adaptation planning and stakeholder engagement.

Tourism dependent businesses face growing long-term threats as increased wildfire activity, environmental degradation, and repeated access restrictions undermine visitor confidence. In urban areas, higher temperatures reduce visitor comfort, contributing to lower footfall during peak summer periods. Water-intensive sectors, such as hotels and visitor attractions, face increasing pressure from reduced water availability. Rising temperatures also worsen water scarcity and degrade river water quality, encouraging algal growth and harming biodiversity, with knock-on effects for tourism, recreation, and water-dependent businesses—particularly during prolonged heatwaves.

Higher temperatures further heighten the risk of subsidence, especially for older and heritage buildings. Many historic assets require costly adaptations to manage heat, humidity, and water stress, while museums and archive collections are particularly vulnerable to temperature and humidity fluctuations that could result in irreversible damage. Urban adaptation efforts are also constrained by the high costs and practical difficulties of tree planting in hard landscapes, compounded by limited availability of grant funding.

The group and identified a range of adaptation actions sequenced and combined over time as the various risk increases, moving from the low-regret, ongoing and near-term measures to a small number of more transformational interventions where risks and impacts become intolerable. Again, the aim was to focus on strengthening community, business, and visitor resilience through improved planning, communication, and contingency measures to reduce disruption, financial losses, and operational downtime.

Indicative metrics / thresholds

Climate projection data indicates the median number of fire danger days is projected to increase and within the workshop, key sector thresholds were discussed. Participants noting the duration of wildfire events and associated road closures had the most significant impact on local businesses and tourism during the 2025 incident. While Forestry Commission wildfire statistics for England provide unitary authority level data on wildfire frequency, duration, and area burned, this information could serve as a useful supplementary metric for monitoring impacts.

Annual climate reports provide authoritative data on the current and changing state of the UK's climate, which can be used to track trends over time. An annually updated and reliable source of evidence is the State of the UK Climate report (Kendon et al., 2025). This shows that, for Yorkshire, the number of days each year when the county's highest maximum temperature exceeds 28 °C averaged 4–6 days during the 1991–2020 period, increasing to 6–8 days in the 2015–2024 period.

Based on this trend, a useful indicative metric for assessing which phase we are at along the pathway is the average annual number of days in which the highest maximum temperature exceeds 28 °C, as outlined below.

Table 24 Indicative average annual number of days exceeding 28°C used as thresholds for heat adaptation pathway triggers within the business and industry sector in York and North Yorkshire.

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Thresholds and implementation pathways will be refined through future climate observations, adaptation planning, monitoring of heat-related impacts, and stakeholder engagement

Adaptation stage	Average annual number of days exceeding 28°C	Interpretation
Baseline conditions	~8 days	Routine heat preparedness, monitoring and awareness activities.
Emerging stress	~12 days	Early implementation of heat adaptation measures, including public awareness, operational planning and passive cooling.
Moderate stress	~14 days	Expansion of heat resilience measures, targeted protection of vulnerable people and infrastructure, and integration into asset management.
Severe stress	~16 days	Significant investment in heat-resilient infrastructure, urban cooling, workforce protection and emergency response capability.
Extreme stress	~18 days	Transformational adaptation, including redesign of buildings, public spaces and critical infrastructure to operate under sustained extreme heat.

5.6.5 Infrastructure and Transport

Summary for Policymakers

The Rapid Adaptation Pathway Framework highlights a strategic approach to strengthen the resilience of transport and infrastructure networks to increasing flood and drought risks, to help inform long term planning.

- There are indicative thresholds for when actions could take place, this includes responses are linked to increasing percentages of properties at higher flood risk, moving from routine resilience measures to transformational strategic infrastructure investment where flood exposure becomes widespread. For flooding, early measures include transport maintenance and community preparedness, before progressing to major infrastructure investment and integrated flood management.
- For drought management, there are several pathway actions. This includes integrated water management through demand reduction, water-efficient development, and leakage. Reduction. As water stress increases, responses should escalate from monitoring and efficiency improvements to major water supply investments.
- Overall, long-term planning, policy alignment and sustained investment are essential to manage interconnected climate risks across transport, water, energy and telecommunications infrastructure.

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Flooding

Strategic workshop insights

Stakeholders identified several vulnerabilities across the transport network and utility systems. These included landslips, unstable retaining walls, and the exposure of substations and powerlines to flooding. Short funding cycles were seen as a barrier to long-term planning, especially for infrastructure that relies on multi-year investment. The group also discussed drought-related issues, such as increased pipe bursts in hot weather, uncertainty around reservoir operations and impacts of low flows on wastewater treatment. Opportunities included strengthening water efficiency standards, aligning resilience work with Local Plans, and supporting renewable energy and storage projects that are designed with climate risks in mind.

During the workshops, Yorkshire Water stakeholders highlighted their catchment management plans as a central component of long-term water resilience in the region. These plans aim to ensure reliable and sustainable water supplies while adapting to the effects of climate change. Key actions included above were improving catchment condition through peatland restoration, natural flood management, and collaborative land management to enhance water storage and quality. This is complemented by their planned actions on infrastructure investment to reduce leakage, increase reservoir capacity, expand water reuse, and improve the flexibility of the water supply network.

The flooding workshop highlighted that the greatest climate resilience challenge is not identifying flood risks but securing the long-term investment, governance arrangements and partnerships needed to address them. Stakeholders demonstrated a strong understanding of existing vulnerabilities, including flood-prone transport corridors, coastal erosion impacts, landslide risks, infrastructure interdependencies etc. A key insight was that resilience should be measured not only by the number of properties protected, but by the ability of communities, businesses and critical services to remain connected and operational during flood events. The workshop also reinforced the importance of adopting a systems-based approach, recognising the interconnected nature of transport, energy, telecommunications and water infrastructure. Nature-based solutions, managed retreat, property flood resilience measures and improved community preparedness were identified as opportunities to deliver multiple benefits, while planning policy and long-term infrastructure investment were seen as critical mechanisms for embedding climate resilience into future development and infrastructure decisions.

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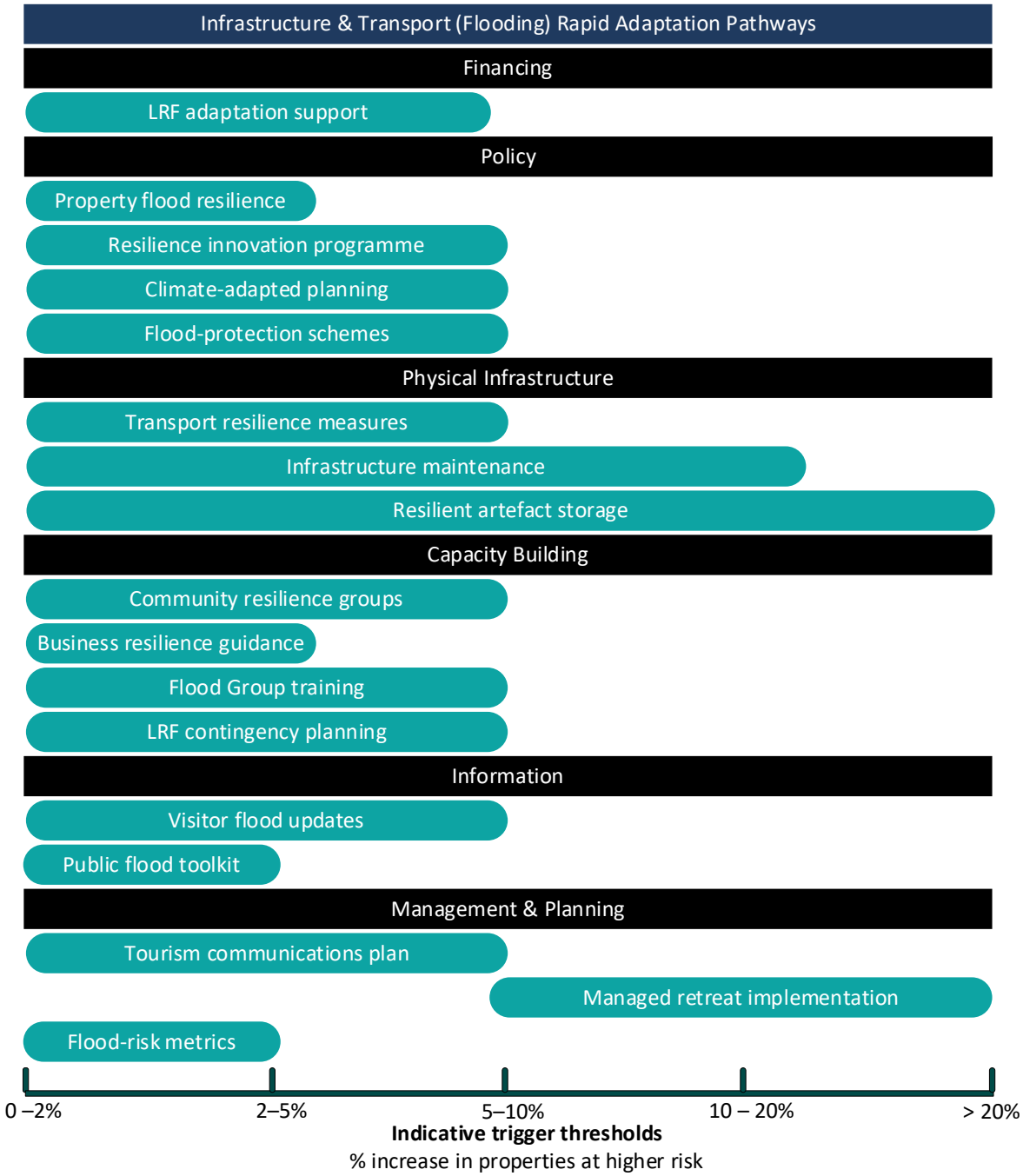

Figure 32 Indicative adaptation pathway for managing flood risks to infrastructure and transport systems in York and North Yorkshire. Developed through a Rapid Adaptation Pathway Assessment (RAPA) workshop, the pathway illustrates potential adaptation actions that could be implemented as the number of properties at higher flood risk increases relative to the baseline year. Actions are grouped by theme and aligned with these indicative adaptation stages to support discussion of when different responses may become appropriate. The pathway is intended to inform long-term planning and does not represent agreed policy or investment commitments. The thresholds are indicative and should be refined through future flood risk assessments, monitoring of properties at higher risk, adaptation planning and stakeholder engagement.

At lower levels of climate hazard, the pathway prioritises enabling actions that can be implemented at pace and relatively low cost. Early financing support through local resilience forum adaptation

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funding may provide preliminary financial resource, while policy measures such as property flood resilience, creating climate-adapted planning processes and pursuing flood protection schemes are positioned in the near term to create early resilience for present day flood risk. Property-level resilience, in particular, offers an immediate means of reducing damages, although its effectiveness depends on widespread uptake and appropriate standards. Similarly, embedding climate risk into planning decisions represents a critical early step, but one that has historically been inconsistently applied and therefore may limit its overall impact unless strengthened.

Developing suitable flood risk metrics to monitor damages and thresholds across the region is a critical initial step within the adaptation pathway, allowing for the rest of the pathway. Similarly, the tourism communications plan reflects the importance of managing public relations to conserve a key sector. Flood events in York have previously had significant implications for visitor confidence, and maintaining clear communication will become more important as events become more frequent.

Alongside policy, early investment in physical infrastructure focuses on maintaining and adapting existing assets. Transport resilience measures and infrastructure maintenance appear at relatively low thresholds, reflecting the pressing need to ensure that roads, rail and associated systems can withstand current levels of disruption. In North Yorkshire, where transport networks often traverse flood-prone valleys and rural areas, maintaining serviceability during flood events is essential for both economic continuity and emergency response.

Capacity building and information measures are likewise front-loaded in the pathway. Community resilience groups, business guidance, flood training and public communication tools are all positioned early, indicating that adaptation is not solely a technical challenge but also a social and organisational one. These measures are particularly important in dispersed rural communities across North Yorkshire, where local knowledge and preparedness can significantly influence outcomes during flood events. However, their effectiveness will depend on sustained engagement and support, rather than one-off initiatives.

As the climate hazard intensifies and thresholds are crossed, the pathway shifts towards more coordinated and systemic interventions. At this stage, the limitations of incremental adaptation begin to emerge. Existing flood protection schemes may become less effective as design standards are exceeded, and reliance on maintenance alone will be insufficient to manage rising risks. The persistence of measures such as resilient artefact storage and infrastructure upgrades across these thresholds suggests that certain assets will require ongoing adaptation rather than one-time solutions.

At higher levels of climate change, the pathway introduces more transformative responses, most notably managed retreat implementation. This represents a significant shift in approach, acknowledging that in some locations—potentially including parts of York's floodplain, the Selby area and the Vale of Pickering—continued defence may no longer be viable or cost-effective. The introduction of managed retreat at a later threshold reflects both its complexity and the social, economic and political challenges associated with relocation.

Indicative metrics / thresholds

Key adaptation thresholds for the infrastructure and transport sector were discussed during the workshop. Participants noted that, given the diversity of infrastructure systems and the absence of a consistent regional measure of impacts across transport, energy, water and telecommunications networks, a suitable proxy for increasing climate risk is the indicative percentage increase in properties at higher flood risk relative to the baseline year. This metric provides a common indicator of escalating flood exposure across the region and has therefore been used to define the indicative trigger thresholds within the adaptation pathway.

To complement this measure of increasing risk, the workshop also considered data published by the Environment Agency on the number of properties better protected from flooding (Environment Agency, 2024a). This indicator tracks the number of homes and businesses benefiting from new or

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improved flood defences, natural flood management measures and property-level resilience interventions, providing an important measure of adaptation progress. While this metric is valuable for monitoring the effectiveness of adaptation over time, the pathway itself uses the percentage increase in properties at higher risk relative to the baseline year as the primary trigger for progressing between adaptation stages.

Table 25 Indicative number of properties at higher risk as thresholds for infrastructure and transport adaptation pathway triggers in York and North Yorkshire. Thresholds and implementation pathways will be refined through future adaptation strategies, monitoring of environment.

Adaptation stage	Indicative trigger threshold (% increase in properties at higher risk relative to the baseline year)	Interpretation
Baseline conditions	0–2%	Routine resilience measures, continued monitoring, flood-risk metrics, visitor communications, community resilience activities and Local Resilience Forum (LRF) adaptation support.
Emerging stress	2–5%	Early preventative action through property flood resilience, flood group training, business resilience guidance, resilience innovation programmes and climate-adapted planning.
Moderate stress	5–10%	Expansion of adaptation measures, including transport resilience improvements, enhanced infrastructure maintenance, flood protection schemes, tourism communications and strengthened contingency planning.
Severe stress	10–20%	Major investment in resilient infrastructure, flood protection, heritage and artefact resilience, strategic planning, and coordinated catchment-scale adaptation.
Extreme stress	More than 20%	Transformational adaptation where flood risk becomes widespread and systemic, including integrated flood risk management, strategic infrastructure investment and, where necessary, managed retreat implementation.

Drought

Strategic workshop insights

The drought discussion highlighted a growing recognition that water scarcity is becoming an economic, infrastructure and planning issue, rather than solely a water resource management challenge. Stakeholders emphasised that the primary risk is an increasingly erratic water cycle, characterised by "the wrong amount of water at the wrong time", with periods of drought and intense rainfall becoming more common. This creates significant uncertainty for water resource planning, reservoir management and future infrastructure investment. A key insight was that future economic

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growth, housing delivery and emerging industries such as hydrogen production could become constrained by water availability if resilience is not strengthened. The session identified substantial opportunities to improve resilience through integrated water management, including demand reduction, water-efficient development, rainwater harvesting, sustainable drainage systems, soil restoration and landscape-scale water retention. Planning policy was viewed as a particularly powerful lever, enabling water scarcity considerations to be embedded into future development decisions and helping to ensure that growth can be accommodated without increasing long-term drought vulnerability.

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Infrastructure & Transport (Drought) Rapid Adaptation Pathways
Technology
Future resource modelling
Practice and Behaviour
Leak reduction measures
Water conservation incentives
Agricultural rain harvesting
Soil moisture enhancement
Behavioural water savings
Permeable surfaces promotion
Climate-smart farming
Green Infrastructure
Place-based renewables
Upland water storage
Landscape restoration
Financing
Water-efficiency incentives
Policy
Efficiency-linked incentives
Reservoir approval reform
Drought-resilient planning
Capacity Building
Raw-water transfers
Arid-region standards
Sustainable land partnership
Information
Water awareness campaigns
Management & Planning
Future resource modelling
1
2
3
4
5
Indicative trigger threshold
To be confirmed

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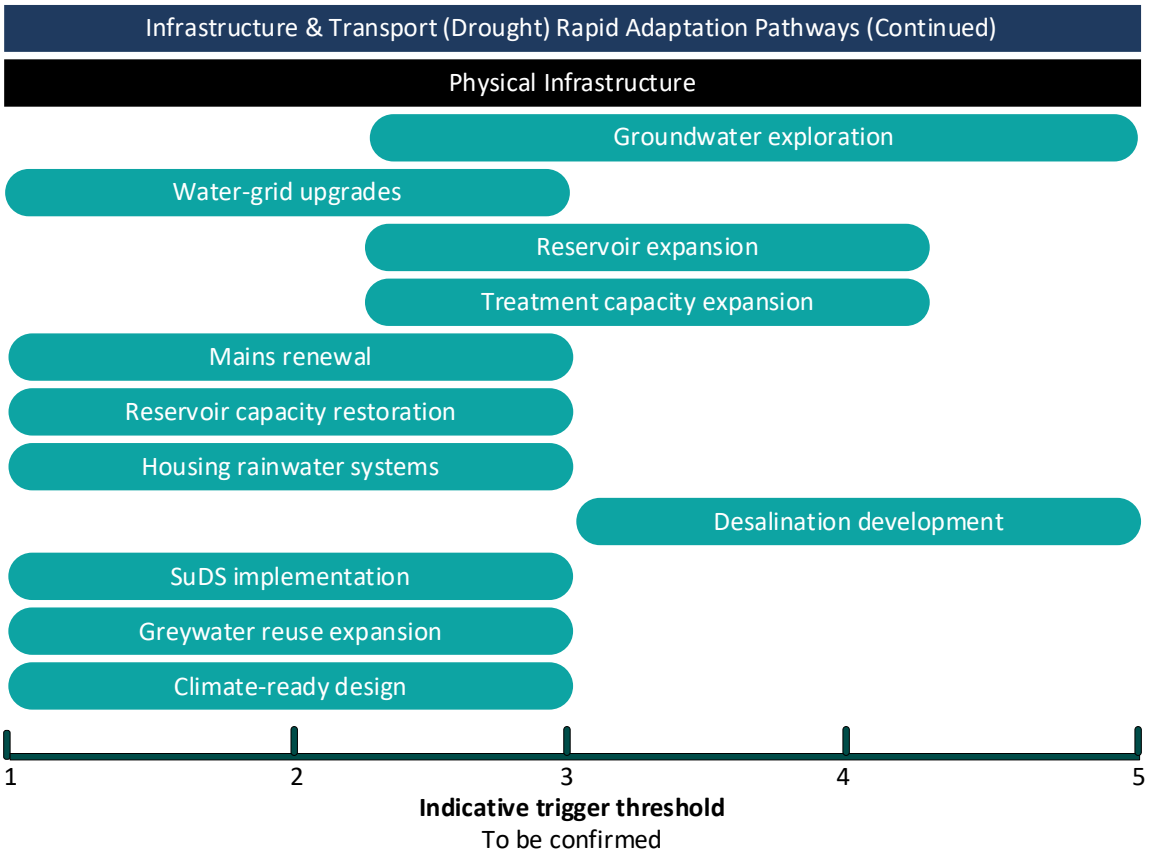

Figure 33 Indicative adaptation pathway for managing drought and water resource risks to infrastructure and transport systems in York and North Yorkshire. Developed through a Rapid Adaptation Pathway Assessment (RAPA) workshop, the pathway illustrates potential adaptation actions that could be implemented as drought and water resource pressures increase. A range of indicators should be monitored published by Yorkshire Water. Together, these metrics provide an indication of the resilience of the regional water supply system and the need for adaptation. The pathway is intended to inform long-term planning and does not represent agreed policy or investment commitments. The indicative thresholds and implementation pathways should be refined through future water resource planning, climate monitoring and stakeholder engagement.

Taken together, the drought adaptation pathways set out a comprehensive but demanding transition in how water is managed across infrastructure systems, land and communities. The pathways reflect a growing recognition that drought risk in regions such as YNY—historically considered relatively water secure—is likely to increase under climate change, with hotter, drier summers, greater variability in rainfall, and heightened pressure on both public water supply and agricultural systems. The sequencing places early reliance on efficiency, behavioural change and improved evidence, followed by more capital-intensive interventions and systemic reform.

At the outset, the pathway places considerable emphasis on improved modelling and information, recognising that a stronger understanding of future resource constraints is essential for effective planning. For catchments across North Yorkshire, from the uplands of the Moors and Dales to the lower Ouse basin, this is particularly important given the spatial variability in water availability.

Demand-side measures dominate the early stages and represent a critical foundation for resilience. Leak reduction, water conservation incentives and behavioural change are identified as near-term priorities, alongside agricultural measures such as rainwater harvesting, soil moisture enhancement and climate-smart farming. These are well aligned with the needs of the region, where agriculture is

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a major water user and where soil degradation and compaction can exacerbate both drought and flood risk. Enhancing soil water retention and reducing abstraction pressures can help buffer against increasingly frequent dry periods and reduce ecosystem damages. Experience suggests that voluntary behaviour change alone is unlikely to deliver the scale of reductions required without sustained incentives and regulatory backing. The latter may come in the near- or mid-term if the EA opts to mandate abstraction license reductions for farmers.

Green infrastructure plays a central role in the near and medium term, including upland water storage, landscape restoration and integrated land management. In North Yorkshire, this aligns strongly with opportunities to restore peatlands, rewet landscapes and create natural water storage in upland catchments. These measures offer multiple co-benefits, including improved water quality and biodiversity, but the pathway's timing suggests that delivery may be too slow relative to the pace of climate risk. Earlier and more widespread implementation would likely yield greater long-term resilience.

Policy and financing mechanisms are included within the pathway, including water-efficiency incentives, planning reform and lobbying central government for accelerated on-farm reservoir approvals. These are particularly important given the long lead times associated with new infrastructure. The pathway points to a necessary shift towards drought-resilient spatial planning, ensuring that growth in the region does not lock in unsustainable water demand.

If and when drought conditions become highly severe, the pathway switches to large-scale infrastructure and system integration. Measures such as reservoir expansion, water-grid upgrades, increased exploration / utilisation of groundwater resources and, ultimately, desalination and interregional transfers signal a move towards engineered resilience. While these may be necessary to meet future demand, they also introduce higher costs, environmental trade-offs and potential dependencies. In a region like North Yorkshire, which has traditionally relied on more localised water systems, this represents a significant shift.

Capacity building and partnerships are positioned as critical throughout, reflecting the need for coordination across sectors and geographies. Sustainable land management partnerships and the introduction of more stringent standards suggest a gradual tightening of expectations. Public awareness campaigns support this transition but are unlikely to be sufficient in isolation.

Overall, the pathways set out a credible but challenging trajectory, combining early efficiency gains with longer-term structural change. For York and North Yorkshire, the key risk lies in the pace of delivery. Without accelerated implementation particularly of nature-based solutions and demand reduction the region may face increasing water stress, with implications for ecosystems, agriculture and economic activity.

Indicative metrics / thresholds

Yorkshire Water's Water Resources Management Plan and Drought Plan use a range of indicators to monitor water resource resilience and inform both long-term planning and operational drought management. Key strategic metrics include Per Capita Consumption (PCC) and the Supply–Demand Balance (Ml/d). PCC measures the average daily water use per person and provides an indication of water efficiency and demand management, with lower consumption reducing pressure on water resources. The Supply–Demand Balance compares available water supplies with projected demand, providing an indicator of the resilience of the water supply system. A positive balance indicates sufficient capacity to meet current and future demand, while a narrowing or negative balance signals increasing pressure on water resources and the potential need for additional demand management, new water sources or infrastructure investment.

For operational drought management, reservoir storage relative to the Drought Control Line (DCL) provides a key trigger for escalating drought response. As reservoir storage approaches the DCL, they

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can progressively implement drought measures, including communications, demand management activities, Temporary Use Bans), and, where necessary, drought permits or orders. At a regional level, organisations should monitor these indicators alongside published Yorkshire Water updates to understand emerging water resource pressures and support coordinated adaptation planning.

Recommended indicators include:

- Per Capita Consumption (litres/person/day)
- Supply–Demand Balance (Ml/d)
- Reservoir storage (% capacity relative to seasonal average and proximity to the Drought Control Line)
- Leakage (Ml/d)

5.6.6 Built Environment

Summary for Policymakers

This Rapid Adaptation Pathway Framework for the built environment showcases the transitions that can be implemented, from routine adaptation measures to larger-scale, transformational resilience practices, in response to extreme heat and flood-related climate hazards.

- For extreme heat, the pathway uses an indicative metric of increases in excess heat-related mortality as a trigger for action, progressing from routine preparedness and monitoring to more significant interventions as risks escalate from emerging to severe and extreme levels.
- Key heat adaptation measures focus on scaling up passive cooling, urban greening, and cool public spaces in the near term, before progressing to widespread retrofit programmes, strengthened development standards, and active cooling solutions where conditions become more challenging.
- Increasing flood risk requires a shift from site-level resilience measures to catchment-scale adaptation, with pathways designed to support progressively stronger interventions as climate impacts intensify.
- Managing future flood exposure will depend on embedding resilience within planning strategies, expanding nature-based solutions, and strengthening collaboration between planning authorities, developers, and flood risk management authorities.

Across both hazards, the pathway framework provides a structured basis for linking climate risk thresholds to adaptation decisions, demonstrating when specific actions should be implemented as risks increase over time.

Extreme Heat

Strategic workshop insights

This workshop focused on planning, housing and the wider built environment. Participants raised risks relating to overheating in public buildings, the limitations placed on new housing by flood risk, and the backlog of maintenance in older assets. The group also noted the unintended consequences that can arise from retrofit measures if they are not designed well. A key challenge discussed was how to deliver housing that is both climate-resilient, low emission and affordable. The session also highlighted risks to cultural assets, the value of green and blue infrastructure, and the need for clearer resilience standards to support the Local Plan and the Combined Authority's wider development work.

The first session focussed on high temperatures and demonstrated that overheating is becoming a significant climate risk for the built environment and requires a more systematic response. Discussion

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highlighted that consideration of heat risk remains insufficiently embedded within planning policy, building standards and asset management practices, limiting the effectiveness of current adaptation efforts. Stakeholders also noted that the ability to pursue adaptation within buildings is constrained by national level regulations, such as UK building standards.

Passive cooling measures were identified as a low-regret adaptation response, with the potential to reduce overheating risks across a wide range of building types. Participants also highlighted the challenge posed by the existing building stock, where improving resilience will require substantial retrofit activity over the coming decades. Identified that public-sector assets provide value in supporting vulnerable populations during periods of extreme heat will be an important component of local resilience. Participants saw opportunities to strengthen the integration of heat resilience within future development standards, investment decisions and net zero retrofit programmes.

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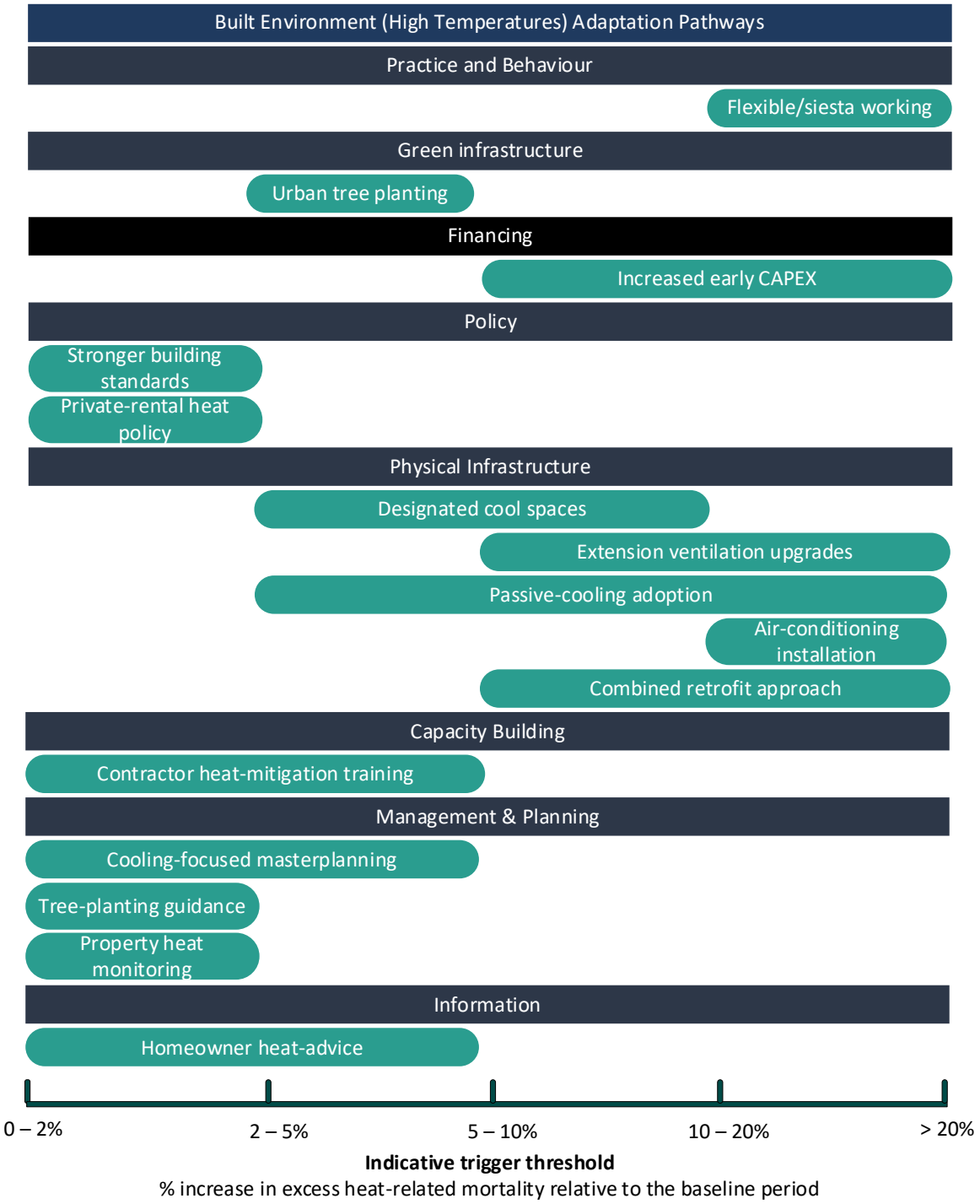

Figure 34 Indicative adaptation pathway for managing extreme heat risks within the built environment in York and North Yorkshire. Developed through a Rapid Adaptation Pathway Assessment (RAPA) workshop, the pathway illustrates potential adaptation actions that could be implemented as excess heat-related mortality increases relative to the baseline period. Actions are grouped by theme and aligned with these indicative adaptation stages to support discussion of when different responses may become appropriate. The pathway is intended to inform long-term planning and does not represent agreed policy or investment commitments. The indicative example trigger threshold is based on the percentage increase in excess heat-related mortality relative to the baseline period, this alongside other metrics should be refined through future climate observations, monitoring of heat-related health outcomes, adaptation planning, planning policy and stakeholder engagement.

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The pathway begins with practice and behavioural measures. Flexible working can reduce exposure to overheated transport systems and buildings, while also lowering peak energy demand. The inclusion of a “Water Me” scheme helps trees to be watered during extreme heat, reducing mortality and conserving the cooling effects they provide to buildings.

Green infrastructure is given a prominent role, particularly through tree planting strategies at both strategic and street scales. This is well aligned with the needs of urban areas such as York, where historic streetscapes and dense development can exacerbate the urban heat island effect and where planting is already underway. Expanding tree cover can provide shading, reduce surface temperatures and improve thermal comfort, while also delivering wider environmental benefits. The presence of urban tree funding highlights the importance of dedicated financial support to scale these interventions. However, the pathway suggests that while planning may begin early, full delivery extends over a longer timeframe, potentially delaying benefits in the face of near-term increases in heat risk.

Stronger policy signals, particularly around building standards and occupational heat risk, may be required to drive widespread change. This would likely require lobbying of central government.

The provision of cool public spaces is identified as an early- to mid-term intervention, reflecting the role of shared environments in protecting public health during heatwaves. In urban centres and larger towns across North Yorkshire, access to shaded and ventilated spaces will become increasingly important, particularly for vulnerable populations and outdoor workers. Passive cooling is recommended at a similar threshold as temperatures become more severe. If conditions continue to worsen, active cooling and widespread retrofits are likely to be required.

Capacity building and planning measures focus on upskilling workers on working in extreme heat conditions. This pathway originates in the early to medium term, reflecting their role in enabling faster response to extreme events.

Indicative metrics / thresholds

Key thresholds for heat resilience in the built environment were discussed during the workshop. Participants noted that there is currently no single, consistent metric used across the housing, planning, infrastructure and health sectors to measure the effectiveness of adaptation actions. Indoor temperature performance, measured as the proportion of homes, care facilities and public buildings able to maintain safe indoor temperatures (for example, below 26°C during heatwaves), was identified as a potential proxy indicator of regional heat resilience. To apply this metric effectively, a baseline would first need to be established through a representative survey of building types and vulnerable settings, enabling changes in performance to be monitored over time. This indicator would provide direct evidence of the effectiveness of measures such as passive cooling, improved ventilation, retrofit programmes, urban greening and enhanced building standards.

Currently, excess heat-related mortality is monitored nationally and provides an important outcome-based indicator of the overall effectiveness of adaptation in protecting public health. As it reflects the combined influence of building performance, urban design, public health interventions and community preparedness, it represents a useful example of an indicative trigger metric for the adaptation pathway. While the pathway uses the percentage increase in excess heat-related mortality relative to the baseline period to illustrate how adaptation responses may escalate over time, organisations should consider this alongside other relevant indicators, including indoor building temperatures, heat-health alerts, hospital admissions and the exposure of vulnerable populations.

The table outlines indicative trigger thresholds and associated adaptation responses for managing increasing heat risks within the built environment.

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Table 26 Indicative % increase in excess heat-related mortality used as thresholds for heat adaptation pathway triggers within the built environment sector in York and North Yorkshire. Thresholds and implementation pathways will be refined through future adaptation strategies, and monitoring of the environment.

Adaptation stage	Indicative trigger threshold (% increase in excess heat-related mortality relative to the baseline period)	Interpretation
Baseline conditions	0–2% (or consistent with the recent historical average)	Routine heat preparedness, continued monitoring, homeowner heat advice, property temperature monitoring, cooling-focused masterplanning and contractor heat-mitigation training.
Emerging stress	2–5%	Early implementation of adaptation measures, including urban tree planting, strengthened building standards, private-rental heat policies and passive cooling in new developments and refurbishments.
Moderate stress	5–10%	Expansion of heat resilience measures through designated cool spaces, passive cooling retrofits, enhanced ventilation, climate-ready urban design and increased investment in adaptation.
Severe stress	10–20%	Significant investment in heat-resilient buildings and neighbourhoods, including combined retrofit programmes, ventilation upgrades, urban greening and strengthened planning and policy interventions.
Extreme stress	More than 20%	Transformational adaptation to protect public health, including widespread deployment of active cooling where necessary, revised building standards, flexible working practices and long-term redesign of buildings and urban environments for sustained extreme heat.

Flooding

Strategic workshop insights

The second session participants highlighted that improving flood resilience requires action beyond individual sites and developments, with a greater focus on catchment-scale planning and coordinated adaptation. Discussion identified planning policy as a key mechanism for reducing future flood risk by influencing the location, design and resilience of new development. Participants also noted the importance of embedding flood resilience within future growth strategies to ensure that economic development and housing delivery do not increase exposure to climate hazards.

Nature-based solutions were recognised as an important component of adaptation, with the potential to deliver flood risk reduction alongside wider environmental and community benefits. Participants further emphasised the need for stronger collaboration between planning authorities, flood risk managers, developers and infrastructure providers to support more effective and joined-up decision-

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making. The role of YNYCA in providing strategic coordination was also highlighted, particularly through the development of the Economic and Land Use Framework and wider climate adaptation initiatives.

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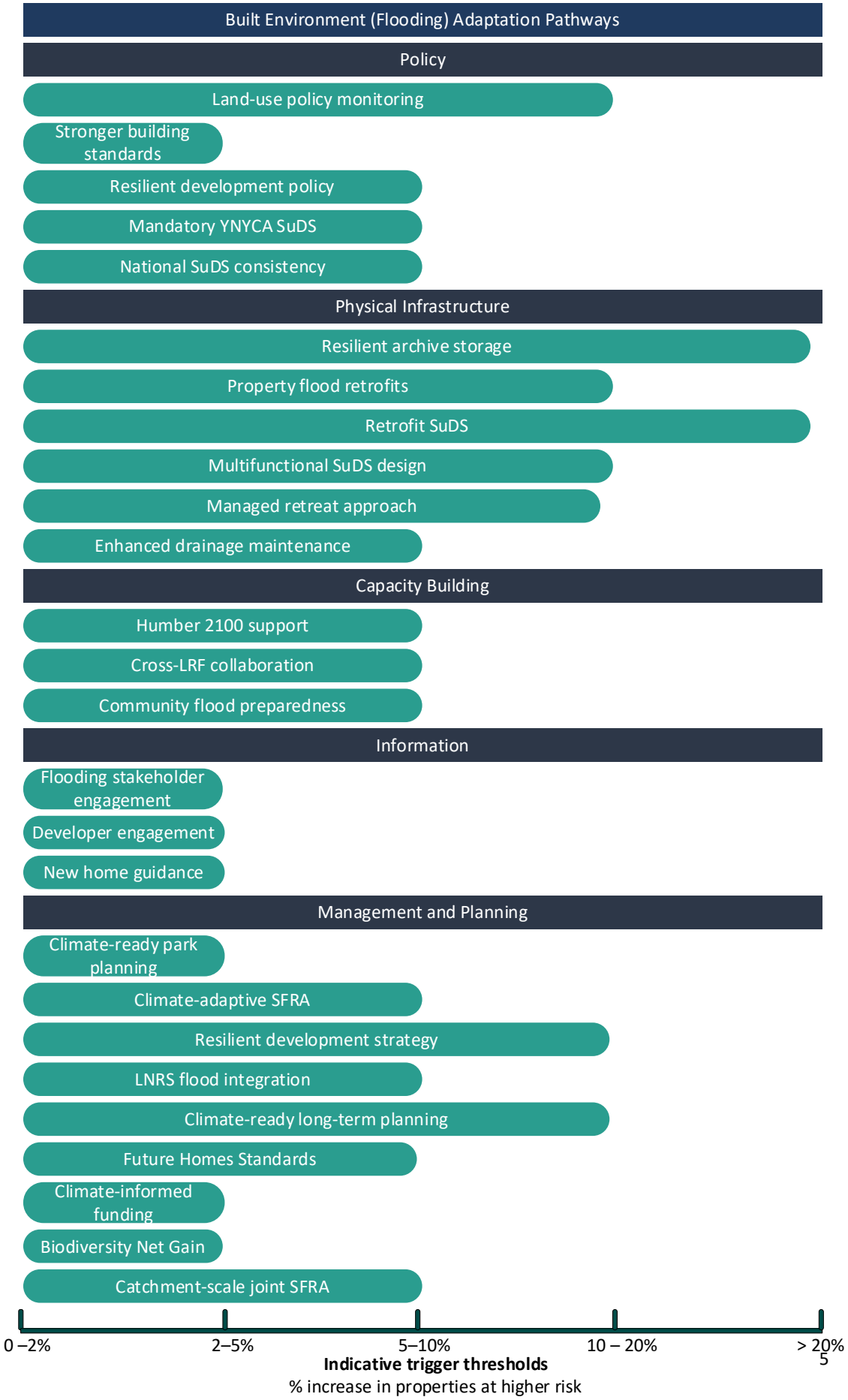
Built Environment (Flooding) Adaptation Pathways
Policy
Land-use policy monitoring
Stronger building standards
Resilient development policy
Mandatory YNYCA SuDS
National SuDS consistency
Physical Infrastructure
Resilient archive storage
Property flood retrofits
Retrofit SuDS
Multifunctional SuDS design
Managed retreat approach
Enhanced drainage maintenance
Capacity Building
Humber 2100 support
Cross-LRF collaboration
Community flood preparedness
Information
Flooding stakeholder engagement
Developer engagement
New home guidance
Management and Planning
Climate-ready park planning
Climate-adaptive SFRA
Resilient development strategy
LNRS flood integration
Climate-ready long-term planning
Future Homes Standards
Climate-informed funding
Biodiversity Net Gain
Catchment-scale joint SFRA
0 –2%
2–5%
5–10%
10 – 20%
> 20%
Indicative trigger thresholds
% increase in properties at higher risk

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Figure 35 Indicative adaptation pathway for managing flood risks within the built environment in York and North Yorkshire. Developed through a Rapid Adaptation Pathway Assessment (RAPA) workshop, the pathway illustrates potential adaptation actions that could be implemented as the percentage of properties at higher flood risk relative to the baseline year increases. Actions are grouped by theme and aligned with these indicative trigger thresholds to support discussion of when different adaptation responses may become appropriate. The pathway is intended to inform long-term planning and does not represent agreed policy or investment commitments. The indicative thresholds and implementation pathways should be refined through future flood risk assessments, monitoring of changes in the number of properties at higher risk, adaptation planning, planning policies and stakeholder engagement.

At lower thresholds, where flood hazards remain comparatively moderate, the pathway emphasises early action through setting a range of relevant standards, improving existing standards and capacity building. Measures such as prohibiting flood plain development, stronger building standards and putting in place mandatory sustainable drainage policies can limit flood damages. These actions are complemented by a range of initially light-touch physical interventions, including enhanced drainage maintenance, retrofitting at risk properties with initial sustainable drainage systems.

In parallel, efforts to build local capability—through community flood preparedness, Humber-region coordination, and stakeholder engagement—play a critical role in reducing vulnerability. For York and North Yorkshire, where historic urban form and dispersed rural settlements create varied exposure, this early phase is particularly important in embedding resilience within planning decisions while risks remain manageable.

As hazard thresholds increase to more pronounced levels, the pathway indicates a transition to more coordination- and capital-intensive interventions. Physical measures expand to include widespread property flood retrofits, multifunctional drainage systems, and integrated water management approaches. These are likely to be designed not only to manage floodwaters but also to deliver co-benefits for biodiversity and urban quality. At this stage, improved collaboration between local authorities, developers and communities becomes essential, alongside clearer guidance for new developments and stronger alignment with emerging standards such as Future Homes Standards.

At the highest hazard thresholds, representing severe and highly disruptive flood conditions, the pathway transitions to more significant interventions. Measures such as managed retreat and large-scale resilient infrastructure become necessary as existing systems approach or exceed their limits. Financing mechanisms also evolve, requiring sustained, climate-informed investment to support large-scale adaptation. In parts of North Yorkshire, where river catchments and rural floodplains play a critical role in downstream risk, these approaches would likely involve reconfiguring land use, restoring natural flood management functions reconsidering the viability of continued development in the highest-risk areas.

Indicative metrics / thresholds

Key sector thresholds for flood resilience within the built environment were discussed during the workshop. Participants noted alignment with the Natural Environment RAPA, which identified the percentage increase in properties at higher flood risk relative to the baseline year as a suitable regional indicator of increasing climate risk. As this metric provides a consistent measure of flood exposure across communities and the built environment, it was adopted as the indicative trigger metric for the adaptation pathway.

The workshop also recognised the importance of complementary indicators, particularly the number of properties better protected from flooding, reported through the Environment Agency flood risk assessment (Environment Agency, 2024a). While the percentage increase in properties at higher risk provides an indication of the scale of climate exposure and is used to define the adaptation stages

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within the pathway, the number of properties better protected reflects the effectiveness of adaptation measures such as flood defence schemes, natural flood management, sustainable drainage systems (SuDS) and property-level resilience interventions. Together, these metrics could provide a balanced assessment of both increasing flood risk and the success of adaptation actions over time. For the RAPA diagram above the table below outlines the example metric.

Table 27 Indicative % increase in properties at higher risk relative to the baseline year as thresholds for built environment adaptation pathway triggers in York and North Yorkshire. Thresholds and implementation pathways will be refined through future adaptation strategies, and monitoring of the environment.

Adaptation stage	Indicative trigger threshold (% increase in properties at higher risk relative to the baseline year)	Interpretation
Baseline conditions	0–2%	Routine flood resilience measures, stakeholder engagement, climate-ready planning, stronger building standards and continued monitoring of flood risk.
Emerging stress	2–5%	Early implementation of adaptation measures, including resilient development policies, mandatory SuDS, enhanced community flood preparedness, developer engagement and climate-adaptive strategic flood risk assessments.
Moderate stress	5–10%	Expansion of flood resilience through property flood retrofits, multifunctional SuDS, enhanced drainage maintenance, resilient development strategies, catchment-scale planning and increased cross-sector collaboration.
Severe stress	10–20%	Significant investment in resilient infrastructure and flood adaptation, including retrofit SuDS, resilient archive storage, integrated long-term planning, climate-informed funding and strengthened partnership working across catchments.
Extreme stress	More than 20%	Transformational adaptation where flood risk becomes widespread and systemic, including managed retreat where appropriate, long-term land-use change, strategic catchment-scale flood management and major investment in resilient communities and infrastructure.

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5.6.7 Health and Communities

Summary for policymakers

For health and communities, the Rapid Adaptation Pathway Assessment highlights how the health and safety of the YNY population can be maintained in the face of increased flooding and extreme heat as a result of climate change.

- For flooding, the indicative metric used to identify when adaptation measures may need to be implemented is the increasing flood risk to high-risk non-residential properties. A wide range of actions can be taken, spanning behavioural change, governance, financing, planning, and infrastructure interventions.
- Flood adaptation actions can evolve from preparedness measures, strengthened governance, and flood-proofing of critical facilities to resilient power supplies, coordinated multi-agency planning, and infrastructure retrofitting in response to major flood events.
- For extreme heat, as with other sectors, the pathway uses increases in excess heat-related mortality as an indicative trigger metric. Adaptation actions escalate from routine preparedness and monitoring under baseline conditions to more coordinated interventions and transformational adaptation as risks progress through emerging, moderate, severe, and extreme stress levels. Additional metrics are also needed to support more informed decision-making.
- The extreme heat pathway sets out when adaptation actions could begin to be implemented. Actions progress from heat-health awareness, monitoring, governance, and care home preparedness to coordinated resilience planning, cooling spaces, retrofit programmes, and backup power provision. At the highest risk levels, the focus shifts towards protecting critical NHS services, maintaining safe indoor environments, and embedding long-term climate resilience across health and care systems through sustained investment and anticipatory planning.

Flooding

Strategic workshop insights

The flooding discussion highlighted that the principal climate risk to the health and care sector is not necessarily direct damage to healthcare facilities, but the ability of health and social care systems to continue operating during increasingly frequent and complex disruption events. Stakeholders identified significant gaps in long-term adaptation planning, governance, monitoring and funding, with emergency preparedness arrangements largely focused on managing current risks rather than future climate conditions. While NHS organisations generally have business criticality and emergency response plans, there was concern that climate adaptation responsibilities remain unclear, adaptation is often secondary to decarbonisation and operational pressures, and resilience is not yet fully embedded within strategic decision-making.

The workshop also highlighted growing interdependencies between healthcare delivery, energy systems, digital infrastructure, transport networks and care homes, particularly as services become increasingly electrified. A key insight was the need to move from reactive emergency management towards proactive resilience planning that incorporates future flood risk, infrastructure dependencies, vulnerable populations, mental health impacts. Strengthening adaptation capability within NHS organisations, improving coordination through Local Resilience Forums, and embedding climate resilience into estates management, procurement and planning were identified as priority opportunities.

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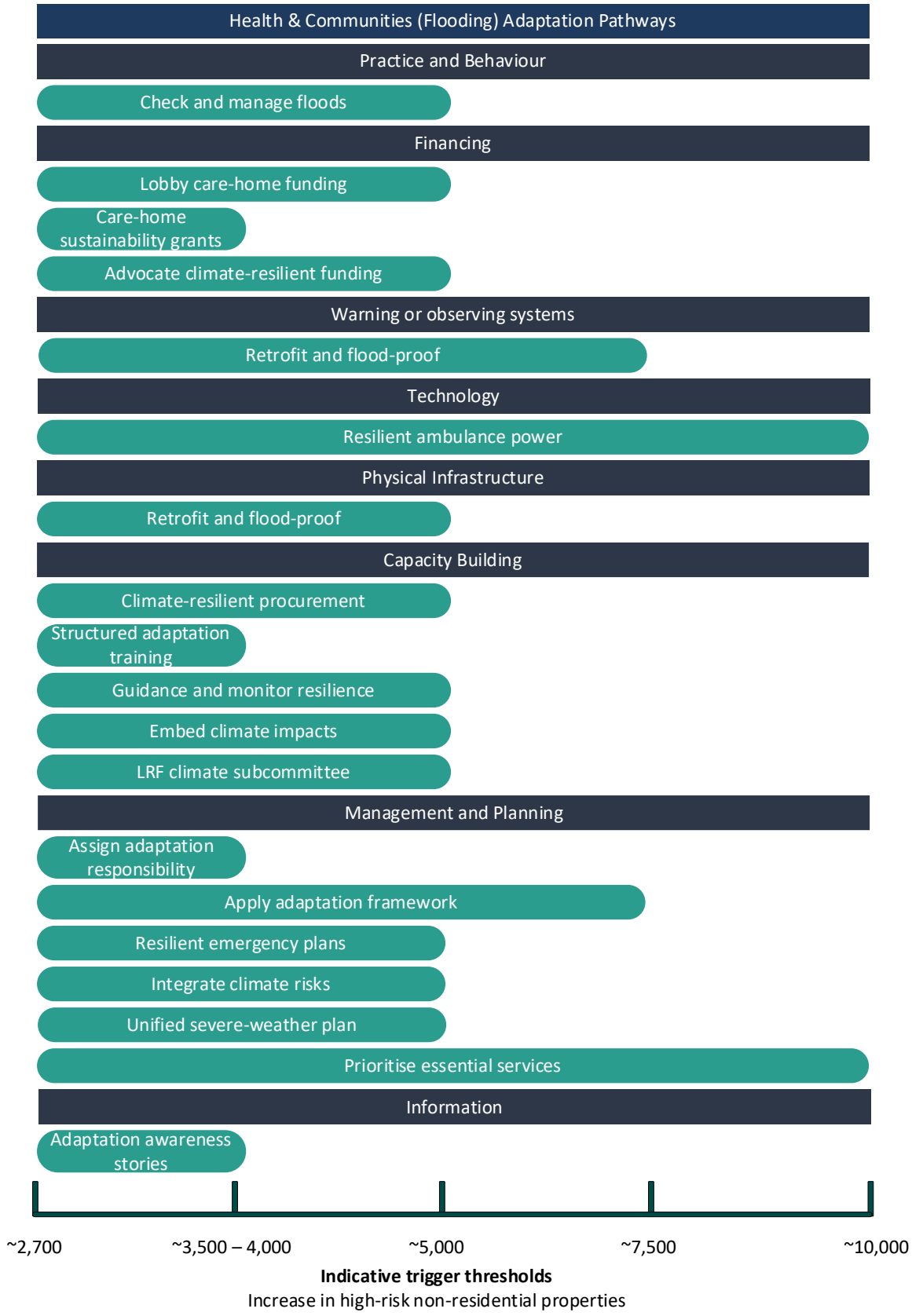

Figure 36 Indicative adaptation pathway for managing flood risks to health, care and community services in York and North Yorkshire. Developed through a Rapid Adaptation Pathway Assessment (RAPA) workshop, the pathway illustrates potential adaptation actions that could be implemented as the number of high-risk non-residential properties increases, representing progressively greater

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disruption to health, care and community services. Actions are grouped by theme and aligned with these indicative trigger thresholds to support discussion of when different adaptation responses may become appropriate. The pathway is intended to inform long-term planning and does not represent agreed policy or investment commitments. The thresholds and implementation pathways should be refined through future analysis.

At lower levels of flood hazard, the pathway prioritises awareness and preparedness by local communities. Early measures centre on practice and behaviour, such as establishing processes to check and manage flood risks, alongside building awareness through communication and the sharing of adaptation stories. These are reinforced by initial management actions, including assigning clear responsibility for adaptation and integrating climate considerations into existing risk processes. In parallel, targeted investments in physical resilience—such as basic retrofit and flood-proofing of health and care facilities—can help to reduce immediate community exposure. In rural areas where smaller care settings and community-based services are common, such early interventions are relatively low cost but highly effective in preventing service disruption during more frequent, lower-severity flood events.

As thresholds increase and flood events become more severe or frequent, the pathway shows a shift towards formalised systems, coordinated planning and expanded financial support. Financing mechanisms become more prominent, with efforts to secure care-home funding, provide sustainability grants, and advocate for dedicated climate-resilient investment streams. At the same time, warning and observing systems and technological measures, including more robust facility-level flood-proofing and resilient backup power for emergency services, become critical to maintaining continuity of care.

Capacity building intensifies at these thresholds, with structured training programmes and the establishment of governance structures such as climate subcommittees. New preparation frameworks and resilient emergency plans are developed, with integration of climate risk analysis across service delivery. Mid-stage interventions reflect the need to strengthen coordination across services and ensure that critical systems remain operational under more challenging conditions.

At the highest flood hazard thresholds, the pathway transitions to ensuring continuity of essential services under extreme but temporary conditions, exemplified by actions such as prioritising critical care functions, implementing unified severe-weather plans, and embedding resilience across all aspects of healthcare planning and delivery. Fully resilient healthcare energy systems and widespread, high-specification flood protection measures across the health estate would be required. Financing would need to be sustained and scaled as a result.

Indicative metrics / thresholds

Key sector thresholds for Health and Communities were researched and considering alignment with other sectors that the number of properties at risk from flooding via the EA risk assessment (Environment Agency, 2024a) would remain a critical indicator of potential disruption to health and care services, vulnerable populations, and emergency response capacity. This includes risks to hospitals, care homes, ambulance stations, and community health facilities, where flooding can directly affect service continuity and patient safety.

Participants noted that, consistent with other sectors, the percentage increase in non-residential properties at higher flood risk relative to the baseline year, derived from the Environment Agency Flood Risk Assessment (Environment Agency, 2024a), provides a suitable regional indicator of escalating flood risk and was therefore adopted as the indicative trigger metric for the adaptation pathway. As flooding affects homes, healthcare facilities, care homes, community buildings and transport access simultaneously, changes in the number of properties at higher risk provide a practical proxy for the potential disruption to health and care services, impacts on vulnerable populations, and pressures on emergency response and recovery.

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The workshop also recognised the importance of complementary resilience indicators, particularly the number of properties better protected from flooding. This metric reflects the effectiveness of adaptation measures, including flood defence schemes, property-level resilience, sustainable drainage systems (SuDS) and natural flood management. While the percentage increase in properties at higher risk is used to define the indicative adaptation stages within the pathway, the number of properties better protected provides an important measure of progress in reducing flood exposure and improving community resilience over time.

Table 28 Indicative number of high-risk non-residential properties used as thresholds for flood adaptation pathway triggers within the business and industry sector in York and North Yorkshire. Thresholds and implementation pathways can be refined in the future.

Adaptation stage	Number of high-risk non-residential properties	Interpretation
Baseline conditions	~2,700	Routine resilience measures, continued monitoring, flood preparedness, adaptation awareness, emergency planning and governance arrangements to protect health and community services.
Emerging stress	~3,500–4,000	Early adaptation measures, including climate-resilient funding, care-home resilience initiatives, flood-proofing of critical facilities, structured adaptation training and integration of climate risks into emergency planning.
Moderate stress	~5,000	Expansion of resilience programmes through adaptation frameworks, strengthened community preparedness, resilient procurement, enhanced flood-proofing of health and care facilities, and improved monitoring and governance.
Severe stress	~7,500	Major investment in resilient health and community infrastructure, including resilient power supplies for emergency services, retrofit of vulnerable facilities, coordinated Local Resilience Forum (LRF) action and strengthened multi-agency emergency planning.
Extreme stress	~10,000	Transformational adaptation to maintain essential health and community services under widespread flooding, including prioritisation of critical services, long-term investment in resilient infrastructure, and strategic adaptation of healthcare and community assets.

Extreme Heat

Strategic workshop insights

The discussion highlighted a growing mismatch between the design and operation of health and care infrastructure and the future climate conditions it will increasingly experience. Stakeholders noted a shift from traditional winter pressures towards rising summer pressures, with heat-related impacts affecting healthcare facilities, IT systems, staff productivity, patient wellbeing and service delivery.

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However, there remains insufficient understanding of the economic costs of heat-related disruption, and a lack of long-term strategic planning for escalating heat risks. The session revealed that adaptation is often constrained by short-term budgets and investment decisions that prioritise immediate operational needs over whole-life resilience. A key insight was that adaptation to extreme heat should be viewed as a core healthcare resilience issue rather than solely an estates or sustainability concern. The discussion also highlighted the importance of public health measures, including heat-health communication, cool spaces, awareness raising. Overall, the group reinforced the need for a more strategic and preventative approach that recognises extreme heat as a growing public health challenge requiring coordinated action across healthcare, housing, planning and community resilience systems.

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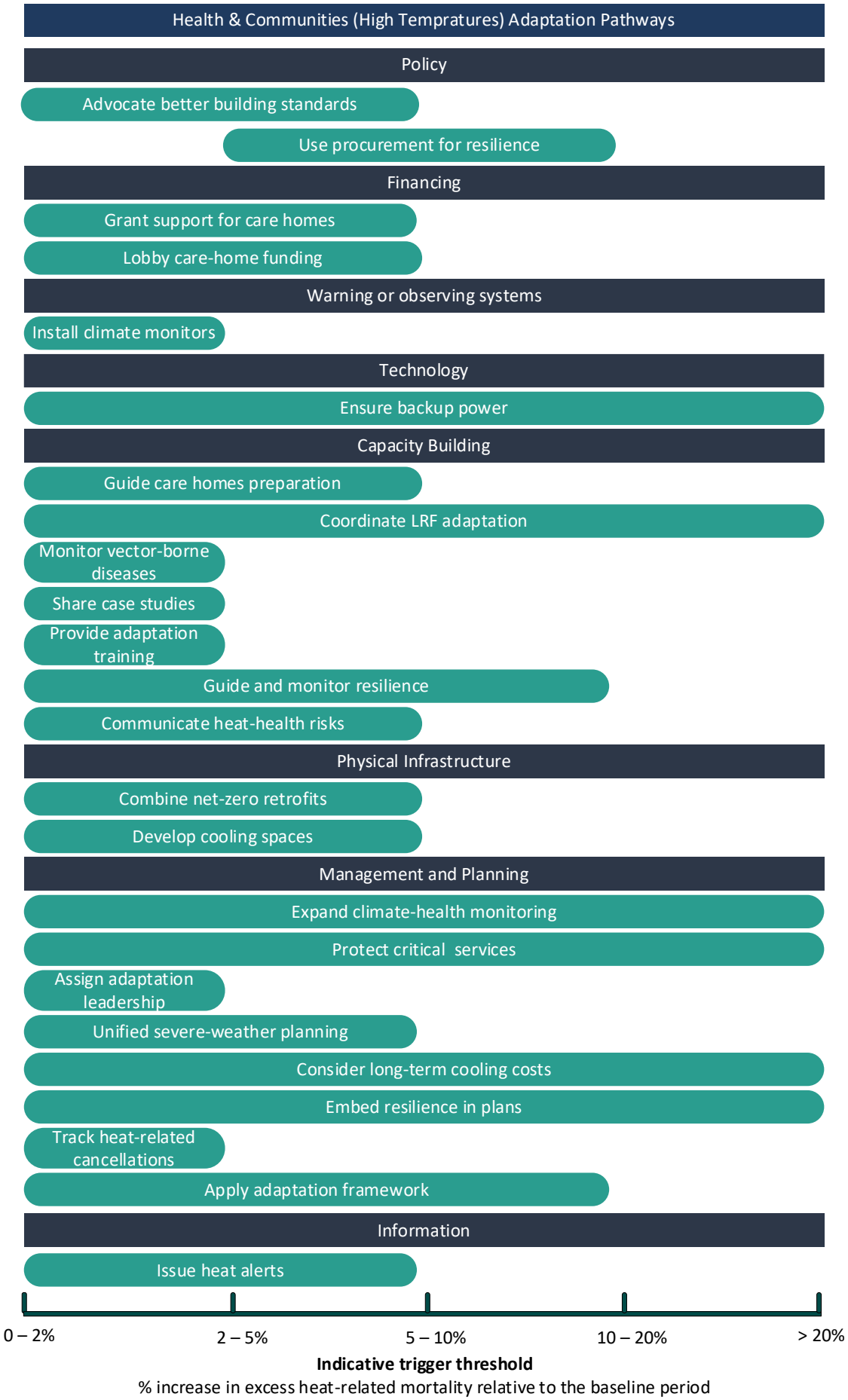
Health & Communities (High Tempratures) Adaptation Pathways
Policy
Advocate better building standards
Use procurement for resilience
Financing
Grant support for care homes
Lobby care-home funding
Warning or observing systems
Install climate monitors
Technology
Ensure backup power
Capacity Building
Guide care homes preparation
Coordinate LRF adaptation
Monitor vector-borne diseases
Share case studies
Provide adaptation training
Guide and monitor resilience
Communicate heat-health risks
Physical Infrastructure
Combine net-zero retrofits
Develop cooling spaces
Management and Planning
Expand climate-health monitoring
Protect critical services
Assign adaptation leadership
Unified severe-weather planning
Consider long-term cooling costs
Embed resilience in plans
Track heat-related cancellations
Apply adaptation framework
Information
Issue heat alerts
0 – 2%
2 – 5%
5 – 10%
10 – 20%
> 20%
Indicative trigger threshold
% increase in excess heat-related mortality relative to the baseline period

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Figure 37 Indicative adaptation pathway for managing extreme heat risks to health, care and community services in York and North Yorkshire. Developed through a Rapid Adaptation Pathway Assessment (RAPA) workshop, the pathway illustrates potential adaptation actions that could be implemented as the percentage increase in excess heat-related mortality relative to the baseline period increases. Actions are grouped by theme and aligned with these indicative trigger thresholds to support discussion of when different adaptation responses may become appropriate. The pathway is intended to inform long-term planning and does not represent agreed policy or investment commitments. The thresholds and implementation pathways should be refined through future climate observations, monitoring of heat-related health outcomes, adaptation planning and stakeholder engagement.

At lower temperature thresholds, the pathway prioritises early, enabling actions that build awareness, establish suitable heat response governance mechanisms and embed resilience in routine healthcare activity. Measures such as issuing heat alerts, installing climate monitoring systems, and advocating for improved building standards provide early mitigatory action. These actions are reinforced through early leadership measures, including assigning responsibility for heat adaptation across organisations and beginning to integrate resilience into planning frameworks. Initial capacity-building interventions, such as guiding care home preparation, sharing case studies, and communicating heat-health risks, play a critical role in reducing immediate exposure. In the York and North Yorkshire context, where many health and care facilities occupy older buildings not originally designed to cope with overheating, these early-stage measures offer relatively low-cost opportunities to reduce risk before more severe thresholds are reached.

As heat thresholds rise, the pathway moves towards more coordinated, systematic and resource-intensive responses. Financing becomes increasingly important, with grant support and advocacy for sustained funding streams enabling upgrades across the care estate. Policy tools, including mandating resilience awareness during procurement and system upgrades, begin to influence how buildings and services are designed and delivered. At the same time, operational resilience is strengthened through increasingly sophisticated climate-health monitoring and more comprehensive and structured adaptation training, and ensuring proportional increases in local resilience forum activity and planning. Physical interventions become more prominent, including the development of cooling spaces and the integration of overheating mitigation within broader net zero retrofit programmes. These measures are particularly pertinent in urban areas such as York, where the urban heat island effect can exacerbate high temperatures, and where healthcare demand may rise sharply during prolonged heat events. Backup power systems also become increasingly critical to ensure continuity of care during periods of peak demand and infrastructure stress.

At higher temperature thresholds, the pathway indicates a transition to protecting critical NHS services during extreme heat events, even where this requires pausing other less critical services. This requires comprehensive contingency plans, including backup generators at all relevant sites. Long-term strategies, such as planning for sustained cooling requirements and embedding resilience across all organisational processes, signal a shift from reactive to fully anticipatory adaptation. At this stage, infrastructure and technology must be capable of maintaining safe internal environments under extreme conditions, requiring significant investment and long-term planning. The pathway also highlights the importance of continuous monitoring and evaluation, ensuring that resilience measures remain effective as climate conditions continue to evolve.

Indicative metrics / thresholds

As with other sectors, participants recognised that no single metric can fully capture resilience to increasing heat risks. Indoor temperature performance, measured as the proportion of healthcare facilities, care homes and community buildings able to maintain safe indoor temperatures (for example, below 26°C during heatwaves), was identified as a useful proxy indicator of heat resilience. Establishing a representative baseline for different building types would enable changes in

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performance to be monitored over time and provide evidence of the effectiveness of measures such as passive cooling, ventilation improvements, retrofit programmes and enhanced building standards.

Currently, excess heat-related mortality is monitored nationally and provides an important outcome-based indicator of the overall effectiveness of adaptation, and it was recognised that excess heat-related mortality provides an important outcome-based indicator of the combined effectiveness of adaptation across the health and communities sector. It reflects the influence of building performance, heat-health monitoring, Heat-Health Alerts, care home preparedness, emergency planning, community resilience and coordinated Local Resilience Forum action. As such, the percentage increase in excess heat related mortality relative to the baseline period was selected as the example trigger metric for the RAPA pathway to illustrate how adaptation actions may need to escalate as heat-related impacts increase. Organisations should, however, consider this alongside other relevant indicators, including indoor temperatures within health and care facilities, hospital admissions.

The table below outlines indicative trigger thresholds and associated adaptation responses for managing increasing heat risks within the built environment.

Table 29 Indicative % increase in excess heat-related mortality used as thresholds for heat adaptation pathway triggers within the health and communities sector in York and North Yorkshire. Thresholds and implementation pathways will be refined through future adaptation strategies, and monitoring of the environment.

Adaptation stage	Indicative trigger threshold (% increase in excess heat-related mortality relative to the baseline period)	Interpretation
Baseline conditions	0–2% (or consistent with the recent historical average)	Routine heat preparedness, climate-health monitoring, Heat-Health Alerts, adaptation awareness, care-home preparedness, resilience planning and coordination through the Local Resilience Forum (LRF).
Emerging stress	2–5%	Early implementation of adaptation measures, including strengthened building standards for health facilities, climate monitoring, adaptation leadership, care-home funding, adaptation training and improved communication of heat-health risks.
Moderate stress	5–10%	Expansion of resilience measures through cooling spaces, climate-health monitoring, net-zero retrofit programmes, resilience guidance, procurement for resilience and coordinated multi-agency adaptation planning.
Severe stress	10–20%	Significant investment in health and community resilience, including backup power for critical facilities, protection of NHS services, long-term cooling strategies, strengthened emergency planning and enhanced surveillance of climate-sensitive health risks.

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Extreme stress	More than 20%	Transformational adaptation to maintain essential health and community services during sustained extreme heat, including embedding climate resilience across health and care systems, widespread cooling provision, resilient healthcare infrastructure, coordinated regional response and long-term adaptation of service delivery.

5.6.8 Interconnected Risks

The final workshop looked at how climate risks related to storms and flooding can cascade across different systems. Participants discussed how failures in telecommunications, water treatment, digital systems or utilities could quickly affect other sectors and communities. Risks to vulnerable people relying on home monitoring systems, as well as potential data centre outages, were highlighted. It is worth noting data centre computing power is largely provided by large data centres outside of the YNY region. These are managed by large international technology companies who have commercial incentives to ensure that risks to their data centres are properly managed. The group also touched on longer-term policy and political risks, such as decisions about whether to continue protecting certain high-risk locations. Participants agreed that stronger cross-agency coordination and strategic planning are needed, particularly as many organisations work to different funding cycles and priorities.

Strategic workshop insights

Stakeholders emphasised that disruptions to a single system, such as power, telecommunications or transport, can rapidly affect multiple dependent services, creating wider social, economic and operational consequences. The discussion revealed that existing governance structures, funding cycles and planning processes are often fragmented, making it difficult to manage risks that cut across organisational boundaries. A key insight was that effective climate adaptation requires a shift from asset-by-asset resilience towards a coordinated systems approach, supported by shared resilience objectives, integrated emergency planning, improved understanding of infrastructure interdependencies and longer-term strategic collaboration. This presents an opportunity for YNYCA to play a convening role, bringing together infrastructure providers, emergency planners and local authorities to develop a more joined-up and proactive approach.

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Figure 38 Indicative adaptation pathway for managing interconnected and cascading climate risks in York and North Yorkshire. Developed through a Rapid Adaptation Pathway Assessment (RAPA) workshop, the pathway illustrates potential adaptation actions that could be implemented to strengthen resilience to cascading impacts across infrastructure, utilities, emergency services and communities. Actions are grouped by theme and aligned with these indicative adaptation stages to support discussion of when different responses may become appropriate. The pathway is intended to inform long-term planning and does not represent agreed policy or investment commitments. The adaptation stages and implementation pathways should be refined through future climate risk

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assessments, cross-sector collaboration, monitoring of interconnected risks and stakeholder engagement.

At lower levels of climate hazard, represented by threshold values between 1 and 3, the pathway prioritises actions that strengthen understanding, governance and collaboration. Early adaptation focuses on reporting climate adaptation progress, enabling organisations to monitor emerging risks and identify where resilience gaps remain. Financing arrangements are aligned across partner organisations to ensure that investment cycles support timely adaptation rather than reactive responses following disruption. A strong emphasis is placed on information sharing, including maintaining underground asset registers, mapping critical infrastructure and applying updated climate allowances to decision-making. These measures improve the evidence base for adaptation and help ensure that infrastructure design reflects future rather than historical climate conditions. Alongside this, collaborative reporting, integrated water planning, flood management partnerships and shared resilience targets seek to establish a common understanding of risk across the region's infrastructure operators and public bodies.

As climate hazards become more pronounced, approaching threshold levels around 3 to 4, adaptation activity shifts towards more coordinated planning and system-wide management interventions. In a region where drought and flood risks increasingly interact, coordinated drought–flood planning becomes particularly important. Strategic catchment planning and integrated water management help address upstream and downstream impacts simultaneously, supporting both flood attenuation during wetter periods and water availability during extended dry spells. Higher levels of maintenance are required to sustain ageing assets under greater climatic stress, while emergency planning increasingly incorporates climate considerations to prepare responders and service providers for more frequent extreme weather events. These activities reflect a transition from building organisational preparedness towards actively managing climate risks across interconnected infrastructure systems.

At the highest hazard thresholds, between 4 and 5, adaptation increasingly relies on more substantial physical interventions. Avoiding development and infrastructure placement in high-risk locations becomes a critical means of reducing future vulnerability and preventing the creation of additional exposure. Existing assets are progressively hardened against extreme weather impacts, and greater redundancy is introduced into networks so that failures in one location do not cascade across essential services. These interventions are likely to be more costly and complex than earlier actions, requiring long-term investment and potentially difficult planning decisions. However, they become increasingly necessary as climate hazards exceed the coping capacity of existing systems and as the consequences of service disruption grow.

The pathway demonstrates that successful adaptation in York and North Yorkshire will depend on acting before severe thresholds are reached. Early investment in governance, data, collaboration and planning can reduce the need for more disruptive measures later. Nevertheless, the increasing severity of projected climate hazards means that resilience will ultimately require a combination of institutional change and targeted infrastructure transformation. The pathway therefore reflects a progressive adaptation journey, moving from understanding and coordination, through integrated management and planning, towards major physical interventions that enable critical infrastructure systems to continue functioning under a changing climate.

Indicative metrics / thresholds

Metrics discussed in the workshop focused on measuring improvements in flood resilience, infrastructure performance, and service continuity. The latest National Adaptation Progress Reporting (Climate Change Committee, 2025) highlights a wide range of potential metrics for assessing interconnected infrastructure risks, including power-related telecoms incidents, lost user hours, backup power availability, and asset-level resilience such as mobile network uptime during outages. These metrics demonstrate how interdependencies between transport, energy, water, and

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telecommunications can be measured through indicators covering service disruption, asset vulnerability, and recovery capability. However, in the transport sector, reporting remains largely qualitative, with limited quantitative data available to assess interdependency risks or adaptation effectiveness.

At a regional level, identifying and agreeing on suitable metrics for interconnected risks presents additional challenges. Workshop discussions highlighted constraints including limited data availability, differences in organisational reporting frameworks, and the complexity of capturing cross-sector interdependencies in a consistent way. Time limitations within the workshop process restricted detailed metric development and alignment. As a result, while a broad range of relevant national metrics exists, further collaboration, data sharing, and coordinated regional engagement may be needed to define practical, measurable indicators for interconnected risk adaptation. For the interconnected risks pathway, stages could reflect increasing levels of cross-sector coordination, governance and infrastructure resilience rather than a single hazard-specific metric. An example metric is presented below:

Adaptation stage	Indicative adaptation stage	Interpretation
Baseline conditions	1	Routine collaboration and governance, including climate adaptation reporting, collaborative information sharing, maintenance of underground asset registers, mapping of critical infrastructure assets and integration of climate considerations into routine planning.
Emerging stress	2	Early coordinated adaptation across organisations, including strategic catchment planning, integrated emergency planning, coordinated drought and flood planning, and the application of updated climate allowances to new investment decisions.
Moderate stress	3	Expansion of cross-sector resilience through shared resilience targets, integrated water resource planning, collaborative flood management, enhanced maintenance programmes and strengthened Local Resilience Forum (LRF) coordination.
Severe stress	4	Significant strategic investment in resilient infrastructure, including avoidance of high-risk infrastructure locations, increased asset redundancy, coordinated investment programmes and strengthened regional governance to manage cascading climate risks.
Extreme stress	5	Transformational adaptation where interconnected climate risks require fully integrated regional planning, long-term infrastructure transformation, coordinated investment across sectors, resilient critical infrastructure networks and adaptive governance capable of managing multiple concurrent climate hazards.

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5.6.9 Recommended governance frameworks

Effective adaptation requires clear ownership, accountability and integration into existing governance structures. Climate risks cut across organisational, sectoral and geographic boundaries, requiring coordinated action by the York and North Yorkshire Combined Authority (YNYCA), City of York Council, North Yorkshire Council and a wide range of regional partners.

It is recommended that YNYCA and its constituent authorities provide strategic leadership for climate adaptation across the region, supported by a formal governance framework that defines roles, responsibilities, decision-making arrangements and reporting requirements. Local authorities would be responsible for embedding adaptation within their statutory functions and service delivery, while key partners including the Environment Agency, water companies, National Park Authorities, infrastructure providers, health organisations and the Local Resilience Forum would lead delivery within their respective areas of responsibility.

Further detail on proposed governance arrangements, delivery structures and reporting mechanisms is provided in **APPENDIX 11 – Adaptation Strategy Governance**.

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6 Regional cost and benefit estimation

6.1 Introduction

An understanding of the potential costs of climate change risks and the benefits of adaptation is critical to ensuring that action is taken that is cost effective and feasible. If an adaptation intervention costs more than the benefits it provides in terms of reducing future socioeconomic damage from climate change risks, then there is arguably no incentive to pursue the intervention. Furthermore, if one climate change risk is likely to cause highly disruptive or costly economic damages relative to a separate risk, then adaptation to the former should be prioritised. Understanding the investment required to mitigate key risks is also important for decision-makers so that suitable budgets can be planned for and allocated. Understanding the economic impacts of climate change impacts and associated adaptation measures is therefore a key foundation to any adaptation strategy or programme.

However, estimating the costs of climate change and climate change adaptation at a national and local level is analytically complex (Watkiss, 2022). Climate change risks are diverse and are typically affected by a range of interrelated factors including physical, biological and socioeconomic. Climate projections can estimate the types of climate change futures the UK is likely to experience but often cannot provide high confidence that specific risks will take place at given geographic areas and/or temporal junctures. The effects of climate change risks are, in turn, diverse (Steen et al., 2022) while not all impacts can be monetised and converted into economic figures. Estimations require analysis of the specific context of each risk, including likely receptors and susceptibility, noting that these change over time. Feasible adaptation options then need to be identified and assessed. The pursued adaptation option will be decided by societal institutions that are subject to a range of influences and constraints, further complicating how associated costs are estimated.

At the national level, the CCC estimates that investment of around £11 billion per year (range £7–£22 billion, 2025 prices) is needed from the public and private sectors (Climate Change Committee, 2026), with estimated returns in the tens of billions. Whilst limits in data and methods mean both the investment and the returns are likely to be underestimated, the CCC notes that the economy currently invests around 50 times as much. Other analyses have shown that every pound invested in adaptation saves five in the future (LSE, 2022).

This analysis therefore sought to develop a strategic, high-level and indicative analysis of the costs of inaction with respect to climate change and the benefits of pursuing adaptation within the context of the YNY region. A regional cost benefit analysis was carried out (see Section 6.2) alongside an assessment of priority risks (see Section 6.5).

6.2 Cost Benefit Analysis

The partial cost benefit analysis (CBA) conducted as part of this study provides an evidence-led assessment of the potential economic costs of climate risks and the potential costs and benefits of adaptation at the York and North Yorkshire Combined Authority (YNYCA) regional scale using national level data. The results provide indicative signals only designed to support regional prioritisation and sequencing of adaptation action and provides a transparent appraisal framework that can be progressively refined as improved local evidence becomes available.

Climate adaptation decisions typically involve long time horizons, substantial uncertainty about future hazards and exposure, and impacts that are only partially observed through markets. The economic appraisal undertaken for this study therefore aims to make the costs and benefits of action and inaction transparent to help support prioritisation and sequencing of actions, and highlight

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distributional implications, while remaining proportionate to the current evidence available at a strategic study level.

These limitations mean results should be used to inform strategic decisions rather than as precise forecasts.

6.2.1 Choosing an appropriate economic appraisal approach

Given the complexity and interacting components that climate adaptation studies present, a tiered appraisal toolkit should be used where timeframes permit. Social cost–benefit analysis (CBA) can be applied where options have significant welfare implications and where monetised evidence is available or can be represented using defensible proxies. Cost-effectiveness analysis (CEA) and multi-criteria analysis (MCA) are useful at earlier stages or where monetisation is limited, enabling transparent comparison of options against defined outcomes or multiple criteria. Decision pathways and real-options thinking are more complex approaches that support sequencing and flexibility under deep uncertainty by linking actions to triggers and preserving the ability to adjust as evidence improves.

Where markets exist, costs and benefits are valued using market prices consistent with HM Treasury Green Book appraisal conventions. Where markets do not exist (e.g., health and wellbeing impacts, ecosystem services or cultural benefits), valuation may draw on non-market evidence and value transfer approaches, including avoided-damage/avoided-cost methods, production-function approaches, revealed preference evidence and stated preference where appropriate. In this study, the partial CBA primarily uses an avoided-damage framework that is based around reductions in Annual Expected Damages (AED), and records non-monetised impacts transparently in a coverage-and-gaps register to avoid over- or understating quantified benefits.

6.2.2 CBA methodology and assumptions

A partial, high-level societal cost benefit analysis was undertaken to evaluate the economic costs and benefits of place-based climate adaptation packages for the YNYCA region. Costs and benefits were assessed over multiple horizons (e.g., 30, 50, 80 and 100-year time periods) and discounted to present values using long-term discounting conventions for public appraisal in line with HM Treasury guidance. Distributional and vulnerability considerations are reported alongside efficiency metrics. In the YNYCA CBA model, benefits are reported on an equity-weighted basis by applying distributional and vulnerability weights to benefits (with costs left unweighted) to reflect differential welfare impacts on more vulnerable groups and places.

Uncertainty is addressed using scenario analysis (alternative warming pathways), one-way sensitivity testing (low/central/high bounds) and stochastic simulation (Monte Carlo) for selected uncertain parameters. This supports a robust, focused interpretation of results and helps identify priorities for evidence improvement.

The flow of costs and benefits over different time horizons and under a set of 'with' adaptation packages (PK1–PK4) and a 'business-as-usual' base case (PK0: cost of inaction, i.e., 'without' additional adaptation actions) have been evaluated to understand the economically preferred strategic investment themes for regional adaptation. Due to the strategic scope of the CBA, several simplified assumptions (based on the best available data at the time of analysis) have been applied to each package. All key assumptions and parameter values (including low/central/high bounds) are recorded in the ***YNYCA Societal CBA spreadsheet model v1.1***.

The economic desirability of each adaptation package compared to the baseline was assessed using the following investment appraisal measures:

Net Present Value (NPV): the sum of the flow of annual net social benefits, each of which is expressed as a present value. This sum is equivalent to the difference between the present value of benefits and

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the present value of costs and indicates the magnitude of net benefits to society from implementation of the adaptation package. The net present value is calculated using:

$$NPV_i^N = \sum_{t=0}^{N} \frac{B_t}{(1+i)^t}$$

where t represents the discount period (e.g., year 0 to year 100), B_t equals net benefits in year t, N is the number of periods, and is the Social Time Preference Rate (STPR).

Benefit Cost Ratio (BCR): the ratio of the present value of benefits to the present value of costs. A package with a BCR greater than 1 is expected to deliver a positive NPV. While BCRs provide a useful comparison metric, they can over-simplify complex decisions because non-monetised benefits and wider system effects may not be captured fully in the quantified benefit stream. For this reason, BCRs are presented alongside qualitative considerations and the CBA model's explicit coverage-and-gaps statement.

While CBA is a well-established method and the RSK project team followed general practice guidelines as outlined in HM Treasury's Green Book, the outcomes from the climate change risk and opportunity assessment and RAPA workshops ultimately guided the final design of the CBA. The approach adopted to estimate net benefits followed an avoided-damage framework combined with a package performance adjustment that recognises that benefits depend on the value of assets at risk (V), the proportional reduction in expected damages achievable (W), adoption/coverage (A), the probability of adaptation action failure (R), time lag (L) to benefit realisation, the discount rate (r), and the present value of costs (C). The resulting Benefit Cost Ratio (BCR) was calculated using:

$$BCR = \frac{V \times W \times A \times (1-R)/(1+r)^L}{C}$$

In the CBA spreadsheet model, these elements are implemented through baseline annual expected damages (AEDs), package effectiveness factors, adoption and lag assumptions, and discounted cost streams derived from unit costs and scale drivers (see Section 2.2.4).

Future costs and benefits have been discounted into present values, following HM Treasury Green Book guidance and applying a long-term declining discount rate schedule (Table 2). Discounting allows packages with different benefit-cost profiles and time periods to be compared on a common present-value basis. The assumed discount rate can materially influence results, particularly in long-horizon adaptation appraisal where benefits may accrue slowly and increase over time.

Table 30: Long term declining discount rate. Source: HM Treasury Green Book (2026)

Year	0-30	31-75	76-126
STPR (standard)	3.50%	3.00%	2.5%
STPR (reduced rate where pure STP=0)	3.00%	2.57%	2.14%
Health	1.50%	1.29%	1.07%
Health (reduced rate where pure STP=0)	1.00%	0.86%	0.71%

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The partial CBA for this study was used to estimate the incremental[3] net climate change adaptation benefits from the assessed placed-based package alternatives. Assessment of incremental changes recognises the difference between a 'baseline' state and an 'alternative' state[4]. Marginal assessments of changes in climate change adaptation are more robust than 'absolute' valuation as the large number of assumptions and uncertainties used are applied to both the 'base' and 'alternative' cases. Using available data and assumptions, climate change adaptation benefits and costs have been quantified (where possible). Appendix 1 details the framework, methodology and data sources used in the partial CBA.

In addition, the costs and benefits associated with each adaptation package depend on programme or project scale, delivery efficiency, asset/hazard exposure, and the extent to which non-monetised co-benefits (e.g., biodiversity, amenity, cultural heritage) are realised. These factors vary across places in the YNYCA region and should be refined with scheme-level evidence as programmes or projects mature.

6.2.3 Scenarios

Scenarios in the CBA model followed the climate risk and opportunity assessment's global-warming-level (GWL) framing and were used to test how the scale and timing of damages (and therefore the value of avoided damages from adaptation alternatives) change under different plausible climate futures. Scenarios represent combinations of time horizon and warming level rather than single deterministic forecasts, and they are intended to support robust decision-making under uncertainty. It should be noted that the scenario mapping in the CBA model is slightly different to that in the climate and opportunities assessment as the CBA uses a 100-year appraisal time period (2025-2125).

In the CBA model, calendar years were mapped to discrete scenario states (S1–S4) using a scenario mapping table with the following current mapping:

- S1: 2030–2039 (1.5°C GWL)
- S2: 2050–2059 (2°C GWL)
- S3: 2080–2125 (2°C GWL)
- S4: 2080–2125 (4°C GWL)

The long-term, end-century state can be tested as either a 'prepare' (~2°C) pathway (S3) or a higher-warming (~4°C) pathway (S4) via the scenario control setting function in the CBA model. For reporting purposes, S3 (2080–2125; ~2°C 'prepare' pathway) was adopted as the central planning case. S3 provides a coherent basis for long-term programme design because it represents an end-century state consistent with a 'prepare' trajectory and has been used to parameterise the model's long-run multipliers, effectiveness and equity weights across the full appraisal horizon. S4 (2080–2125; ~4°C) has been included in the CBA model as a sensitivity (stress-test) to examine whether package conclusions remain robust under higher-warming conditions that could arise from global mitigation shortfalls or stronger-than-expected hazard responses. Using S4 in this way supports practical risk management as it highlights where benefits may be understated (e.g., where non-monetised impacts dominate) and where delivery assumptions (effectiveness, adoption and lag) become more critical. The interpretation therefore focuses on robustness across S3 and S4 rather than on point estimates in a single scenario.

[3] Incremental refers to the marginal change in outcomes between alternative and base case. Incremental change is measured relative to what would have happened in a base ('business as usual') case situation.

[4] As some adaptation pathways have not been implemented broad assumptions have been made about the likely post-implementation state.

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The scenario logic within the CBA model operates as follows: (i) baseline annual expected damages (AED) are specified by monetised impact category; (ii) scenario multipliers scale these baseline damages through time to represent changing hazard intensity and/or exposure; (iii) adaptation packages reduce allocated baseline damages according to package effectiveness, adoption/coverage, benefit lag and failure risk; and (iv) annual costs and avoided damages are discounted to present values (PV) and summarised as PV benefits, PV costs, NPV and BCR over reporting horizons (e.g., 30/50/80/100 years). Scenario testing therefore shows whether packages provide value-for-money across a range of plausible climate futures and highlights where results are most sensitive to assumptions that should be prioritised for refinement.

6.2.4 Exposure Scaling

As the CBA is structured around place-based packages (PK1–PK4), the model allocates baseline damages (i.e., the pool of AED in the cost of inaction) and the resulting avoided damages across packages in a transparent and consistent way using 'exposure scaling' indices that represent the relative exposure of people, assets and activity to each hazard category in each placed-based package.

In the current configuration, national or regional default AED values are scaled to the YNY area and then allocated to packages using category-specific exposure indices, which sum to 1 across packages for each category. This ensures that the total regional cost of inaction is conserved when distributed across placed-based packages and avoids double counting. Exposure indices are designed to be pragmatic and updateable as better local evidence becomes available. The model structure allows baselines and/or indices to be overridden so that allocation reflects local datasets rather than national proxies.

Exposure indices are category-specific. For example, flood exposure scaling uses the relative distribution of properties/assets in flood likelihood bands; heat-health exposure scaling uses indicators of population exposure and vulnerability; transport exposure scaling uses proxy indicators of network extent/criticality (e.g., road kilometres) and disruption pathways; and water security exposure scaling uses proxy indicators linked to dependency and sensitivity to water restrictions. Note, water-resource-plan evidence and locally derived restriction-cost functions were not incorporated into the current CBA model due to the complexity and level of detail required to build in this functionality. At this strategic stage, exposure scaling provides an order-of-magnitude allocation for screening and communication and should be refined where allocation assumptions are likely to materially influence conclusions.

6.2.5 Effectiveness (fraction of base case damages avoided)

Effectiveness in the CBA model is the assumed proportion of baseline annual expected damages that a placed-based adaptation package avoids. Effectiveness is specified by package, impact category and scenario and is applied within an avoided-damages framework alongside adoption/coverage, failure risk and benefit lag to estimate annual avoided damages relative to the PK0 business-as-usual (cost of inaction) baseline. For the purposes of the current study, effectiveness values should be interpreted as screening assumptions designed to be transparent and updateable. They are a key driver of benefit uncertainty and should be refined over time using local monitoring evidence and scheme-level appraisal outputs.

6.2.6 Equity weighting

Equity weighting has been used in the model and is applied to benefits only (costs have been treated as unweighted). Equity weighting was applied to benefits only because the CBA model, in its current format, was able to link avoided harms (benefits) to vulnerable groups and places through exposure and vulnerability evidence, whereas the incidence of programme/project costs (who ultimately pays) was uncertain and dependent on future funding and delivery arrangements at the time the CBA was

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undertaken. Applying equity weights to costs without known or defensible assumptions risks false outcomes that could distort comparison across packages. Costs are therefore reported unweighted, while benefits are equity-weighted using combined distributional and vulnerability weights to reflect the welfare significance of avoided damages accruing to more vulnerable groups and places. Equity weighting multiplies benefits by a combined factor comprising a distributional weight (DW) and a vulnerability weight (VW), allowing results to reflect differential welfare value of avoided damages accruing to more vulnerable groups and places. The model has been set-up to allow equity weightings to be adjusted as more local evidence becomes available.

Example of how the equity weighting is applied to benefits

For PK1 Flood under S2, the model applies effectiveness = 0.31 with VW = 1.05 and DW = 1.10, giving a combined factor of 1.16 (1.05 x 1.10). An illustrative baseline benefit of £3,350,000 is therefore converted to an equity-weighted benefit of £1,199,468 after applying effectiveness and the combined equity factor.

6.2.7 Place-based adaptation package alternatives

Four place-based package alternatives were assessed that together, partially represent internal (YNYCA) and external (public and market) climate change adaptation value pathways (**Table 2**). The alternatives were assessed against a 'business-as-usual' base case (PK0) which assumed no additional adaptation actions on top of already committed schemes.

Table 31: Key characteristics of adaptation packages

Place-based package alternative	Typical scale driver	Cost components	Monetised benefit categories
PK1: Urban	Properties / urban assets (number at risk)	Capex + Opex (unit cost × scale)	Flood, Heat Health, Transport, Water Security
PK2: Rural Catchments	Catchment area (hectares)	Capex + Opex	Flood, Heat Health, Transport, Water Security
PK3: Coast	Coastline (kilometres at-risk)	Capex + Opex	Flood, Heat Health, Transport, Water Security
PK4: Uplands and protected landscapes	Upland area (hectares)	Capex + Opex	Flood, Heat Health, Transport, Water Security

PK0: COST OF INACTION (BASELINE)

The cost of inaction alternative represents a 'counterfactual' with no additional adaptation beyond committed schemes. It estimates baseline annual expected damages for four monetised climate-impact categories (Flood, Heat-health, Transport and Water security). These AEDs are projected through time under climate scenarios and discounted to present values.

The base case provides the reference baseline against which all other packages were assessed. By construction, PK0 provides no additional benefits (avoided damages) relative to itself, however, it

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quantifies the scale of expected damages faced by the region and provides the benchmark for calculating incremental benefits from action.

Because the baseline relies on scaled national values and exposure allocation, it should be interpreted as an order-of-magnitude[5] indicator, rather than an 'absolute' valuation of regional costs of inaction. The model includes switches to incorporate local evidence for selected baselines (e.g., flood) where robust local series exist, reducing reliance on national proxies.

PK1: URBAN

Represents an indicative bundle of urban adaptation actions focused on urban centres and surrounding urban areas, addressing river and surface water flooding, overheating/heat-health risks, and related infrastructure disruption.

Costs are generated using a scale driver (e.g., properties/urban assets) multiplied by capex and opex unit costs. Benefits are represented as avoided AEDs across the four monetised categories, adjusted for adoption, failure risk and implementation lag.

This package is intended as a strategic screening case and should be replaced by scheme-level modelling for specific interventions such as flood alleviation schemes or urban heat mitigation programmes.

PK2: RURAL CATCHMENTS

Represents catchment-scale resilience actions across rural areas, including nature-based solutions, land and water management, and measures that reduce downstream flood risk and improve drought resilience.

Benefits can be substantial because catchment measures can affect large areas and multiple receptors; the model allocates baseline damages using exposure indices and applies package effectiveness factors to estimate avoided damages.

Because benefits depend on exposure allocation and effectiveness assumptions, this package is a priority for refinement using local catchment evidence, programme costs, and monitored outcomes.

PK3: COAST

Represents adaptation actions for coastal towns and cliffs, focusing on coastal flooding and associated disruption, and capturing a subset of coastal risks that can be represented using the current avoided-damage framework.

The model currently does not fully monetise coastal erosion and managed retreat impacts, therefore, quantified benefits may understate the full value of coastal adaptation where erosion/retreat is a dominant risk driver.

Coastal packages should be interpreted alongside Shoreline Management Plans and qualitative assessments of erosion, social impacts and long-term viability of assets and communities.

[5] Order-of-magnitude (OoM): Values are presented in £ billions and should be treated as indicative. OoM estimates are intended to convey the scale of expected net benefits and are subject to uncertainty arising from assumptions, delivery timing, and evidence quality (see Section 2.3.2 - Sensitivity analysis). As such, they are appropriate for high-level strategic appraisal and prioritisation, but not for determining precise value-for-money differentials.

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PK4: UPLANDS / PROTECTED LANDSCAPES

Represents adaptation actions in uplands and protected landscapes, including land management and ecosystem restoration measures that can support flood regulation, water security and resilience of natural capital.

The model represents a subset of benefits through avoided damages, but some ecosystem service co-benefits (e.g., biodiversity, carbon, recreation) are not comprehensively monetised within the current version of the CBA model.

Given the strategic importance of uplands for downstream risk regulation, the package provides a screening view that should be refined with protected landscape plans and natural capital evidence.

6.2.8 Costs

The costs expected under PK0 and the adaptation packages are derived from unit cost assumptions (capex and opex) applied to package scale drivers. For strategic screening, the model uses aggregated cost profiles with simplified timing assumptions. Where future detailed scheme appraisal is undertaken, these cost profiles should be replaced with scheme-specific delivery schedules and detailed business case cost estimates.

Unit cost values (low/central/high) are recorded in the model's unit cost library, enabling sensitivity testing. Costs are expressed in real terms and discounted using the Green Book schedule to generate present value costs for each package.

6.2.9 Benefits

The flow of quantified benefits under PK0 and the placed-based adaptation packages is estimated using avoided damages across four monetised climate-impact categories: flooding/extreme rainfall, heat-health (QALY-based valuation), transport disruption/asset impacts (proxy representation), and drought/water security (proxy representation). Benefits are calculated as reductions in the baseline AED stream. A simplified representation is:

$$Benefit\ (avoided\ damages) = Baseline\ AED \times Effectiveness \times \frac{Adoption}{Coverage} \times (1 - Failure\ risk)$$

with an additional timing adjustment for Benefit lag and discounting to present value within the CBA model.

This structure ensures benefits are incremental, that is, they represent the difference between the baseline (PK0) and the 'with package' case, rather than gross economic gains.

There are other important risks and co-benefits that were not monetised in the current CBA model due to evidence and method limitations, including, coastal erosion/managed retreat impacts, wildfire response and damage costs, pests and pathogens, and complex cascading failures across infrastructure networks. These are logged in the model's coverage and gaps register and should be considered qualitatively alongside CBA results.

6.2.10 What is monetised in the current model and what needs strengthening

Table 4 highlights hazards/impact areas monetised within the CBA model and those that require further investigation and strengthening within the model. Suggested approaches to improve/include monetisation of hazards/impact areas is also provided.

Table 32: Brief description of the hazards/impact areas currently monetised and not monetised within the CBA model.

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Hazard / impact area	Status	Where represented in model	Why it matters for YNYCA	Data source / method	Owner / next step
Flooding/ extreme rainfall (property, infrastructure, business disruption)	Monetised	Flood category (AED - avoided damages)	Priority risk in YNYCA report; major driver of damages and service disruption	Use local flood series; disaggregate by sector where possible	CBA owner • flood refinement
Extreme heat – health impacts	Monetised	HeatHealth category (QALY valuation)	Priority risk; impacts vulnerable groups and services	Link to local heat-health evidence; refine baseline QALYs and exposure	CBA owner / Public health lead • local evidence and refinement
Drought/water security (public supply, agriculture, economy)	Monetised (proxy)	WaterSecurity category (proxy AED)	Priority risk; can dominate long-term costs; cross-sector effects	Replace proxy with local WRMP/yield-loss/restriction cost evidence	CBA owner/ Water lead/agri lead • local evidence and refinement
Transport disruption and asset damage	Monetised (proxy)	Transport category (proxy AED + share × Flood AED)	Priority risk incl. cascading failure; major for connectivity	Refine with local network exposure and disruption evidence	CBA owner/ Transport lead/ • local evidence and refinement
Coastal erosion /managed retreat (beyond flood damages)	Not monetised	Partly implicit in Coastal package costs; flood proxy only	Explicit priority risk for coastal towns/cliffs; may dominate long-term	Add erosion/ retreat damage functions and adaptation options	CBA owner/ Coastal lead • build into model
Wildfire (uplands, peat, property, health, tourism)	Not monetised	Not in monetised categories (except minor indirect effects)	Observed events and rising risk in YNYCA region	Add wildfire damage/ response costs; link to CRI fire danger indicators	CBA owner • build into model
Pests/pathogens/invasive species impacts on habitats and agriculture	Not monetised	Not in monetised categories	Priority natural environment risks; biodiversity and working lands	Add avoided loss estimates (habitat, yield, management cost)	CBA owner • build into model

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6.3 Discussion of CBA Findings

6.3.1 Interpretation of main findings

The CBA developed for this study provides strategic evidence on the potential net benefits of indicative place-based adaptation packages relative to the cost of inaction base case.

The partial CBA results (central assumptions) indicate positive net benefits for three of the four place-based packages over the appraisal horizon (Table 5). PK1 (Urban), PK2 (Rural Catchments) and PK4 (Uplands/Protected Landscapes) have BCRs above 1 (i.e., benefits outweigh costs) across the tested scenarios, while PK3 (Coast) is below 1 (i.e., costs outweigh benefits) in the current configuration. This does not imply that coastal adaptation is poor value, rather it reflects that the model currently monetises only a subset of coastal outcomes (primarily flood-related damages) and does not yet include coastal erosion/managed retreat valuation, which is likely to be material for long-term coastal decisions. Consequently, package rankings should be treated as indicative and used to prioritise where improved evidence and expanded monetisation would most strengthen decision confidence. For this report, S3 is used as the central planning case and S4 is used as a sensitivity (high-warming) stress-test.

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Table 33: Summary of key outcomes from cost benefit analysis (Deterministic, central values). Values are per unit (e.g., number of properties (PK1), hectares (PK2 and PK4), kilometres (PK3)) and rounded to nearest whole decimal.

Scenario >>	S1				S2				S3				S4			
Package >>	**PK 1**	**PK 2**	**PK 3**	**PK 4**	**PK 1**	**PK 2**	**PK 3**	**PK 4**	**PK 1**	**PK 2**	**PK 3**	**PK 4**	**PK 1**	**PK 2**	**PK 3**	**PK 4**
Equivalent annualised costs (£m/year)	2.6	1.0	2.5	0.3	2.5	0.8	2.1	0.2	1.4	0.8	1.9	0.2	2.4	0.7	1.9	0.2
Equivalent annualised benefits (£m/year)	3.3	4.8	1.2	0.6	3.8	4.8	1.2	0.6	3.8	5.0	1.2	0.6	3.9	5.0	1.3	0.6
NPVA[6] (£m/year)	1.0	3.8	-1.3	0.3	1.2	4.0	-0.9	0.4	1.4	4.2	-0.7	0.4	1.5	4.3	-0.6	0.4
BCR	1.3	**5.0**	0.5	2.5	1.5	**5.9**	0.6	3.0	1.6	**6.6**	0.6	3.3	1.6	**6.8**	0.6	3.4

[6] NPVA: Net present value as an equivalent annual annuity (EEA).

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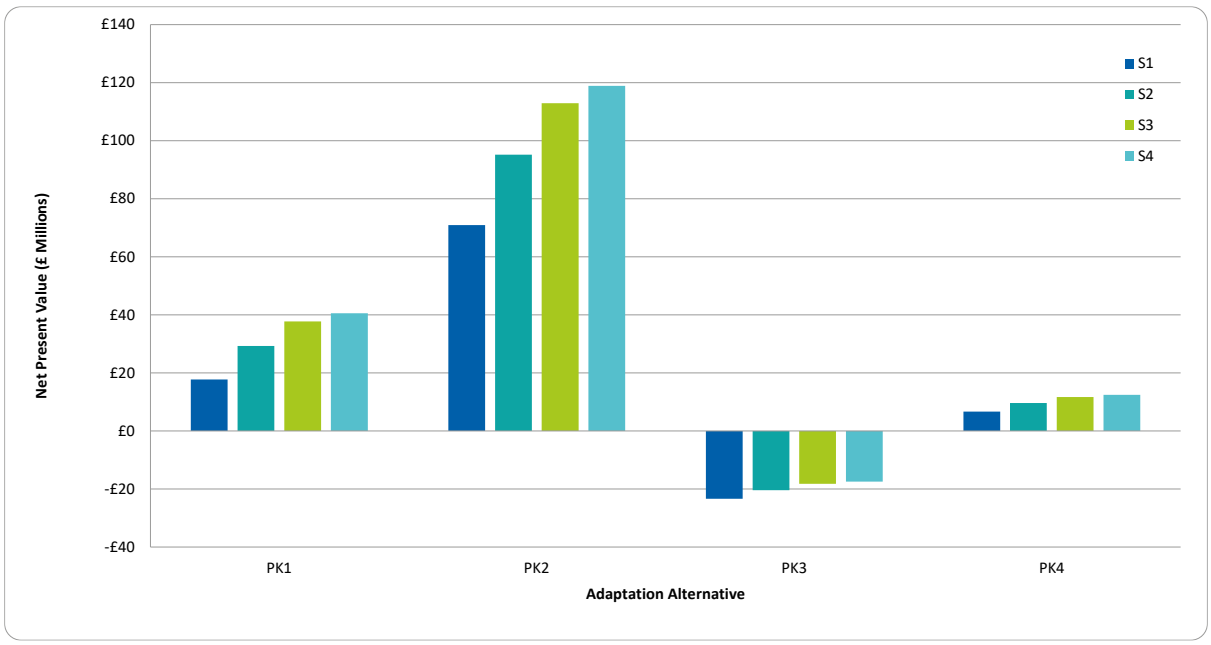

Figure 39: Comparison of net present value for placed-based adaptation interventions alternatives under different scenarios. Source: RSK, 2026.

Figure 1 provides a visual ranking check of which place-based packages deliver the largest net gains in the model, and whether that ranking holds when the long-term climate assumptions are tested under the pessimistic S4 scenario. The chart should be viewed as a comparative signal of potential net economic benefits rather than an absolute forecast. It shows where the model concentrates value across packages once costs, timing and discounting are applied. In the central planning case (S3), the rural catchments package stands out as the largest net-benefit option in the quantified model, with urban and uplands/protected landscapes also delivering positive net benefits, while the coastal package remains weaker (in part due to lower coverage of input data).

The key insight is the pattern, not the exact height of each bar. Moving from S3 to the S4 stress-test tends to strengthen the net-benefit signal for packages whose benefits are driven by avoided damages that scale up under higher warming (notably those linked to water security and flooding in the current configuration). If a package's position changes little between S3 and S4, that suggests the result is comparatively robust to this particular dimension of uncertainty. If it changes more, it flags where decisions depend heavily on long-term climate severity and therefore where adaptive pathways, monitoring triggers, or staged investment may be more appropriate.

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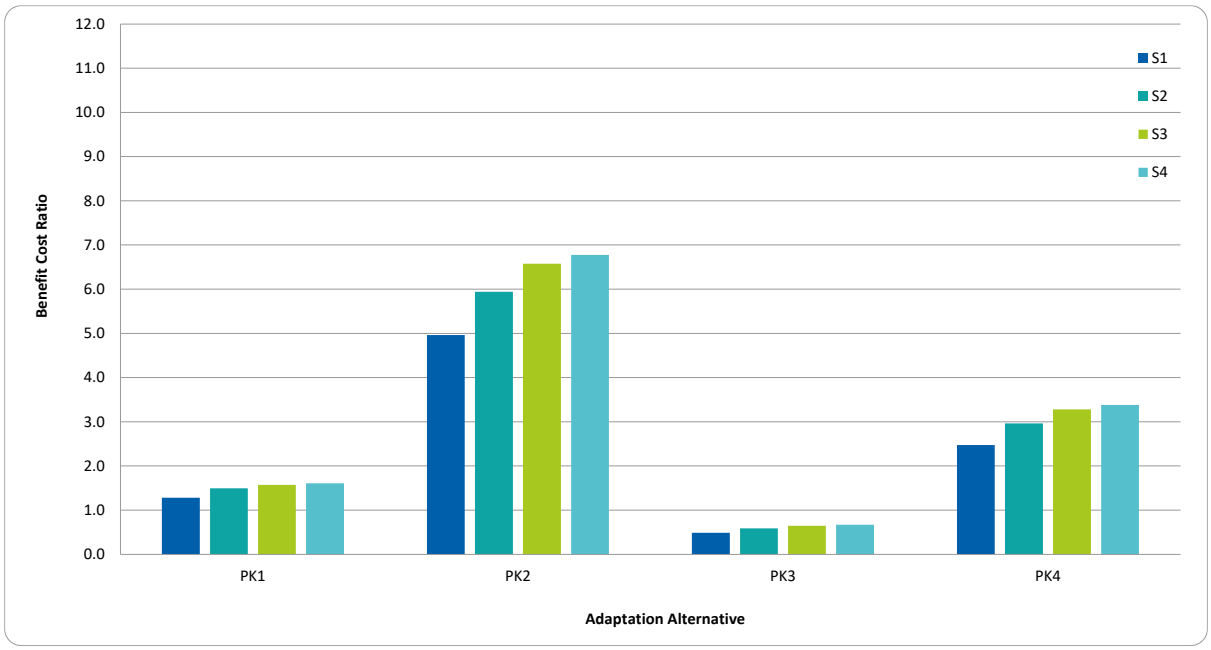

Figure 40: Comparison of 'benefit cost ratios' for placed-based adaptation intervention alternatives under different scenarios. Source: RSK, 2026.

Figure 2 complements Figure 1 by showing how efficiently each package converts investment into quantified benefits under the model assumptions. Where Figure 1 is most useful for judging overall scale of gain, Figure 2 is most useful for judging value per pound spent. In the S3 central planning case, rural catchments remain the strongest performer on this efficiency view, with uplands/protected landscapes and the urban package also showing positive performance, while the coastal package stays below the model's value-for-money threshold in its current quantified form.

The most decision-relevant feature is the stability of the pattern across S3 and the S4 stress-test. If the ordering and relative separation between packages is similar in both, that supports confidence that prioritisation is not being driven by a single climate assumption. Where a package remains weak even under S4, it is a strong prompt to check whether the model is missing major benefit pathways for that package (for example, coastal outcomes where erosion/managed retreat and wider social impacts dominate but are not yet captured in the model). In other words, Figure 2 can be used as a practical "evidence improvement map". It highlights where better valuation and better representation of outcomes would most change decision confidence.

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6.3.2 Sensitivity analysis

A sensitivity analysis provides information about the extent to which critical variables can change before a package's positive NPV is reduced to zero or its negative NPV is increased to zero. This is important for identifying which assumptions materially drive results and where further evidence collection would most improve decision confidence.

There are shortcomings in using one-way sensitivity analysis alone: (i) it may rely on limited information to define optimistic and pessimistic bounds; (ii) it holds other variables constant and therefore does not capture interactions; and (iii) it does not provide a probabilistic assessment of the likelihood of outcomes.

These shortcomings can be addressed by simulating probability distributions for identified critical variables. The YNYCA Societal CBA model includes Monte Carlo simulation that uses repeated random sampling from probability distributions of uncertain variables to produce risk profiles (distributions) for outputs such as NPV and BCR. **Appendix 1** provides additional information on the shortcomings of simple sensitivity analysis and the use of Monte Carlo simulation to overcome these.

Modelling risk and uncertainty surrounding key drivers

Monte Carlo simulation results provide a probabilistic view of how NPV and BCR could vary when key uncertain parameters are sampled within their plausible ranges. In the current configuration, the median (50th percentile) BCRs are above 1 for PK1, PK2 and PK4, while PK3 remains below 1 in the median and lower-tail outcomes. This indicates that coastal package value-for-money is particularly sensitive to assumptions and may be understated where non-monetised erosion/retreat impacts are material. The 10th–90th percentile range indicates that effectiveness and adoption/coverage parameters exert the greatest influence on outcomes, followed by risk-of-failure and benefit-lag assumptions; cost variations are generally less influential at the strategic screening level. These findings reinforce the need to strengthen local evidence on package effectiveness, delivery and uptake, and to expand monetisation coverage for coastal erosion, wellbeing and wider co-benefits.

Table 34: Probability distributions for the range of NPVs (£millions) resulting from Monte Carlo sensitivity testing. Results between 10% and 90% are considered robust.

Percentile	PK1	PK2	PK3	PK4
100%	£37.07	£103.05	-£17.93	£10.54
90%	£33.20	£98.89	-£19.91	£10.08
80%	£31.87	£97.14	-£20.47	£9.86
70%	£30.86	£95.78	-£20.87	£9.65
60%	£29.99	£94.59	-£21.26	£9.46
50%	**£29.33**	**£93.53**	**-£21.67**	**£9.27**
40%	£28.47	£92.16	-£22.05	£9.04
30%	£27.55	£90.73	-£22.44	£8.81
20%	£26.60	£89.37	-£22.86	£8.58
10%	£25.36	£87.59	-£23.50	£8.33
0%	£20.88	£83.21	-£25.08	£7.88
True Mean	**£29.25**	**£93.29**	**-£21.67**	**£9.23**
St.Dev	£2.98	£4.23	£1.38	£0.64

Table 35: Probability distributions for the range of BCRs resulting from Monte Carlo sensitivity testing.

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Percentile	PK1	PK2	PK3	PK4
100%	1.63	6.38	0.63	3.18
90%	1.56	6.05	0.60	3.03
80%	1.54	5.96	0.59	2.98
70%	1.52	5.89	0.58	2.94
60%	1.51	5.81	0.58	2.90
50%	**1.50**	**5.74**	**0.57**	**2.86**
40%	1.48	5.68	0.56	2.81
30%	1.47	5.60	0.56	2.77
20%	1.45	5.52	0.55	2.72
10%	1.43	5.42	0.54	2.66
0%	1.35	5.14	0.51	2.54
True Mean	**1.49**	**5.74**	**0.57**	**2.85**

Graphically, uncertainty in NPV can be represented using a cumulative distribution function (CDF) that maps resulting values to their percentile rank. Percentile ranges (e.g., 10th–90th) provide an indication of robustness to uncertainty in the sampled parameters.

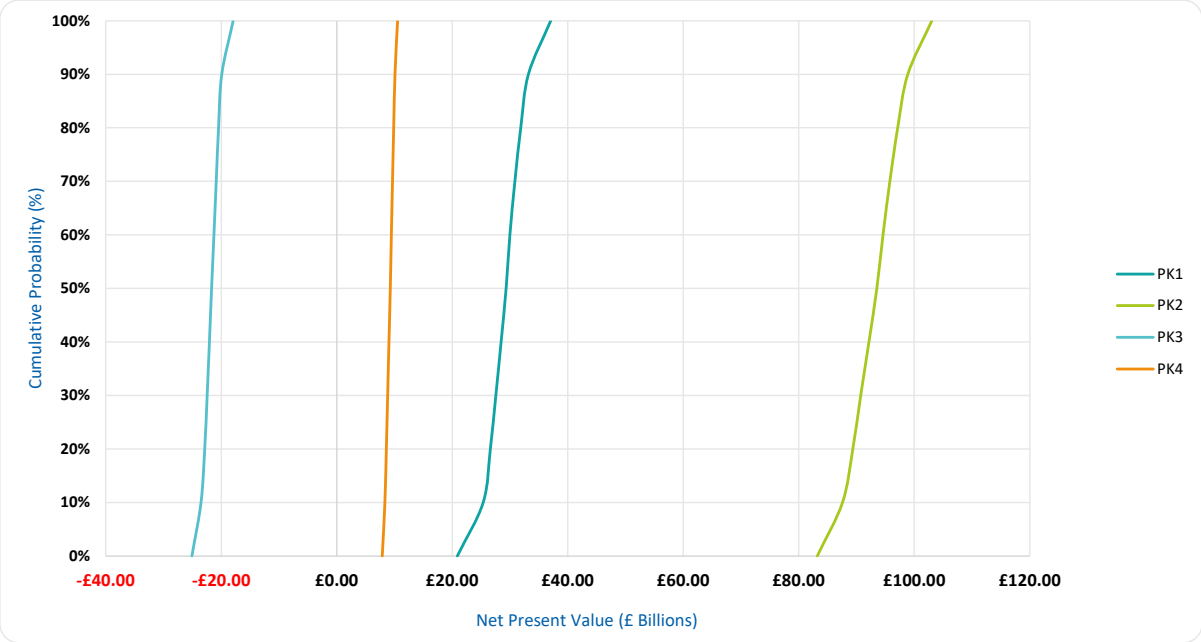

Figure 41: Cumulative Distribution Functions showing NPV probability distributions for placed-based package alternatives.

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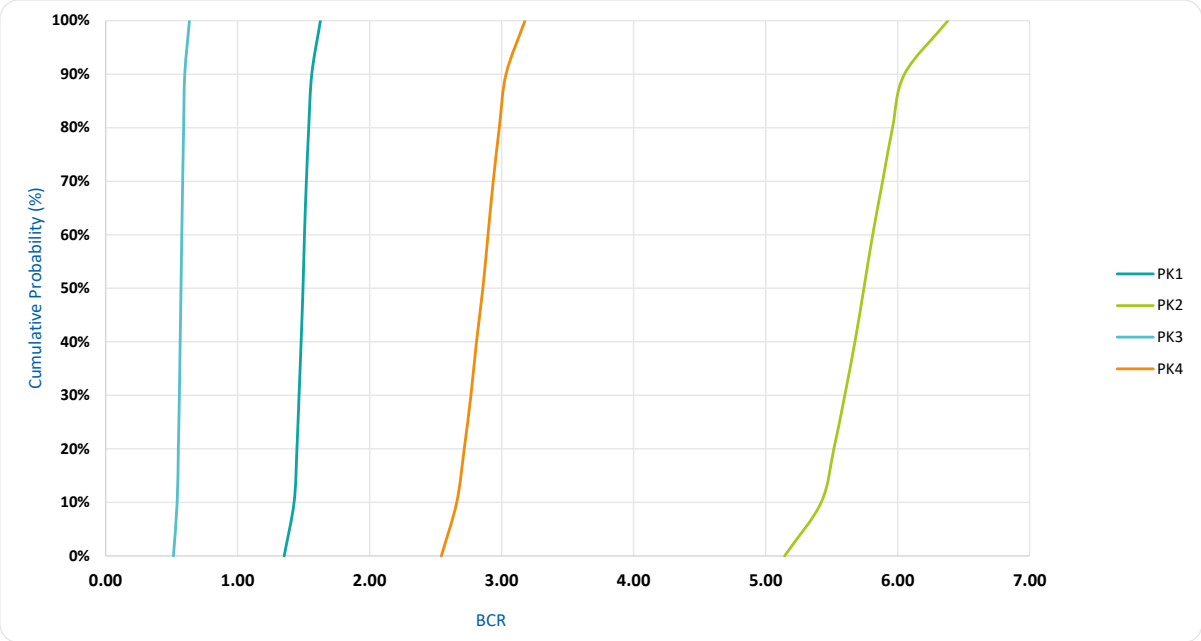

Figure 42: Cumulative Distribution Functions showing BCR probability distributions for placed-based package alternatives.

Figures 3 and 4 present cumulative distribution functions (CDFs) from the Monte Carlo analysis. A CDF shows, for any given NPV or BCR value on the x-axis, the probability that the model output is less than or equal to that value on the y-axis. It therefore provides a concise representation of uncertainty: how likely outcomes are to fall above or below key thresholds when uncertain parameters are repeatedly sampled within their plausible ranges.

For NPV (Figure 3), values to the right indicate greater net benefits (benefits exceed costs by a larger margin). For BCR (Figure 4), the key threshold is BCR = 1.0. Values above 1 imply benefits exceed costs in present value terms. The median outcome is read at the 50th percentile. The steepness of a curve indicates stability. Steeper curves suggest outputs are relatively stable across parameter draws, while flatter curves indicate greater variability and therefore greater downside and upside risk.

For robust interpretation, focus on ranges such as the 10th to 90th percentiles as an indication of performance under pessimistic and optimistic conditions, rather than relying on a single point estimate. The Monte Carlo analysis represents uncertainty in selected model parameters (e.g., effectiveness, adoption/coverage, benefit lags, failure risk and selected cost inputs) rather than all real-world uncertainties (such as policy change, delivery constraints or behavioural responses). Results should therefore be used as strategic screening evidence alongside non-monetised impacts and scheme-level appraisal as packages are developed into investable programmes.

6.3.3 Limitations of the CBA model

There are various limitations to this high-level, partial CBA model. The greatest relate to the strategic nature of the model (i.e., a high-level indicative assessment vs a focussed project level assessment) and the partial monetisation coverage. The model relies on scaled national baseline damages for some categories and uses exposure indices to allocate damages to packages. While this supports transparent regional screening, it is not a substitute for detailed scheme appraisal.

In addition, some benefit categories are represented using proxy values (notably transport disruption and water security) and several important risks identified in the wider climate change and opportunities assessment are not monetised in the current CBA model (e.g., coastal erosion/managed retreat beyond flood damages, wildfire damages, pests and pathogens, wastewater pollution harms,

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and complex cascading failures). As stated previously, this can bias appraisal outcomes for packages whose primary benefits fall in non-monetised categories.

The model includes Monte Carlo functionality to represent parameter uncertainty, but stochastic outputs reflect uncertainty in model parameters rather than the full range of real-world uncertainties (e.g., policy change, delivery risk, technological change or behavioural responses). For future updates, improved local evidence and expanded monetisation modules would increase confidence.

Various other key limitations are summarised below. These limitations mean results should be used to inform strategic decisions rather than as precise forecasts.

General analytical and contextual limitations

- Estimating climate change and adaptation costs is analytically complex.
- Climate risks are diverse and driven by interrelated physical, biological, and socioeconomic factors.
- Climate projections cannot provide high confidence about specific risks occurring at precise locations and times.
- Climate impacts are diverse and context-specific, requiring tailored analysis.
- Receptors and vulnerabilities change over time, making estimation dynamic and uncertain.
- Adaptation decisions are influenced by institutions subject to multiple constraints, complicating cost estimation.

Scope and purpose limitations of the CBA

- The analysis is a partial CBA, not a full economic assessment.
- Results are indicative only, intended for strategic prioritisation, not precise decision-making.
- The framework is high-level and designed for refinement as better evidence emerges.
- The analysis is proportionate to current evidence, meaning it is not comprehensive.

Data and evidence limitations

- Reliance on national-level data scaled to regional level (YNY), rather than fully local data.
- Use of proxies where monetised evidence is limited.
- Some values are based on simplified assumptions due to data constraints.
- Baseline damages often rely on scaled national values, not fully localised datasets.
- Exposure allocation uses proxy indices, which are approximations.

Uncertainty and modelling limitations

- Long time horizons involve substantial uncertainty in hazards, exposure, and impacts.
- Many impacts are only partially observed in markets.
- Results are sensitive to key assumptions (e.g., effectiveness, adoption, discount rates).
- Discount rates materially influence outcomes, especially over long periods.
- Scenario analysis does not represent deterministic forecasts, only plausible futures.
- Scenario mapping differs slightly from other assessments (e.g., 100-year horizon mismatch).

Methodological limitations

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- The CBA uses an avoided-damage framework, which may not capture all value pathways.
- Non-monetised impacts are only recorded qualitatively, not quantified.
- Using BCR (Benefit Cost Ratio) can oversimplify complex decisions and does not fully capture non-monetised benefits or system effects.

Monetisation limitations

The analysis is high-level and has entailed partial monetisation coverage only —many impacts are not quantified while some categories are represented with proxy values (notably transport disruption and water security).

Important risks not monetised include:

- Coastal erosion and managed retreat
- Wildfire damages
- Pests, pathogens, invasive species
- Wastewater pollution impacts
- Cascading infrastructure failures
- Ecosystem service benefits (e.g., biodiversity, recreation, carbon) are also not fully monetised.

6.4 CBA conclusions and recommendations

The YNYCA Societal CBA provides a transparent and updateable framework for comparing indicative adaptation packages against a cost of inaction baseline under climate uncertainty. Under current central assumptions, the base place packages (PK1, PK2 and PK4) deliver positive net present values and benefit-cost ratios greater than 1 under the S3 scenario.

Given the high-level nature of the model and the limitations in current monetisation coverage, results should be interpreted with caution and used to guide strategic prioritisation, sequencing and evidence development for proposed adaptation actions. Continued improvement of local baseline datasets and extension of benefit modules will enable more robust appraisal over time.

The YNYCA Societal CBA model provides a transparent and updateable framework for comparing indicative, place-based adaptation packages against a cost of inaction baseline under long time horizons and climate uncertainty. Using an avoided-damages approach, the model estimates how baseline annual expected damages evolve through time and the extent to which those damages could be reduced by adaptation packages after accounting for effectiveness, adoption/coverage, benefit lags and failure risk.

The model is intentionally proportionate at this strategic stage. Some benefit categories are represented using proxies (notably transport disruption and water security) and several important priority risks and co-benefits are not fully monetised (e.g., coastal erosion beyond flood damages, biodiversity and cultural heritage, wastewater pollution impacts, and some wellbeing and cascading infrastructure effects). Quantified NPV/BCR outputs should therefore be interpreted as screening evidence alongside qualitative impacts and distributional considerations, and refined through scheme-level appraisal as programmes are developed.

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6.4.1 Key findings

The economic case for proactive adaptation is strong at regional scale

The modelled baseline indicates substantial and rising "cost of inaction" across scenarios with order-of-magnitude AED increasing from ~£61.6m/year to ~£88.5m/year in current monetised categories. This supports the strategic conclusion that proactive adaptation is likely to deliver net societal benefits when targeted to material risks and delivered effectively.

Catchment resilience emerges as the most robust strategic investment theme (within current coverage)

Across deterministic and Monte Carlo outputs, PK2 shows the strongest performance. The result is consistent with the logic that catchment-scale measures can influence multiple receptors (flood, water security, agriculture and downstream disruption) and generate additional co-benefits not fully captured in the monetised categories. However, because catchment benefits depend on effectiveness, adoption and lag assumptions, this package should be treated as a priority for evidence strengthening so that strategic signals translate to robust business cases.

Urban resilience has a clear positive case, especially when it targets vulnerable groups and assets

PK1 is positive under current assumptions. This supports a strategic case for integrated urban packages combining flood risk management with overheating/heat-health measures and service continuity planning. The welfare case can be stronger than the monetised case where benefits accrue to vulnerable groups or where non-monetised wellbeing and amenity co-benefits are material.

Uplands/protected landscapes show positive returns, but quantified results likely understate total value

PK4 is positive in the current model. However, many ecosystem service co-benefits central to upland and protected landscape interventions (e.g., biodiversity, recreation, carbon, soil resilience, wildfire risk reduction) are not comprehensively monetised in the current version of the CBA model. This means the quantified BCR/NPV is likely conservative relative to the true societal case, particularly where upland actions provide cross-boundary downstream protection.

Coastal adaptation is strategically necessary, but current monetisation is incomplete

PK3 screens below 1 under current assumptions primarily because the model does not yet fully monetise coastal erosion and managed retreat impacts and associated social, economic and cultural consequences. The conclusion is therefore not that coastal adaptation is poor value, but that current quantified outputs are incomplete and should be interpreted alongside Shoreline Management Plan evidence, coastal exposure mapping and qualitative impacts. A priority next step would be to incorporate erosion/retreat valuation modules into the CBA model to avoid systematic undervaluation of coastal decisions.

Interpretation should prioritise robustness, not point estimates

Because long-horizon adaptation appraisals are sensitive to baselines, effectiveness, uptake and discounting, the modelled outputs should be used primarily to identify:

- actions that perform well across plausible ranges (robustness),
- where more evidence will most improve confidence, and
- where non-monetised impacts are likely to change priorities.

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6.4.2 Recommendations

Based on the current CBA model, including assumptions and outcomes, the following are recommended as next step improvements/updates:

Use the current CBA as a strategic screening tool; progress to scheme-level appraisal for investment decisions

- Use placed-based package results to help prioritise regional investment themes and sequencing, but develop specific scheme-level appraisals for business cases (capital programme, funding bids, delivery planning).
- Present NPV/BCR alongside a clear statement of what is monetised, proxied and excluded, to avoid false precision.

Strengthen the biggest value drivers first (evidence improvement priorities)

- **Flood baseline refinement (high priority):** Replace scaled national defaults with locally grounded EAD/AED series (including residual risk and committed schemes) and improve receptor disaggregation (residential, commercial, infrastructure, social impacts).
- **Water security module replacement (high priority):** Replace proxy water security AED with a local restriction-cost function aligned to water resource planning (probability, severity and duration of restrictions; welfare and productivity impacts by user group).
- **Transport disruption and cascading impacts (high priority):** Develop a critical-corridors assessment (GIS exposure + criticality + historic disruption) to replace conservative proxies and better represent cascading failures.
- **Coastal erosion / managed retreat (high priority):** Build an erosion/retreat damage and adaptation module (property loss, community disruption, relocation, heritage/tourism impacts) to prevent structural undervaluation of coastal packages.
- **Natural capital and wildfire (medium–high priority):** Expand valuation for upland ecosystem services and management costs, and include wildfire damages/response where locally material.
- **Wastewater / storm overflow impacts (medium priority):** Map overflow hotspots and sensitive receptors (tourism, bathing waters, fisheries, health) and develop proportional valuation consistent with environmental appraisal guidance.

Improve confidence in "real-world performance" assumptions (effectiveness, adoption, lag)

- Prioritise monitoring and evaluation for measures where benefits depend on uptake and long benefit lags (catchment and nature-based packages).
- Use a small set of representative case studies and monitoring indicators to refine effectiveness bounds over time (learning-by-doing).

Embed CBA updates into an annual governance cycle (a "living" appraisal)

- Assign named owners for key evidence inputs (flood, water, health/vulnerability, transport, unit costs).
- Version inputs and outputs, maintain an evidence register, and align refresh cycles with annual risk review and programme planning.

Use the results to support adaptive pathways and sequencing

- **Link the CBA to the pathways/threshold framework:** If and when indicators show thresholds being approached (e.g., increasing heat-health risk, higher drought restriction frequency, repeated flood disruption), trigger CBA re-runs and adjust sequencing.

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6.5 Qualitative cost assessment of priority risks

In addition to the regional cost benefit analysis, this study also sought to estimate the potential costs associated with specific material risks identified during the CCRA (see Section 2). The most urgent risks identified for the 2030s time horizon were considered. Five priority risks were selected from the CCRA for further high-level economic analysis due to their relevance to the YNY economy, their materiality and their likelihood to increase in severity in future time horizons. Within Table 36, the approach (quantitative, qualitative, mixed) to estimating the economic costs of the risks is provided.

While all sectors contribute to the YNY regional economy, the most important sectors within the region are described by the YNYCA as agriculture, food and drink manufacturing and tourism (YNYCA, 2024). These sectors, particularly agriculture, are vulnerable to the effects of climate change, and any damage resulting to the sector could have a disproportionate effect on the regional economy and associated employment. Risks that could disrupt these sectors were therefore prioritised for the cost analysis.

For some of the risks described below, estimating quantitative economic costs and benefits would entail complex economic analysis that goes beyond the constraints of this adaptation study. Recommendations for further studies are provided where relevant. The risks explored below are not exhaustive and focus only on the most material risks for the near-term period (i.e., 2030s). The focused assessments are partial only and utilise high-level methodologies and data sources. The results are indicative only and can be used to guide further analysis.

'Impacts to ecosystem services' were not grouped in a single risk that was specifically scored during the CCRA. Risks to the environment were more granular and were scored across a range of potential hazard/damage drivers within distinct risks. The risk grouping was included within this risk specific cost analysis due to the importance of ecosystem services to the YNY economy.

The estimates of current and future costs are generated from a mix of quantitative and qualitative assessments, drawn from academic and grey literature studies. Given the uncertainty in climate and impact models, a range of studies have been explored and used alongside expert judgement to generate indicative values of impact. Significant data gaps at the regional level limited the scope of the assessment and represents a key limitation; where sufficient data was not available to produce a quantitative analysis, a qualitative assessment was completed. Due to a lack of data, and the inherent uncertainties associated with climate change, the quantitative analyses had to rely on use of proxy data.

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Table 36 CCRA risks taken forward for priority economic analysis within the YNY Adaptation Study

Risk ID# (RR)	Hazard	Risk description	UK CCRA3 Chapter	Risk Rating (2030, 1.5C)	Qualitative approach	Quantitative approach	Mixed
105	Drought and extreme rainfall	Risks to **agricultural** productivity from extreme events, unpredictable weather and changing climatic conditions.	Natural Environment and Assets	[4] Major			X
26	Flooding	Risks to business sites from flooding (river, surface water and groundwater)	Business and Industry	[4] Major		X	
40	High temperatures	Risks to health and wellbeing from high temperatures including exacerbation of existing health conditions).	Health, Communities and the Built Environment	[4] Major		X	
65	Cascading	Risks to transport networks from cascading failures.	Infrastructure	[4] Major	X		
68	Drought / water scarcity	Risk of reduced **public** water availability due to drought conditions.	Infrastructure	[4] Major	X		
N/A	General	Impacts to ecosystem services	Natural Environment and Assets	N/A – not specifically scored during CCRA	x		

6.5.1 Agricultural productivity

The interaction between agriculture / agricultural economics and climate change is highly complex. At present, a comprehensive model of how climate change may impact the economics of the UK agricultural and food sector has not been completed, though in 2025 the Institute for Grocery Distribution (IGD) developed a model to analyse the potential effects of chronic climate effects (and excluding acute effects such as flooding) on 10 key food commodities (Institute for Grocery Delivery, 2025). This analysis is explored in the context of the YNY region below. The limitations of the YNY adaptation study precluded the completion of a comprehensive quantitative analysis of the economic cost to the agriculture sector from worsening climate change in the future, which would require a detailed separate scope of work.

In some cases (i.e., for certain types of crops), climate change may present opportunities for the agriculture sector in the future. For example, winter wheat yields have been modelled to increase by 10% in 2050 due to as a result of the combined effect of CO2 fertilization and a shift in phenology (Putelat et al., 2021). However, climate change appears to be increasing fluctuations between extreme weather types both within and between seasons (i.e., acute climate change risks); historically,

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farmers were presented with more predictable weather patterns. As a result, operational planning for farmers has become more difficult and risk prone. Furthermore, while academic models may provide modelled future impacts on crop yields, models represent simplified versions of reality and may therefore exclude certain factors that may significantly influence crop yield (such as impacts to the ability of farmers to plan their cropping effectively or a scenario where future water supply management is insufficient to maintain agricultural output).

Models may also exclude these acute climate change risks and therefore underestimate risk to agriculture. Within farming the timing of an extreme weather hazard could have a large effect on agricultural performance in addition to the severity of the hazard, representing further analytical complexity. This is due to crops and livestock being more sensitive to these hazards during specific periods of their lifecycles. For example, crops and livestock tend to be at greater risk to high temperatures during flowering and late gestation, respectively. This also relates to the timing of farming operations. For example, heavy extended rainfall during the drilling period for arable crops could prevent farmers from planting a crop but would not necessarily cause as much damage at a different window in time.

Academic models that use average seasonal or annual conditions to model impact to agricultural productivity may therefore not adequately address the potential impacts from increasing fluctuations in interannual, inter-seasonal and intraseasonal variability due to climate change.

Research from the LSE estimated that the economic output of the UK arable sector could nearly halve by 2100 (Rising et al., 2022). Their analysis is partially based on Ritchie et al. (2019) who note that arable areas in the south and east of the country (including in YNY) could disappear by 2100 under an RCP 8.5 scenario due to increasing drought and heat, being replaced by grassland. Arable areas spread into the cooler, wetter west of the country, which is currently mostly grassland. The researchers hypothesise that irrigation could counteract the loss of current arable areas, but that this would require significant water supply (ibid.).

These risks increase with the potential weakening of the Atlantic Meridional Overturning Circulation (AMOC), an ocean conveyor-belt of waters that warm Europe (Ritchie et al., 2020). The weakening of the AMOC would likely cause large reductions in rainfall in the UK, which could make most land unsuitable for arable farming (ibid.) with a corresponding loss of economic activity.

Utilisation of Defra statistics for arable and oilseed production in the Yorkshire and Humber region (more granular data for YNY is not available) indicates minimal yield declines in the 2021 to 2025 period compared to recent history for the 2001 to 2020 period (Defra, 2026a). However, the area of land allocated to different crops is also dependent on weather patterns; combining yield and production area figures is therefore required to understand the effect of climate change on cropping and productivity. Figures for the overall production of cereals (yield multiplied by hectares grown) indicates, since records began in 1999, the worst two years have occurred since 2020 (see Figure 43 below) (ibid.). Even if these declines do not appear significant, they have occurred over a period of technological innovation where yield should arguably have increased with time (Clarke, 2026). The actual impact of climate change relative to this hypothetical scenario could therefore be even more pronounced. It also appears that fluctuations in yields year-on-year are becoming more pronounced, representing added instability for farmers.

It is also worth noting that production and yield data does not represent all potential economic costs related to yields; for example, extreme weather may have caused other economic costs to the farmers even where yields did not decline, such as machinery loss or increased use of energy.

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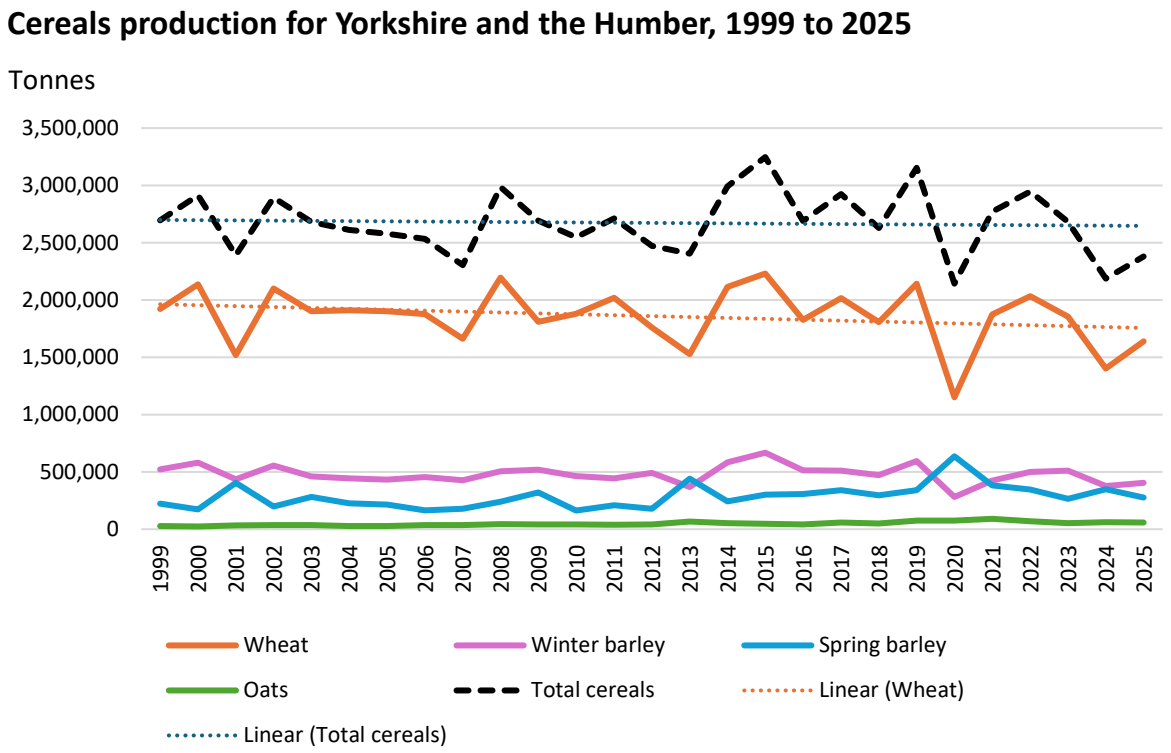

Figure 43. A graph displaying overall production of cereals in the Yorkshire and Humber region from 1999 to 2025. Source: (Defra, 2026a).

Due to the importance of agriculture to the YNY regional economy and the complexity of analysing the potential impacts of climate change on agriculture in the future, further localised analysis is recommended, including the costs and benefits of key adaptation options. It Furthermore, in 2026 it was recognised by the UK government that climate change and biodiversity loss are driving ecosystem loss which in turn could drive disruption to overseas food production systems that the UK relies on (Defra, 2026b). This has the potential to negatively affect YNY's food security and warrants more detailed analysis.

Downscaling of Institute for Grocery Delivery financial impact modelling

In 2025 the Institute for Grocery Delivery or 'IDG' (2025) estimated financial costs to the UK agriculture sector from climate change in 2050. The models were assessed under three distinct climate change scenarios: Net Zero (NZ), Delayed Transition (DT) and Business as Usual (BAU). Financial impact was estimated by calculating changes in the yield or production of commodities in the UK and key overseas sourcing regions. This model does not reflect acute climate change risks and therefore likely underestimate economic costs from climate change within the sector.

The commodities were selected to include key produce types and are provided below:

- Banana
- Barley
- Citrus
- Milk
- Potato
- Soy

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- Sunflower
- Tomato
- Wheat
- White fish

Three global warming scenarios by 2050 were assessed for potential cost impact within the UK, which are described in Table 37 alongside the downscaled impact to the YNY economy. The downscaling conversion factor was 0.995%, reflecting estimations of the YNY contribution to the overall UK economy. Note, the key drivers for cost increases under the Business as Usual scenario related to heat stress (diary, marine heat stress for white fish), water stress in sourcing regions such as Spain for citrus and tomato and domestic water stress (wheat).

The net financial impact was defined by IGD as the sum of the increase or decrease in import and domestic production costs into the UK food system as a result of physical climate change)

Table 37 Financial cost implications of future climate change scenarios on the UK food sector as modelled by the Institute for the Grocery Delivery with downscaling to the YNY included.

Scenario	Global warming level	Annual cost to the UK (£, millions)	Additional cost relative to total spend on commodity in 2050 (%)	Downscaled impact to YNY (£, millions)
'Net Zero' scenario	1.5°C of warming by 2050)	23 (net benefit)	N/A – net benefit	0.20 (net benefit)
Delayed Transition (described as the most likely scenario)	2 °C of warming by 2050	1,400 (net cost)	7.9%	14 (net cost)
Business as Usual	>2.5°C by 2050 (assumes a 4.0°C warming level outcome by 2100, i.e., aligning to RCP 8.5)	2,600 **(net cost)**	14.7%	26 (net cost)

Note, as this analysis constituted a downscaling of national level figures it does not reflect any local variation relevant to the YNY region. This is a high-level assessment, and the figures should be considered as preliminary and indicative only.

These figures indicate that climate change is likely to add significant production costs to key commodities within the YNY and broader UK market. These costs could negatively affect farmers financially (via reduced yields) and consumers (via increased retail prices). These costs would affect a sector that is already financially strained and products that are already susceptible to inflation.

Economic cost of flooding to arable farmland

Flooding frequently affects arable farmland, causing a range of negative economic effects such as crop damage, soil erosion, equipment and property damage and disruptions to farming operations (Cotterills, 2024). As both future forecasted flood risk modelling and readily available calculations on costs to farmland from previous flood events exist, it is possible to estimate the future economic costs resulting from flooding to farmland.

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RSK utilised the Living England Habitat Map (Phase 4) data from Natural England to estimate the total arable farmland area within the YNY region (Natural England, 2022). This was then combined with geospatial flood risk datasets from the Environment Agency (Defra and Environment Agency, 2025) to understand the area of farmland at risk from flooding for both the current time period and the "2050s Epoch", i.e., the 2040 to 2069 period under a scenario of RCP 8.5 and 4°C warming. This was combined with estimates of the economic impact of flooding to farmland during historic flood events in England (Environment Agency, 2010), which was adjusted for inflation from 2010 to December 2025 (£2,023 of damage per hectare flooded). The modelled costs are provided in Table 38.

Table 38 Modelling estimating the high-level indicative costs resulting from river, sea and surface water flooding to arable land in the York and North Yorkshire region under two climate change scenarios: 'Current Flood Risk' and a pessmistic 'RCP 8.5 Flood Risk (2040 - 2069) scenario. Costs are represented in annual average figures based on the likelihood of flooding in arable land areas. Source: RSK, 2026.

Current Flood Risk					
Flood Risk Level	**Arable land at risk (Rivers and Sea) (ha)**	**Arable land at risk (Surface Water) (ha)**	**Chance of flooding per year (%)**	**Land at risk each year (ha)**	**Estimated yearly cost (£)**
High	21,550	6,079	3.30%	912	1,800,200
Medium	7,059	2,740	2.20%	216	400,000
Low	9,647	8,534	0.50%	91	200,000
Very low	1,911		0.10%	2	4,000
Totals				**1,220**	**2,468,095**

RCP 8.5 Flood Risk (2040-2069)					
Flood Risk Level	**Arable land at risk - Rivers and Sea (ha)**	**Arable land at risk (Surface Water) (ha)**	**Chance of flooding per year (%)**	**Land at risk each year (ha)**	**Estimated yearly cost (£)**
High	31,630	7,866	3.30%	1,303	2,600,000
Medium	3,925	4,072	2.20%	176	400,000
Low	5,831	11,252	0.50%	85	200,000
Very low	1,090		0.10%	1	2,000
Totals				**1,566**	**3,167,190**

Notes and assumptions:

- *These figures are based on significant assumptions and modelling by the Environment Agency. As such, they are not representative of actual reality and should be used as indicative values only.*
- *These figures do not include indirect costs*

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- *Flood risk within Environment Agency modelling is calculated on a likelihood basis. For example, high risk represents an area where flooding is modelled to occur once every 33 years. Annual costs above were estimated by calculating the potential impact over a 33-year period and dividing this by 33 to provide an indicative average annual impact. In reality, flooding is highly likely to occur inconsistently over time and space rather than consistently year on year. The annual flood damages per year are therefore an indicative value only.*

6.5.2 Flooding (river and sea) impacts to property

Key findings

In the 2040 to 2069 period, annual property flood costs (river and sea) in the YNY region (excluding other types of flood costs, such as damage to roads, power networks) are estimated to range between £23,285,900 and £121,367,200 per year, at an average middle bound value of £72,326,500. This represents a doubling on the expected annual damages from 2026 onwards (approximately 38,319,000). If the YNY GDP is assumed to be £25.5 billion in 2025, the current losses would represent 0.15% of GDP, increasing to 0.28% in the 2040 to 2069 period.

These figures emphasise that flooding to properties represents a critical risk for the region, noting these figures only represent a proportion of the overall economic damage that flooding would likely cause. This specific risk could result in a range of other negative effects, such as reducing the insurability of homes and businesses located within affected areas.

The average annual economic costs could be reduced by approximately £11 million (a reduction of 15.3%) at minimal cost by prohibiting new developments in flood zone areas. For properties already located in flood risk areas, natural flood management could be utilised. Data from the York Ousewem project indicates that providing partial protection to properties via natural solutions could be approximately 5 to 25 times cheaper than allowing the property to flood.

Further analysis is recommended to understand the broader economic costs to the region from flooding, beyond property costs.

Approach and results

Data on flooding risk within the UK is relatively well developed and as such relevant external datasets could be accessed to model the potential costs of properties flooding within the YNY region. This analysis only included the direct costs of floods to properties (residential and commercial), as estimated in the HM Treasury Green Book. It does not include an estimate of the economic costs of flooding to broader infrastructure, such as roads, power and/or gas. Furthermore, it does not consider the indirect costs associated with floods to properties, such as business disruption, lost productivity, reduced mental health and increased healthcare costs.

The following approach was utilised to assess the economic costs from property flooding:

1. Approach based on HM Treasury Green Book.
2. Existing property flood risk data obtained from the Environment Agency (Environment Agency, 2025).
3. Number of properties in flood risk areas scaled up at future junctures based on expected population growth in the 2021 census.
4. Number of properties expected to fall within different flood risk categories in the “2050s Epoch”, i.e., the 2040 to 2069 period (RCP 8.5, 4°C warming) analysed using data from WP2. Vulnerability Assessment, itself derived from national level flood risk data (Defra and Environment Agency, 2025).

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5. Different flood risk categories normalised against a 1 in 33-year flood event (e.g., number of properties at risk of 1 in 50-year flood converted to 1 in 33-year flood event).
6. Flood cost damages per property (taken from the Green Book) are aggregated based on the number of properties at flood risk, to produce a total cost in the event of a 1 in 33-year flood event.
7. Total property flood costs following a 1 in 33-year flood event then divided by 33 to understand potential average annual costs.

The results are described in Table 39. and Table 40..

Table 39. Modelling estimating the high-level indicative costs resulting from river and sea flooding to commercial and residential properties in the York and North Yorkshire region given current flood risk exposure for the region as per Environment Agency flood zone mapping (Defra and Environment Agency, 2025). Costs are represented in annual average figures based on the flood risk probability of properties. Source: RSK, 2026.

Scenario: Current Day			
	Lower Bound flood costs, (£, 2025)	Higher Bound flood costs, (£, 2025)	Middle Bound flood costs, (£, 2025)
Estimated total flood damages 2023 to 2056, residential properties	175,151,179	985,225,021	580,188,100
Estimated total flood damages 2023 to 2056, commercial properties	233,896,152	1,134,765,318	684,330,735
Estimated total flood damages 2023 to 2056	409,047,331	2,119,990,339	1,264,518,835
Flood damages per year, residential properties, 2023 to 2056	5,307,611	29,855,304	17,581,458
Flood damages per year, commercial properties, 2023 to 2056	7,087,762	34,386,828	20,737,295
Flood damages per year, all properties, 2023 to 2056	12,395,374	64,242,131	38,318,753

Table 40. Modelling estimating the high-level indicative costs resulting from river and sea flooding to commercial and residential properties in the York and North Yorkshire region under a pessimistic RCP 8.5, 2040-2069 climate change scenario as per Environment Agency flood zone modelling (Defra and Environment Agency, 2025). Costs are represented in annual average figures based on the flood risk probability of properties. The figures below assumes properties currently located in flood risk zones increase proportionally with expected population growth rates for the YNY region. Source: ADAS, 2026.

RCP 8.5, 2040-2069 ("2050s Epoch") – Property Growth in Flood Zone Areas			
	Lower Bound flood costs, 2040-2069 (£2025)	Higher Bound flood costs, 2040-2069 (£2025)	Middle Bound flood costs, 2040-2069 (£2025)

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Estimated total flood damages 2040-2069, residential properties	314,740,397	1,770,414,091	1,042,577,244
Estimated total flood damages 2040-2069, commercial properties	360,549,659	1,749,234,628	1,054,892,143
Estimated total flood damages 2040-2069	675,290,057	3,519,648,719	2,097,469,388
Flood damages per year, residential properties, 2040-2069	10,853,117	61,048,762	35,950,939
Flood damages per year, commercial properties, 2040-2069	12,432,747	60,318,435	36,375,591
Flood damages per year, Total properties, 2040-2069	**23,285,864**	**121,367,197**	**72,326,531**

Table 41. Modelling estimating the high-level indicative costs resulting from river and sea flooding to commercial and residential properties in the York and North Yorkshire region under a pessimistic RCP 8.5, 2040-2069 climate change scenario. Analysis is based on Environment Agency flood zone modelling (Defra and Environment Agency, 2025). Costs are represented in annual average figures based on the flood risk probability of properties. The figures below assume properties currently located in flood risk zones do not increase proportionally with expected population growth rates for the YNY region. Source: ADAS, 2026.

RCP 8.5, 2040-2069 ("2050s Epoch") – No Property Growth in Flood Zone Areas			
	Lower Bound flood costs, 2040-2069 (£2025)	Higher Bound flood costs, 2040-2069 (£2025)	Middle Bound flood costs, 2040-2069 (£2025)
Estimated total flood damages 2040-2069, residential properties	267,016,325	1,501,966,282	884,491,304
Estimated total flood damages 2040-2069, commercial properties	305,497,295	1,482,143,814	893,820,555
Estimated total flood damages 2040-2069	572,513,620	2,984,110,096	1,778,311,858
Flood damages per year, residential properties, 2040-2069	9,207,459	51,791,941	30,499,700
Flood damages per year, commercial properties, 2040-2069	10,534,389	51,108,407	30,821,398
Flood damages per year, Total properties, 2040-2069	**19,741,849**	**102,900,348**	**61,321,099**

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Notes:

- *These figures are based on significant assumptions and modelling by the Environment Agency. As such, they are not representative of actual reality and should be used as indicative values only.*
- *These figures do not integrate benefits from the new Foss Barrier, Ousewem or other future flood defence measures.*
- *These figures do not include non-property related cost from flooding, such as costs resulting from damaged transport infrastructure, lost productivity, etc.*
- *Flood risk within Environment Agency modelling is calculated on a likelihood basis. For example, high risk represents an area where flooding is modelled to occur once every 33 years. Annual costs above were estimated by calculating the potential impact over a 33-year period and dividing this by 33 to provide an indicative average annual impact. In reality, flooding is highly likely to occur inconsistently over time and space rather than consistently year on year. The annual flood damages per year are therefore an indicative value only.*

Within the UK CCRA3 the expected annual damage from river and surface flooding to residential and business properties were estimated, including additional indirect costs (Sayers et al., 2021). These costs were disaggregated at the regional level; for the Yorkshire region costs from flooding were estimated at approximately £230 million in 2020. Whilst these estimates cover a larger geographical area than YNY, they are included here since flooding is a major climate risk for the region and this is currently the best data available.

Cost of adaptation

One means of adapting to increasing flooding impacts to properties in YNY is to prohibit the construction of new buildings in flood zone areas. The difference in Middle Bound figures between Table 40 and Table 41 indicate that this policy, which would theoretically entail minimal costs other than setting and enforcing the policy, could reduce property damage costs by approximately £11 million per year.

Natural flood management (NFM) is another method of adapting to flood risk. Table 42 below highlights how the benefits of pursuing NFM for property flood protection is 5 to 25 times less expensive than allowing the property to flood.

Table 42. A comparison of property flood costs and the cost of providing partial property flood protection via the use of natural flood management. Natural flood management costs were obtained from the Ousewem project. Property flood costs were obtained from the HM Treasury Greenbook.

Metric	Cost (£)
Damage per property from flood event (Range)	26,500 (8,000 to 45,000)
Cost per property partially protected via natural flood management	1,664*

**Data from the York Ousewem project indicate that Cost (Capital and Staff) were £725,936 which has provided partial protection to 436 properties, equalling £1,664 per property.*

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Cost of adaptation

The scale of cooling required to minimise exposure to extreme heat for workers in the YNY region has not yet been completed; as such, it would be difficult to estimate the cost and benefits of cooling systems (both passive and active) required across the region. Such an analysis goes beyond the scope of this adaptation study but is recommended for further analysis.

6.5.3 Extreme heat impacts to productivity

Key findings

Extreme heat events cause a range of health impacts, ranging from reduced productivity and cognitive performance through to mortality. Utilising experimental data produced by the Office for National Statistics (ONS) the cost of lost Gross Value Add (GVA) for the YNY was calculated by downscaling national level figures. The analysis found that losses to GVA as a result of extreme heat could total £35 million per annum by the 2050s, representing approximately 0.14% of YNYCA GDP in 2025. Without adaptative intervention, increasingly frequent and extreme heat events therefore represent a significant economic drag and critical risk.

Approach

The ONS has developed an experimental method to estimate the potential scale of lost output, in terms of gross value added (GVA) lost from hot days (Office for National Statistics, 2024). Initial model-based estimates suggest that between 1998 and 2021, the biggest impacts were in 2020 where hot days could have reduced productivity in Great Britain by £5.3 billion with assumptions that some adaptation measures, such as air conditioning, were in place.

Thes statistics were downscaled to the YNY regional level using the following methodology:

Methodology:

1. National level data estimated (experimental methodology) by the ONS.
2. National average figures downscaled to reflect YNYCA's position within the UK (0.995% of UK GDP).
3. Productivity impacts estimated for future time horizons by analysing Met Office CP18 climate change projection data for hot days.
4. Figures downscaled to reflect lower heat levels in the YNYCA vs the rest of the UK (as detailed in UKCP18 climate projection data).

Assumptions:

1. No future adaptation interventions.
2. Relies on approximate downscaling of modelled (not measured) national level impacts.

The results are described in Table 43.

Table 43 High-level estimations for potential losses to Gross Value Added (GVA) and economic productivity within the UK due to extreme heat events for a historic period and three future climate change scenarios reflecting differing levels of climate change. The data in a) has not been adjusted to account for hot days in YNY relative to the national climate; the data in b) has been adjusted to account for this.

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a) Annual lost productivity value, YNY - figures not adjusted for YNY hot days	
Scenario	**GVA reduction, £ millions (2025 prices)**
2017 to 2021	28
2030s / 1.5°C GWL	37
2050s / 2.0°C GWL	47
2100s / 4.0°C GWL	108

b) Annual lost productivity value, YNYCA – figures adjusted for YNY hot days	
Scenario	**GVA reduction, £ millions (2025 prices)**
2017 to 2021	21
2030s / 1.5°C GWL	27
2050s / 2.0°C GWL	35
2100s / 4.0°C GWL	85

Note: the results assume that some adaptation measures, such as air conditioning, are in place.

6.5.4 Cascading impacts to transport networks

An economic cost impact assessment for the 2007 nationwide floods (totalling about £3.2 billion in 2007 prices) estimated that impacts to railways from flooding resulted in £36 million of damage (~1% of the total) while damages to road, including increased congestion and extra travel time, was £191 million (~6% of the total). Historic local data relevant to extreme weather impacts to transport networks in the YNY region was not identified during this assessment.

Cascading impacts to the transport sector would require impacts in another sector or supply chain impacting the YNY transport network. This could include, for example, the power and / or data centre sectors suffering an outage, which in turn disrupts reliant transport systems such as the rail network. This is an uncertain risk in terms of both likelihood and severity. Relevant externally developed data on this topic was not identified and analysing the specific economic impacts from this risk was beyond the scope of this assessment.

Disruptions to the transport network would have their own cascading impacts through the system, disrupting commuting, business logistics and other. Further analysis is recommended to better understand likely climate-related costs and optimal investment in transport climate adaptation measures. Further information on interdependency risks can be found in Section 2.3.6.

6.5.5 Reduced public water availability due to drought conditions

Key findings

Water stress is beginning to affect YNY on a regular basis, partly due to climate change factors. There is lack of local data estimating the potential impacts to the economy from future water stress events. However, analysis at the national level and for water resource zones in the south and east of England indicate that water stress is beginning to cause significant economic drag as mains water connections are prioritised for housing over new commercial connections, slowing economic development. While the YNY is less affected at present, climate change projection data indicates that it is unlikely to remain immune into the future. Adaptive measures to secure water supplies are therefore recommended.

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Analysis

As noted in Section 3.3.5 2025 was one of the driest spring and summer periods on record for the Yorkshire region, with Yorkshire Water reservoir levels dropping below 40% and a hosepipe ban enacted July through December. The economic impact of drought so far (excluding potential impacts to agriculture noted in 6.5.1 above), however, has been minimal and no restrictions have been placed on commercial activity.

The YNY region faces a lower water stress risk profile than the south and east of England. Public First estimated the potential economic impacts of water stress on the UK's economic performance, finding that the vast majority of economic impacts (resulting primarily from restrictions on commercial water use to accommodate increased housing development) through 2030 will occur in the south and east of the country, with minimal lost economic activity within YNY (Public First, 2025). However, while longer-term water stress risk is uncertain and lower relative to the rest of England, the results of the Vulnerability Assessment (see Section 3.3.5) indicates that drought and water stress will become increasingly material risks for the YNY region.

An estimate of when commercial water use restrictions could be enacted in YNY due to future drought and water stress conditions and the economic impact of water stress has not yet been published. However, figures estimated at the national level or for water resource zones outside of the YNY region by Public First provide an indication of the potential economic value at risk. The Public First report indicates that GVA could be reduced by £6.4 billion at the national level by 2030, resulting in £1.8 billion in lost tax receipts. Annual displaced GVA increases from under £3 billion in 2026 through to over £6 billion in 2030. At the water resource zone level, costs through 2030 range between £500 million and £1 billion across numerous zones in parts of the south and in Cambridgeshire. Costs for more rural zones in Norfolk and Suffolk, which may be a more relevant proxy for future costs in the YNY region due to their rural economic character and relatively low population density, are estimated to range up to £100 million through the same time horizon (Public First, 2025).

These estimated economic costs relate only to blocked new commercial development waters; they do not include other economic losses related to water stress such as loss of sufficient water supply by farmers or more expensive water procurement by industry.

Due to the materiality of water as a critical element for economic activity a more detailed analysis of water stress vulnerability for the YNY region is recommended.

If the YNY region is able to steward its water resources, this could become a regional competitive advantage if businesses in the south and east of England continue to experience economic headwinds due to water stress as detailed in in the Public First (2025) report.

6.5.6 Impacts to ecosystem services

Key findings

Over half of global GDP is highly or moderately dependent on nature and researchers estimate that nature degradation could cost the UK GDP by 12% over the next decade. Data on this topic that is specific to the YNY region is lacking; understanding the potential economic costs of nature loss driven by climate change would require a specialised analysis that goes beyond the scope of this adaptation study and would ideally consider all loss drivers, not just climate change.

However, initial analyses indicate a high economic materiality for potential economic losses as a result of climate driven nature losses. For example, the 2025 North York Moors Wildfire caused £25.9 million in economic losses; climate projection data indicates the conditions witnessed during the 2025 summer are likely to become typical by the 2050s and this level of damage could therefore become a yearly occurrence, highlighting the severity of this risk.

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Analysis

Nature provides diverse 'ecosystem services' benefits to society including water provision, flood risk reductions, pollination, recreation and health benefits (including both mental and physical) (Office for National Statistics, 2024b). Modelling the relationship between these diverse factors and their various interactions with climate change is therefore complex and methodologically challenging. The World Economic Forum estimates that $44 trillion of economic value generation – over half the world's total GDP – is moderately or highly dependent on nature and its services and, as a result, exposed to risks from nature loss (World Economic Forum, 2020).Researchers at the UN Environment Programme (UNEP) estimate that local and overseas nature degradation could cost the UK GDP by 12% over the next decade (United Nations Environment Programme, 2024). This includes soil health decline; global food security repercussions; zoonotic diseases that pass from animals to humans, like bird flu, swine flu, and Covid-19; and antimicrobial resistance, where bacteria and viruses no longer respond to medicines.

These figures are based on abstract models but help to emphasise that economies are reliant on ecosystem services. This is especially the case for the YNY region, where agriculture and tourism, two sectors that are highly reliant on ecosystem services, provide critical economic contribution. The YNY CCRA also indicates that the region's natural capital is highly exposed to climate change (see Section 2.3.5). The UNEP report also highlights that nature-related risks are as detrimental or more to the economy as those from climate risks. Yet, while the economic costs of climate change are becoming increasingly accepted, the risks posed by nature degradation amount to a material cost that has not been sufficiently factored into financial and business decision-making. Climate change and nature risks often compound one another, worsening their impacts; for example, climate change can reduce the viability of native species that are already being outcompeted by invasive species.

However, a majority of nature degradation is likely driven by factors other than climate change such as industrial farming (though climate is a key driver) (Jaureguiberry et al., 2022). Assessing the influence of climate change within the loss of ecosystem services therefore adds an additional layer of complexity to an analysis that is already subject to conceptual difficulties.

This is reflected at the YNY regional level, where relatively little data has been produced on the cost of ecosystem service losses and the interaction thereof with climate change. The Moorland Association estimates that the 2025 North York Moors Wildfire caused £25.9 million in economic losses, though this figure is based on models rather than actual measured data and should not be seen as final (Moorland Association, 2025). This figure includes non-financial environmental damages such as habitat and carbon storage losses. The 2025 North York Moors Wildfire are considered unprecedented and the worst in YNY history, however by the 2050s the 2025 summer conditions are likely to be the average occurrence (see Section 2.2.2). This level of economic damage and disruption could be observed every year, therefore.

This represents just one type of climate hazard; there are a broad range of other impacts to ecosystem services that could result from climate change and drive economic losses. This includes loss of pollinators, recreation, freshwater provision, natural flood management and the loss of natural assets that are attractive to tourists. Given that natural systems are highly exposed to climate change impacts, further analysis of the economic impacts of ecosystem service losses is recommended.

Cost of adaptation

Enhancing the resilience of natural ecosystems to climate change will require restoring their condition and enhancing their extent and connectivity. Research regularly shows that investing in natural capital solutions to environmental challenges often provide large overall economic returns that outweigh initial investment costs once indirect benefits are considered. For example, research by the RSPB and Cambridge Econometrics found that, for the restoration of peatland, every £1 provided £4.62 in returns (Cambridge Econometrics, 2021). The return on investment included: carbon sequestration

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(reduces climate damages); water quality enhancements; reduced flood risk; recreational and health benefits; preservation of broader ecology (which provides other services) and restoration and maintenance employment.

Restoration of the natural environment to minimise the impacts of climate change can therefore provide nature-based adaptation solutions for other sectors, while also enhancing the resilience of existing natural ecosystems and conserving the various benefits that are already critical to society, but which are currently under threat from a range of drivers.

6.5.7 Qualitative climate change economic impact - conclusion

The risk specific cost analysis included as part of this adaptation study relied on limited evidence available at the regional level and, due to project constraints, reviewed a limited number of risks (relative to the broader climate change risk assessment). Even so, the picture emerging is one of significant and increasing economic costs, especially over longer-term time horizons such as the 2050s. By this juncture, agricultural cost increases (excluding acute climate impacts that are likely to entail significant additional costs), property flood costs (excluding the significant other costs associated with flooding), extreme heat impacts to productivity and wildfire impacts to moorland and heather could result in damages of over £160 million per annum. These costs relate to just four risks out of 113 risks and 21 opportunities identified during the climate change risk assessment, highlighting the incompleteness of this assessment and the likelihood that significant additional costs related to climate change can be expected by this juncture.

Climate change has already begun to influence and shape the YNY economy, and the scale and severity of impacts are projected to increase substantially over coming decades. While there are pockets of potential opportunity, particularly in agricultural productivity under certain conditions, the overall trajectory is one of rising risk, growing volatility and increasing economic cost. The available, limited regional evidence suggests that, without timely and effective adaptation, these costs will escalate significantly and outweigh the investments required to manage them.

The interaction between climate change and agriculture in the region is complex and uncertain. Some modelling indicates that yields for specific crops such as winter wheat could increase due to factors such as CO_2 fertilisation and shifting growing seasons. However, these potential benefits are likely to be offset by increasing variability in weather patterns. Farmers in York and North Yorkshire are already experiencing more frequent and unpredictable extremes, including periods of intense rainfall, drought and heat. These changes disrupt planting and harvesting windows, increase operational risks and lead to higher input costs, even where average yields appear stable. Over the longer term, there is a risk of more fundamental shifts in land use, with projections suggesting that arable farming in parts of eastern England could become increasingly unviable under high warming scenarios without significant investment in irrigation. At the same time, the region's food system is exposed to global climate impacts, with rising costs in imported commodities driven by heat and water stress overseas. By mid-century, these combined pressures could add tens of millions of pounds annually to the cost of food in the region, affecting both farmers and consumers.

Flooding represents a particularly acute and immediate risk. The geography of York and North Yorkshire, with its extensive river systems and floodplains, makes it especially vulnerable to both river and surface water flooding. Current estimates suggest that property damages already average around £38 million per year. By the 2050s, this figure could rise to over £70 million annually under high emissions scenarios, with upper estimates exceeding £120 million. This represents a doubling of damages and a growing drag on the regional economy. Importantly, these figures capture only direct damage to residential and commercial properties and exclude wider impacts such as infrastructure disruption, business interruption and health consequences. Flooding also affects agricultural land, with annual damages projected to increase over time, compounding pressures on the farming sector.

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These impacts illustrate not only the scale of the risk but also the extent to which current estimates are likely to understate the true economic burden.

The effects of increasing temperatures are also expected to become more pronounced. As the frequency and intensity of hot days rise, productivity losses will grow across multiple sectors, particularly those involving outdoor work or temperature-sensitive processes. By the 2050s, annual losses to economic output in York and North Yorkshire could reach approximately £35 million, even assuming some adaptation measures are in place. This represents a persistent and cumulative impact, reducing overall economic efficiency and growth.

Water availability presents a further emerging risk. Although the region is currently less exposed to water stress than parts of southern and eastern England, recent dry periods have demonstrated that it is not immune. Climate projections indicate that drought conditions are likely to become more frequent, raising the possibility of constraints on both agricultural production and broader economic activity. National evidence shows that water scarcity can restrict commercial development by limiting new water connections, and similar pressures could emerge in York and North Yorkshire over time. Conversely, effective management of water resources could become a source of competitive advantage if other regions face more severe constraints.

The region's economy is also closely tied to the health of its natural environment, on which the YNY agriculture, tourism and ecosystem service sectors are highly dependent. Climate change is expected to accelerate the degradation of natural systems, amplifying risks such as wildfire, biodiversity loss and declining soil and water quality. The economic impacts of these changes can be substantial, as illustrated by the North York Moors wildfire in 2025, which caused tens of millions of pounds in damages. As climate conditions shift, events of this nature are projected to become more frequent, transforming what are currently viewed as exceptional occurrences into more regular risks. The loss of ecosystem services also has wider economic implications, reducing the natural protection against flooding, limiting agricultural productivity and diminishing the attractiveness of the region for residents and visitors.

Across all these areas, a consistent conclusion emerges: the costs of inaction are likely to be significantly greater than the costs of adaptation. Flood damages alone are projected to increase sharply, while agricultural disruption, productivity losses, and ecosystem degradation will impose additional and interrelated burdens on the regional economy. These costs are not only financial but also social and environmental, affecting livelihoods, health and the long-term sustainability of communities.

By contrast, many adaptation measures offer strong economic returns. Preventing new development in high-risk flood zones, for example, could reduce future damages at relatively low cost. Nature-based solutions such as natural flood management have been shown to provide protection at a fraction of the cost of post-event recovery, while also delivering wider environmental benefits. Investment in natural capital, such as peatland restoration, can generate multiple returns by enhancing carbon storage, improving water quality and reducing flood risk. Similarly, actions to improve water efficiency, support climate-resilient farming and adapt infrastructure and workplaces to higher temperatures can help to reduce long-term risks while supporting economic resilience.

Looking ahead, there is a clear need for more detailed, locally specific analysis to fully understand the scale of these risks and to identify the most effective responses. This includes improving modelling of agricultural impacts, assessing the full costs of flooding across infrastructure systems, and evaluating the economic implications of water scarcity and ecosystem degradation. However, the ability to pursue these analyses will be constrained by available funding and it is likely that economic information related to future climate change impacts will continue to remain limited, which itself represents a potential risk to the region. At the same time, there is a need to integrate adaptation into spatial planning, infrastructure investment and regional economic strategy.

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Climate change therefore presents a set of interconnected and escalating risks for York and North Yorkshire. While uncertainty remains in the precise scale and timing of impacts, the direction of travel is clear. Without early and sustained action, the region is likely to face increasing economic costs and reduced resilience. By acting now to adapt, there is an opportunity not only to avoid the most severe damages but also to build a more robust and sustainable regional economy over the long term.

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APPENDIX 1

Climate change action within YNYCA to date

A review of previous assessments and information from relevant national reports, local authorities and key stakeholder organisations was undertaken to provide background context of climate action in the region. An overview of the relevant detail in the materials assessed is provided below.

National assessments/plans

UK National Climate Change Risk Assessment (2021)

The UK's third Climate Change Risk Assessment (CCRA3) (CCC, 2021) from the Climate Change Committee (CCC) sets out the priority risks and opportunities to the UK from climate change. These risks and opportunities were identified through extensive analysis, including three rounds of evidence gathering from public, private and third sector stakeholders. The outcomes were supported by multiple research reports and a valuation report, prepared specifically for CCRA3.

In total 61 risks and opportunities were identified, across five core sectors (natural environment; infrastructure; health, communities and built environment; business; and international dimensions). The analysis showed that the existing gap between climate risk and adaptation action has grown. Action has been insufficient to meet the growing impacts of a changing climate. CCRA3 highlighted that the UK has the resources available to respond effectively, but it had not mobilised these resources sufficiently as of 2021. Eight risks were identified as the highest priority for further adaptation over the preceding two years (to 2023). The priority risks covered policy areas of land use & nature, green finance, public procurement & business resilience, infrastructure, energy & net zero, building regulations & planning reform and national resilience, overseas aid & research and capacity building. These risks were prioritised due to a need for urgent additional adaptation action, recognising the gap in UK adaptation planning and opportunities to integrate adaptation into policy to avoid locking in poor planning. Despite this prioritisation of specific risks, the recommendation from the CCC was for all 61 of these risks to be considered in the next round of National Adaptation Planning.

UK National Adaptation Plan (2023)

The Third National Adaptation Plan (NAP3) (GOV.UK, 2023) provides the adaptation actions for 2023 to 2028 that the UK government and other key organisations will undertake to build national resilience to the impacts of climate change. The production of the national adaptation plans is required under the Climate Change Act 2008. NAP3 includes the strategy for the fourth round of climate adaptation reporting under the Adaptation Reporting Power (ARP). NAP3 focuses on adaptation action, building information and improving coordination of actions with the aim to ensure more action-focused delivery from government.

The actions included in NAP3 cover key sectors: infrastructure; natural environment; health, communities & built environment; business & industry and international dimensions. The role of local authorities alongside other key stakeholders across sectors is recognised. For example, one action of NAP3 is for the government to provide dedicated local climate projection services to upper tier local authorities to support local adaptation planning on key climate hazards. This service has largely, recently been provided by the Met Office Local Authority Climate Service (LACS). There is also recognition of the need for evidence gathering and capacity building to help local authorities prepare for the impacts of climate change.

UK National Risk Register 2025

The National Risk Register (NRR) (GOV.UK, 2025) is a publicly available assessment of the most serious risks the UK faces. It is based directly on the National Security Risk Assessment (NRSA), which is used within government and local resilience forums but is not publicly available. The NRR provides an assessment of the likelihood and magnitude (impact) of a broad range of risks that may directly affect the UK and its wider interests. It is informed by the latest risk information and evidence and is updated regularly. At time of writing, the current edition is from 2025, updated from 2023.

To meet the threshold for inclusion, NRR risks must have a substantial national impact on the UK's safety, security and/or critical systems. The NRR includes 89 risks categorised into nine themes (terrorism; cyber; state threats; geographic and diplomatic; accidents and system failures; natural and environmental hazards; human, animal and plant health; societal; conflict and instability). Each of the 89 risks are considered within a 'reasonable worst-case scenario' that aim to represent the worst plausible manifestation of the risk to ensure the UK is prepared for a range of possibilities. All risks in the NRR are acute (i.e. require an emergency response). Chronic risks (i.e. long-term challenges) are not included in the NRR because a separate process is used by government to identify and manage chronic risks.

Climate change presents acute and chronic risks. The 2025 NRR highlights that chronic risks, including climate change, are currently being considered internally within government. Several acute climate risks are considered within the NRR natural and environmental hazards, including wildfires, storms, high temperatures and heatwaves, flooding (coastal and river) and drought. Other risks within the NRR influenced by climate change, or the drivers of climate change, include poor air quality, pandemics, infectious animal and plant disease outbreaks, changes in migration into the UK, adult social care provider failure, rail & passenger vessel accidents, national and regional failure of electricity networks and gas supply infrastructure, reservoir/dam collapse, and food supply contamination. This list is not extensive but provides an indication of the broad range of national risks influenced directly or indirectly by climate change.

Regional assessments/plans

North Yorkshire Council Climate Change Strategy 2023-2030 (2023)

The North Yorkshire Council Climate Change Strategy (North Yorkshire Council, 2023) sets out a broad plan for how North Yorkshire will tackle both the drivers and impacts of the climate and nature emergency. The strategy for 2023 to 2030 is split into four core pillars: mitigation, adaptation, supporting nature and becoming a Climate Responsible Council. The need to prepare North Yorkshire for the impacts of climate change is central to the adaptation pillar of the strategy. This includes adaptation for and by nature, harnessing nature-based solutions to improve North Yorkshire's resilience. North Yorkshire Council (NYC)

outline that they plan to follow the recommendation of the Climate Change Committee and prepare for 2°C of global warming, whilst assessing for 4°C global warming. The importance of preparing for not only the physical risks from climate change, such as extreme heat or flash flooding, but global instability caused by climate change is clear throughout the strategy. NYC reference several risks in passing that give some insight into existing experiences of climate risk. These include flooding, the need to cool urban areas and the link between climate and health and disease outbreaks.

To date, adaptation work in the NYC region has been undertaken by various organisations and regional partnerships, such as the Environment Agency, within North Yorkshire. The strategy highlights the strength and breadth of existing partnerships across the region, which will be important networks to tap into to enable further adaptation action. NYC have also outlined their ambition to become a Climate Responsible Council and embed climate risk into day-to-day council service delivery.

A Climate Ready York (2023)

A Climate Ready York (City of York Council, 2023a) is a report from the City of York Council that outlines the council's progress towards strengthening York's resilience to climate change. The report sets out the key climate risks identified through a climate risk and vulnerability assessment and recognises the benefits from improved resilience not only as a protective measure but also as a driver for socio-economic development.

Key risks and opportunities to York from current and future climate change are highlighted, covering heatwaves and high temperatures, heavy rain, storms, flooding and extended dry periods and drought. In total 46 risks and opportunities were identified for York, using the CCRA3 framework as guidance, and six risks were prioritised. Key priority risks included the risk to people, communities and buildings from river and surface water flooding, risks to buildings fabric, risks to terrestrial species, habitats and soils, risk to food safety and security and opportunities from new terrestrial species colonising terrestrial habitats. There were limitations to this risk and opportunity assessment in terms of funding and people power, and it did not assess all CCRA3 risks. It was recommended that future studies assess all 61 CCRA3 risks. City of York Council have interacted with other regional local authorities through the Yorkshire and Humber Climate Commission to share learnings in climate adaptation, as well as City partners and considering changes needed to council services. Some adaptations are already underway, such as changing personal protective equipment to be more lightweight during high temperatures.

City of York has an ambition to be net zero by 2030. This report invites the city's Executive Members to strengthen this ambition and commit that by 2030 York will have set the conditions to be Climate Ready, or in other words suitably resilient to the impacts of climate change.

York and North Yorkshire's Routemap to Carbon Negative (2025)

York and North Yorkshire's Routemap to Carbon Negative (YNYCA, 2022) aims to provides a pathway for all in the region to achieve net zero and carbon negative GHG emissions. This Routemap focuses on emissions reduction to achieve these ambitious targets and become England's first carbon negative region. The document sets out a long-term vision as well as the priorities and actions for 2022 to 2027 to meet the regional ambition. Climate adaptation is acknowledged within the Routemap as an important aspect of the wider picture, however detailing actions to improve climate resilience is not the purpose of this Routemap.

The Yorkshire and Humber Climate Commission are cited within the Routemap as a leading regional organisation within climate adaptation that York and North Yorkshire will work with to address adaptation action. Additionally, the Routemap includes an overarching intervention in the creation of Local Plans to support and enable the delivery of both mitigation and adaptation at local authority and national park level. Heritage and historic buildings are referenced as areas that require an adaptation focus, both in terms of use and reuse and resilience to weather impacts. York and North Yorkshire's distinctive heritage is highlighted as an important consideration in how the region should go about adapting to the impacts of climate and extreme weather. This includes the value of the region's heritage and historic sites in providing opportunities to think differently about how to deal with new challenges, including climate impacts.

The Routemap was scheduled to be updated in 2026.

YNYCA Carbon Abatement Pathways (CAP) (2021, 2025)

YNYCA are in the process of updating the Carbon Abatement Pathways (CAP) analysed in the 2021 CAP Study for a region covering West Yorkshire, York, North Yorkshire and Leeds City Region (Durusut et al., 2021). Element Energy were the technical advisor for this study. These previous pathways informed York and North Yorkshire's Routemap to Carbon Negative that was published in 2022. The 2025 update of the CAP Study aims to reflect the progress in emissions reduction to date within YNYCA and develop a revised pathway to achieve carbon negative by 2040. It will also quantify the social and economic benefits of the net zero pathway and identify recommendations to deliver net zero, informed by local evidence. This involves demonstrating the emissions reduction potential of interventions across all sectors, in different scenarios. The 2025 update of the CAP does not directly account for adaptation action but does recognise where mitigation activities provide resilience benefits.

Weathering the storm – Yorkshire & Humber Regional Adaptation Study (2009)

'Weathering the Storm, the Yorkshire and Humber Regional Adaptation Study' was produced in 2009 for Yorkshire and Humber (Yorkshire Futures, 2009). Yorkshire and the Humber is one of the nine official regions of England, made up of the counties of East Riding of Yorkshire, North Yorkshire (excluding areas in the Tees Valley which are instead part of North East England), South Yorkshire, West Yorkshire, and the districts of North Lincolnshire and North East Lincolnshire that are in the county of Lincolnshire. The study was commissioned and funded by Yorkshire Futures, Yorkshire Forward, Yorkshire and Humber Assembly and the Environment Agency.

The risks from climate change were considered through several broad themes including Flooding; Erosion; Ground and mine waters; Biodiversity; Business and the economy; Infrastructure; Public and voluntary services; Health and welfare.

This study considered the projected changes for the region of key climate variables (average seasonal and annual temperature, hot days, heatwaves, average seasonal and annual rainfall, dry spells, snowfall, frost and sea level changes).

The report provides a high-level overview of the key impacts to Yorkshire and Humber identified through the study. Flooding is highlighted as a particularly important risk to the region. The study details previous flood events including the sources of flooding, future flooding and the impacts to physical

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infrastructure, communities and businesses. The regional impacts from river and sea flooding are set out, as are impacts from extreme rainfall and flooding on surface water and drainage as well as people and businesses.

Protected Landscapes ARP4 Risk Assessment (2025)

This assessment scored climate-related risks and opportunities with a focus exclusively on risks/opportunities related to protected landscapes. Three different climate change projection time horizons were considered: 2020 (Short Term), 2050 (Medium Term) and 2080 (Long Term). However, the global warming level temperature scenario used was not provided in the assessment document. The assessment is granular/detailed and scores projected direct and indirect risks/opportunities as a result of climate change across a large number of impacts and risk/opportunity categories. Mitigation options are proposed for each risk/opportunity.

The assessment included categories related to the national parks as protected landscapes (i.e., excluding risks to the North York Moors authority's own operations) like landscape character and historic environment, coastal erosion and sea level rise, natural habitats and species diversity, agriculture, built environment and infrastructure, and local communities. The assessment also included categories related to the operations of the North York Moors authority's operations, including its properties and estate and the welfare of staff and volunteers.

Within those categories, no risks were identified as 'High' for the 2020 short-term baseline period, and a large number of risks were scored as 'Medium'. For the 2050 time horizon, a large number of risks were scored as 'High'. Identified risks included:

- Coastal erosion and sea level rise leading to flooding and erosion of landscapes, causing risks to property, business and farmland along the coast and watercourses;
- Extreme weather events like storms, high temperature;
- Higher temperatures and repeated cycles of drought affecting farming and livestock, soil's ability to retain/process water and nutrients for plants and habitats and seasonal water supply.

Opportunities were also identified and scored. Example opportunities include expanding tree cover and related carbon sequestration and other ecosystem service benefits from new planting allowed by warmer and wetter winters. Changes in temperature and precipitation also bring an opportunity for new species and regenerative agriculture, while other green infrastructure solutions could be developed in the region to help adapt to climate change impacts; these may have other useful outcomes.

It is unknown whether specific quantitative and qualitative scoring thresholds beyond high-level categorisations were used when scoring risks.

Adapting to Climate Change in the Yorkshire Dales National Park (2011)

The 2011 report 'Adapting to Climate Change in the Yorkshire Dales National Park' prepared on behalf of National Park Management Plan Steering Group looked at the risks and opportunities posed by climate change and outlines actions to support future actions and resilience. Climate change will have a significant impact on the Yorkshire Dales National Park. Projections indicated in the report for up to the 2080s include hotter, drier summers, wetter, warmer

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winters, and more extreme weather events. Those will pose threats to biodiversity, landscapes and farming, heritage, tourism, and local communities. Key risks include habitat loss, infrastructure damage, species migration, and challenges to farming and water supply. The National Park Authority aims to address these through recognising interdependencies between the region's organisations, strategic planning and community engagement, coordinated through the National Park Management Plan. It will ensure adaptation is integrated across the different sectors and periodically reviewed. Key actions outlined also include habitat restoration and improving habitat connectivity, while taking steps to promote and increase sustainable tourism.

Climate reporting

City of York ARP4 report

The City of York Council voluntarily reported to the fourth round of the Adaptation Reporting Power (ARP) in 2023. The ARP4 report provides details on the operations and services within the Council's jurisdiction and how climate change is governed within the authority. The reporting process highlights gaps in the Council's existing CCRA, including alignment with international standards for adaptation (ISO 14090/91) and cites this Adaptation Plan commissioned by YNYCA as a source of evidence to fill these gaps. Additionally, the absence of consideration of interdependent and cascading risks within the existing York CCRA risk register is highlighted. Resilience to river flooding is a key risk to York, and the work to increase resilience through natural flood management and innovation are reported on. Other key adaptation actions underway are also reported, including York Community Woodland, York Green Streets and Retrofit One Stop Shop for York.

City of York CDP & GCOM submissions

The City of York Council reported to the Carbon Disclosure Project (CDP) through the CDP-ICLEI Track reporting pathway in 2023. This method of reporting is aligned with the requirements of multiple international frameworks including the Global Covenant of Mayors (GCOM) Common Reporting Framework (CRF) and the Task Force on Climate-related Financial Disclosures (TCFD), amongst others.

The reporting included details on the mechanisms supporting the Council's oversight of climate-related risks and opportunities, including risks related to transitioning to a low-carbon economy and how these risks have impacted development planning. The Council's Local Plan was cited as an important document in planning for current and future climate change. Data-driven examples of the wider benefits from climate action identified by the Council are reported on. For example, investment in profitable energy efficiency measures for buildings (schools, hospitals, offices etc) could save York £11 million a year in energy bills. The reporting framework collects detailed information on a series of questions relevant to climate risk, including how the Council ensure and quantify the equitable distribution of climate action and opportunities; engagement with other levels of government, businesses and the public on climate action; whether a CCRA has been completed; the most significant climate hazards and impacts on vulnerable populations and sectors. River flooding from the River Ouse and Foss are highlighted as key risks to York with low-income households being particularly vulnerable. The submission includes examples of recent serious flooding. Biodiversity loss, loss of green space, extreme heat and soil erosion are also highlighted as key climate risks to York.

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For reporting to GCOM, the Council shared significant factors impacting their ability to adapt to climate change alongside an emissions inventory method and data, energy consumption, transport, waste, public health and food data, mitigation targets including sector targets and actions, climate action planning and climate-action financing. GCOM also request information on the Council's adaptation goals, if any. City of York Council refer to an increased resilience to flooding as the primary adaptation goal. Goals to increase tree canopy cover to 13% and innovative flood resilience plans are also reported. For adaptation actions, flood defence projects, the aims of York Community Woodland and Our Green Streets to increase tree cover, a pollinator strategy, Blue Green Infrastructure Strategy and catchment wide natural flood risk management solutions are reported on.

Other material climate-related resources/analyses

York and North Yorkshire Community Risk Register (2023)

The York and North Yorkshire Community Risk Register is developed by the North Yorkshire Local Resilience Forum (NYLRF), which brings together multiple organisations, Emergency Services and businesses that will have plans in place to respond to the most probable emergencies highlighted for the region (York and North Yorkshire Local Resilience Forum, 2023). They have categorised the following risks as the most probable for the region: severe weather, health, utilities disruption and cybersecurity risks. Information is shared on how to respond to them on an individual level.

Website link

North Yorkshire Council Flood and Water Management website (n.d.)

The North Yorkshire Flood and Water Management website (North Yorkshire Council, n.d.(b)) includes summaries and investigations of recent flood events, how the local government tackles flood risk across the county and links to The North Yorkshire Local Flood Risk Strategy (latest programme of activities for managing and reducing flood risk that includes legislative, environmental and economical context).

Website link

YNYCA - Review of the state of farming finance and the challenges faced (2025)

Mayor David Skaith commissioned research in partnership with York and North Yorkshire's farming sector to understand their business resilience, and to ensure farming is sustainable for generations to come. All to support Local Growth Plan and an initiative 'Grow Yorkshire' which put food and farming at the top of York and North Yorkshire Combined Authority's strategic growth priorities. The study found that currently less than half of the 7,000 commercial farms in the region make sustainable profits, with many relying on income generated off farm (YNYCA, 2025 (b)).

Website link

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York and North Yorkshire's Retrofit Strategy (2025)

York and North Yorkshire's Retrofit Strategy is a collaborative document that provides strategic direction for retrofit in the region. Its aim is to provide a clear, co-owned plan to accelerate retrofit in York and North Yorkshire. It is intended to compliment other work in the region, not replace it, and YNYCA will work with key stakeholders to ensure it compliments other strategic documents including:

- York and North Yorkshire's Growth Plan
- York and North Yorkshire's Routemap to Carbon Negative
- York and North Yorkshire's 10 Year Housing Strategy and Spatial Development Plan

North Yorkshire County Council Minerals and Waste Joint Plan (2016)

This assessment looks at the risk of flooding from all sources (rivers, sewers, groundwater, canals) and the impact of climate change on minerals and waste sites in the region. It is the only county-wide assessment relating all the information to a minerals and waste context. Informs flood risk management policies and helps identify suitable locations for minerals and waste developments. The aim is to assess plans whose implementation may have a significant impact on flooding and flood risk, preventing unsuitable development in areas at risk, and directing development away from areas at highest risk.

Website link

North Yorkshire Districts Strategic Flood Risk Assessments

Each of the former districts of North Yorkshire created their own Strategic Flood Risk Assessments (SFRAs) though at different times. They follow a similar structure and outline high-level flood risks for the respective areas, providing a strategic overview of flood risks across the districts. They incorporate Environment Agency (EA) flood maps (fluvial, tidal, surface water, groundwater, and reservoir risks) alongside climate projections to identify zones where development is most vulnerable. The reports include maps and site-specific evaluations of potential development sites, enabling the application of Sequential and Exception Tests during Local Plan preparations, guiding developments away from active functional floodplains. They require detailed Flood Risk Assessments for sites in moderate to high-risk zones, incorporating Sustainable Drainage Systems (SuDS), safeguarding land for future flood storage and ensuring cross-authority consultations. The SFRAs are designed to guide future development, infrastructure planning, and flood emergency preparedness, ensuring resilience against rising flood threats.

- Craven District Council
- Hambleton District Council
- Harrogate Borough Council

- Scarborough Borough and Ryedale
- Selby District

North Yorkshire Council is in the process of developing a new SFRA that will be based on updated, comprehensive flood risk modelling and updated central government rules. A publication date for this assessment is yet to be confirmed.

North York Moors National Park Authority Strategic Flood Risk Assessment (2017)

This risk assessment evaluated flood risk from rivers, sea, surface water, groundwater and reservoirs across the National Park and surrounding area (North Yorkshire County Council, 2017). It uses updated EA flood maps, historical data, and detailed models to describe flood zones (including the functional floodplain), identify key at-risk settlements and assess risk from all the above sources with future climate change. The report makes recommendations like avoiding development in outlined high risk flood zones, requirement for site-specific flood risk assessments and use of sustainable drainage systems (SuDS). It also maps flood warning zones, details existing and proposed flood management infrastructure, and provides guidance for Local Plans and developers.

Website link

Yorkshire Dales National Park Strategic Flood Risk Assessment (2022)

This report assesses fluvial, surface water, groundwater, reservoir, and coastal flood risks to the National Park and surrounding areas (Yorkshire Dales National Park Authority, 2022). It utilises EA flood maps, historical incident records and groundwater susceptibility data to outline flood zones and identify areas of highest risk. It also looks at climate change and its impact on flood risk. It offers detailed mapping, flood risk screening tools, and policy guidance aimed at planners and developers, including requirements for site-specific FRAs, the promotion of SuDS, and integration with emergency planning. The report also highlights the need for continued collaboration between planning authorities, infrastructure providers, and the EA to ensure future development is resilient to increasing flood risks.

Website link

The Tyne to Flamborough Head Shoreline Management Plan 2 (2007)

This Shoreline Management Plan (SMP) (Environment Agency, 2007) covers the coastline between the mouth of the River Tyne in North Tyneside and Flamborough Head in East Yorkshire, encompassing the entirety of the North Yorkshire coastline. The SMP for this area presents agreed approaches to managing the risk of coastal flooding and erosion at the shoreline and in estuaries over the short, medium, and long term, considering the implications of climate change. In some locations, the approaches set out in the SMP change over time, for example from holding the current shoreline position with defences to realigning it or allowing the coast to change more naturally.

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The SMP shows where this may affect people, property or the natural environment and the action plan includes measures to manage the local effects of coastal change. Local development planning can then be used to help avoid or address these effects, for example by identifying where new or relocated buildings can be built and defining any conditions to promote safety or sustainability.

Website link

Humber 2100+ Strategy (n.d.)

Note this is not strictly YNYCA-related as the Humber Estuary is not located within the YNYCA area; however, there is a tidal influence within the YNYCA on the River Ouse to Naburn and on the River Wharfe to Tadcaster. Tidal inundation risks are considered potentially relevant through to Selby by YNYCA stakeholders.

Humber 2100+ is a long-term project to review and update the 2008 'Planning for the Rising Tides' flood risk strategy, led by EA, together with 11 local authorities, Internal Drainage Boards, Natural England, and other partners. With over 500,000 residents, thousands of businesses, significant infrastructure, agricultural land, and internationally protected habitats along the tidal Humber estuary. The project is structured around the following: understanding the risk of future flood scenarios across 25-100 years, developing possible strategies, including flood defence upgrades, flood storage, land use changes, and a tidal barrier 'Plan Adaptation and a Sustainability Appraisal' that will be evaluating environmental, social, and economic impacts of the policy development.

Website link

Ousewem Natural Flood Management Scheme (2024 onwards)

This project aims to bring innovative solutions to flood and water environment management to North Yorkshire's Swale, Ure, Nidd and Ouse (SUNO) catchments. To support this, it will encourage farmers and landowners, residents and investors to connect and collaborate in safeguarding the North Yorkshire and City of York communities using nature-based solutions (NbS), natural flood management (NFM) and land management changes.

Website link

City Of York Council Strategic Flood Risk Assessment (2022)

This Strategic Flood Risk Assessment (SFRA) report describes the area with focus on topology and hydrology and outlines the latest flood risk data (from rivers, surface water, groundwater and others) across the City of York's administrative area to inform planning and decision making and Local Plan allocations (City of York Council, 2022). It approaches the analysis using the nationally agreed three-stage approach: assess, avoid, and mitigate, emphasizing avoidance of high flood risk locations wherever possible, and requiring site-specific Flood Risk Assessments for larger sites. The SFRA also includes flood risk mapping, a database of potential development sites rated by relative flood risk, and guidance on resilient design, SuDS and policy recommendations to ensure new developments are safe and do not increase flood risk elsewhere.

Website link

Signposting to other relevant regional / national climate change documentation

- **National Parks England - Protected Landscapes High Level Report for Adaptation Reporting Round 4 (ARP4) (Hyperlink)**
- **Northern Powergrid – Adapting to Climate Change, Fourth Round Report (2024) (Hyperlink)**
- **Northern Gas Networks – Climate Change Adaptation Reporting Power, Round 4 Report (2024) (Hyperlink)**
- **Transport for the North – Climate Change Vulnerability Assessment (2025) (Hyperlink)**
- **Yorkshire Water – Climate Adaptation Report (2025) (Hyperlink)**

Non-climate YNYCA initiatives with linkages to the Adaptation Study

The North Yorkshire Local Plan (publication date TBC)

The North Yorkshire Local Plan will guide future development and conservation in the area until 2045. This plan is currently under development in a consultation phase (North Yorkshire Council, 2025). It will cover North Yorkshire, excluding the North York Moors and Yorkshire Dales National Parks, and outline priorities for land use and development. When adopted, this plan will replace any existing local plans. Consultations will take place throughout 2025 with final plan development to take place thereafter (final date to be confirmed).

Website link

City of York Local Plan 2017 - 2033 (adopted 2025)

Similar to the North Yorkshire Local Plan, this plan sets out development through 2033 (and 2038 for the green belt boundaries) (City of York Council, 2025).

Website link

Integrated Transport Network for York and North Yorkshire (expected 2026)

Members of York and North Yorkshire Combined Authority have taken the steps towards developing a plan for integrated transport in the region (York and North Yorkshire Combined Authority, 2025). Some of the initial plans for the strategy include growing the bus network and identifying areas with poor public transport accessibility for healthier travel accessible to everyone and protection of the environment. A full Local Transport Plan for the region would go out for consultation early in 2026.

Website link

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York Local Transport Strategy 2024-2040 (developed in 2023, released in 2024)

York's Local Transport Strategy sets out a vision for a cleaner transport system, prioritising walking, cycling, public transport, and essential car journeys (City of York Council, 2024a). It aims to cut carbon emissions by up to 71% and reduce car travel by 20%, supporting York's goal of net zero by 2030.

Website link

North Yorkshire Local Transport Plan 2016-2045 (2016)

The North Yorkshire Local Transport Plan describes a long-term strategy for managing and improving the county's transport network (North Yorkshire Council, n.d.(a)). Some of the key objectives include: supporting economic growth, improving safety, enhancing access to services, reducing environmental impact, and promoting healthier travel options.

Website link

APPENDIX 2 – Climate Change Projection Data

Table 44. List of the climate projection data for core variables and indicators extracted for each of the core YNY regions and subregions of North Yorkshire, including data sources. LACS refers to the Local Authority Climate Service, provided by the Met Office. UKCP18 refers to the Met Office UK Climate Projection data. CRI refers to the Climate Risk Indicators platform, which uses UKCP18 data.

		North Yorkshire (whole region)	City of York	North York Moors	Yorkshire Dales	Nidderdale	Howardian Hills	North Yorkshire coast (Filey)	North Yorkshire south (Selby)	North Yorkshire central (Northallerton)
Temperature	Summer maximum	✓ (LACS)	✓ (LACS)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)
	Summer average	✓ (LACS)	✓ (LACS)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)
	Winter average	✓ (LACS)	✓ (LACS)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)
	Winter minimum	✓ (LACS)	✓ (LACS)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)
	Annual average	✓ (LACS)	✓ (LACS)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)
Precipitation	Summer rate	✓ (LACS)	✓ (LACS)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)
	Winter rate	✓ (LACS)	✓ (LACS)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)
Indicators	Summer days (daily max temperature <25°C)	✓ (LACS)	✓ (LACS)	✕	✕	✕	✕	✕	✕	✕

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	Heat stress (WBGT >25°C)	✕	✕	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)
	Hot summer days (daily max temperature <30°C)	✓ (LACS)	✓ (LACS)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)
	Extreme summer days (daily max temperature <35°C)	✓ (LACS)	✓ (LACS)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)
	Tropical nights (daily min temperature >20°C)	✓ (LACS)	✓ (LACS)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)
	Frost days (daily min temperature <0°C)	✓ (LACS)	✓ (LACS)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)
	Icing days (daily max temperature <0°C)	✓ (LACS)	✓ (LACS)	✕	✕	✕	✕	✕	✕	✕
	Growing degree days (daily mean temperature: °C >5.5°C)	✓ (LACS)	✓ (LACS)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)
	Heating degree days (daily mean temperature: °C >15.5°C)	✓ (LACS)	✓ (LACS)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)
	Cooling degree days (daily mean temperature: °C >22°C)	✓ (LACS)	✓ (LACS)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)

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Wildfire	**Met Office Fire Danger (very high)**	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)	✓ (CRI)
Sea level	**Sea level anomaly**	✓ (UKCP18)	✗	✗	✗	✗	✗	✗	✗	✗

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APPENDIX 3 - LIKELIHOOD SCORING THRESHOLDS

Table 45 Likelihood scoring thresholds used in the CCRA to score the likelihood of a given risk occurring.

Score	Rating	Qualitative Risk Definition A	Qualitative Risk Definition B	Probability*	Qualitative Opportunity Definition
5	**Very Likely**	Has historically occurred frequently and/or very likely to occur in the future	The risk in the process of materialising and may already be under active management as an event	90-100% probability	Very likely that the opportunity will come to fruition
4	**Likely**	Has historically occurred several times and/or likely to occur in the future	Past events have not been fully resolved, effective mitigations not yet identified, control weakness are known and are being managed.	66-100% probability	Likely that the opportunity will come to fruition
3	**Possible**	Has historically occurred from time to time and/or possible to occur in the future	Past events satisfactorily resolved, mitigations are in place or are on track to be in place, control improvements are under active management	33-66% probability (i.e. about as likely as not)	Possible that the opportunity will come to fruition
2	**Unlikely**	Has historically occurred infrequently and/or unlikely to occur in the future	Events are rare, required mitigations in place, controls are effective	0-33% probability	Unlikely that the opportunity will come to fruition
1	**Very Unlikely**	Has historically not occurred and/or very unlikely to occur in the future	No known event or if known extremely rare, extreme industry-wide scenarios	0-10% probability	Very unlikely that the opportunity will come to fruition

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APPENDIX 4 - MAGNITUDE SCORING THRESHOLDS

Table 46 Magnitude scoring thresholds used in the regional CCRA to score the magnitude of impact if a given risk were to occur

Score	Rating	Scale of Impact	Temporal Impact	Economic Impact (£)	Health Impact (#)	Land/Water Impact (%/#)	Habitat/Species Impact (%)	Natural Capital Impact (%)
5	Very High	Extreme annual damage and disruption or foregone opportunities:	Substantial change, affecting the YNYCA region for a prolonged period of time (e.g. many months or years) including irreversible changes	• Very high economic impact and/or very high proportion of YNYCA region affected economically • £hundreds of millions in damage/impact (e.g. >£100 million)	• Very high proportion of people in YNYCA region affected and/or high number of deaths • A few or tens of deaths, hundreds of major health impacts, tens of hundreds of people affected / minor health impacts	• Very high proportion of land/river affected • Tens of thousand hectares of land lost or severely damaged, and/or hundreds of km of river water/km2 of water bodies affected	Extreme impact (>15% at regional level) to valued habitat or landscape types (e.g. BAP habitats, SSSI's), and/or extreme impact on or loss of species groups and/or keystone/important species/habitat	Extreme impact (15% or more at regional level) to an individual natural capital asset and associated goods and services
4	High	Major annual damage and disruption or foregone opportunities:	Moderate change, affecting multiple parts of the YNYCA region for a relatively long period of time (e.g. months)	• High economic impact and/or high proportion of YNYCA region affected economically • Many £tens of millions of damage/impact (e.g. £10 million to £100 million)	• High proportion of people in YNYCA region affected and/or moderate number of deaths • A small number of deaths, tens of major health impacts, hundreds of people affected / minor health impacts	• High proportion of land/river affected • Thousands of hectares of land lost or severely damaged, and/or several tens of km of river water/km2 of water bodies affected	Major impact (~10% at regional level) to valued habitat or landscape types (e.g. BAP habitats, SSSI's), and/or major impact on or loss of species groups and/or keystone/important species/habitat	Major impact (10% or more at regional level) to an individual natural capital asset and associated goods and services
3	Medium	Moderate annual damage and disruption or foregone opportunities:	Noticeable change, affecting some parts of the YNYCA region for a moderate amount of time (e.g. many weeks)	• Moderate economic impact and/or moderate proportion of YNYCA region affected economically • £millions of damage/impact (e.g.	• Moderate proportion of people in YNYCA region affected. • No deaths (or 1 in 5 chance of fatality), tens of major health impacts, hundreds of	• Moderate proportion of land/river affected • Tens of hundred hectares of land lost or severely damaged, and/or tens of km of	Moderate impact (~5% at regional level) to valued habitat or landscape types (e.g. BAP habitats, SSSI's), and/or moderate impact on or loss of species groups and/or	Intermediate impact (~5% or more at regional level) to an individual natural capital asset and associated goods and services

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				£1 million to £10 million)	people affected / minor health impacts	river water/km2 of water bodies affected	keystone/important species/habitat	
2	**Low**	Minor annual damage and disruption or foregone opportunities:	Small change, affecting isolated parts of the YNYCA region for a small amount of time (e.g. few weeks)	• Low economic impact and/or low proportion of YNYCA region affected economically • £hundreds of thousands of damage/impact (e.g. £100,000 to £1 million)	• Low proportion of people in YNYCA region affected and/or very low or no deaths • No deaths, a few major health impacts, tens of people affected / minor health impacts	• Low proportion of land/river affected • Hundreds of hectares of land lost or severely damaged, and/or a few km of river water/km2 of water bodies affected	Minor impact (~1% at regional level) to valued habitat or landscape types (e.g. BAP habitats, SSSI's), and/or minor impact on or loss of species groups and/or keystone/important species/habitat	Minor impact (~1% at regional level) to an individual natural capital asset and associated goods and services
1	**Very Low**	Minimal annual damage and disruption or foregone opportunities:	Negligible and/or unnoticeable change in the YNYCA region for a very small amount of time (e.g. few days)	• Very low economic impact and/or very low proportion of YNYCA region affected economically • £tens of thousands damage/impact (e.g. <£100,000)	• Very low proportion of people in YNYCA region affected and/or no deaths • No deaths or major health impacts, a few people affected / minor health impacts	• Very low proportion of land/river affected • Tens of hectares of land lost or severely damaged, and/or km of river water/km2 of water bodies affected	Minimal impact (~0.5% at regional level) to valued habitat or landscape types (e.g. BAP habitats, SSSI's), and/or minimal impact on or loss of species groups and/or keystone/important species/habitat	Minimal impact (~0.5% at regional level) to an individual natural capital asset and associated goods and services

Table 47 Magnitude scoring thresholds used in the organisational CCRA

Score	Rating	Assets	People	Operations
5	**Very High**	Severe and/or widespread damage to multiple assets	Very high percentage of staff effected	Severe disruption to some operations, including failure to provide key services
4	**High**	Major and/or relatively widespread damage to multiple assets	High percentage of staff effected	High disruption to some operations, including major inability to provide some key services
3	**Medium**	Notable damage to a few assets and/or minor damage to a large number of assets	Moderate percentage of staff effected	Moderate disruption to multiple operations, including delays to key services
2	**Low**	Minor damage to a small number of assets	Small percentage of key staff effected	Minor disruption to some operations
1	**Very Low**	Negligible damage to a very small number of assets	Very small percentage of key staff effected	Negligible disruption to operations

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APPENDIX 5 – YNY REGIONAL CCRA SCORES

Overall risk and opportunity scores for each sector grouping are provided below. The full scoring is contained within the YNY Climate Change Risk Register, which is held and managed by the YNYCA and partner authorities.

Table 48 Risk rating scores across four climate change scenarios for climate-related risks to the Business & Industry sector grouping within the YNY region.

Risk ID#	YNYCA risk description	2030s 1.5˚C	2050s 2˚C	2080s 2˚C	2080s 4˚C
1	Risks to **tourism centres** from **greater demand** and pressure associated with more favourable weather conditions (e.g. hotter and drier summers)	[1] Negligible	[2] Minor	[2] Minor	[3] Moderate
2	Challenges for **showgrounds and venue operation** and maintenance from extreme weather events (e.g. storms and high winds, drought)	[1] Negligible	[2] Minor	[2] Minor	[3] Moderate
3	Disproportionate impact on **Small and Medium Enterprises** (SMEs) from **extreme weather events** (storms, heatwaves, water scarcity, wildfire etc.)	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
4	Negative impacts to **bathing water quality** at the coast becoming more severe during heavy rainfall events leading to **reduced tourism activity** at the coast.	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
5	Risks to businesses from Humber Estuary inundation (considered a risk up the River Ouse until Selby; there is tidal influence on the River Ouse to Naburn and on the River Wharfe to Tadcaster).	[1] Negligible	[3] Moderate	[3] Moderate	[4] Major
6	Risks to **business sites** from **flooding** (river, surface water and groundwater)	[4] Major	[4] Major	[4] Major	[5] Severe
7	Risk of **loss of business locations** and infrastructure from coastal change and erosion, flooding and extreme weather events	[2] Minor	[3] Moderate	[3] Moderate	[4] Major
8	Risks to **non-tourist businesses** (manufacturing, industry, retail, etc.) from **water scarcity** (e.g., months, cooling and heating, washing products, dissolving chemicals, suppressing dust, and as a direct input to products)	[2] Minor	[3] Moderate	[3] Moderate	[3] Moderate
9	Risks to **hospitality and leisure** from temporary or longer periods of **water scarcity** (including hotels and tourism businesses noting that research indicates that swimming pools and water parks typically reuse most of their water). Water limitations may be put on these businesses from water utilities.	[2] Minor	[3] Moderate	[3] Moderate	[3] Moderate
10	Negative impacts to water treatment infrastructure and/or drainage/sewage systems resulting in **reduced water quality available for businesses** and reduced business productivity as a result (interdependency with infrastructure).	[2] Minor	[3] Moderate	[3] Moderate	[3] Moderate

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Risk ID#	YNYCA risk description	2030s 1.5˚C	2050s 2˚C	2080s 2˚C	2080s 4˚C
11	Risks to **business locations** and infrastructure from coastal change and erosion, flooding and extreme weather events	[2] Minor	[2] Minor	[3] Moderate	[3] Moderate
12	Loss of business incomes from climate change impacts (e.g., flooding, wildfires) either discouraging tourists from the area or preventing customers from reaching businesses.	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
13	Additional running costs due to extreme weather and chronic changes, e.g., increased cooling requirements in hotter months.	[2] Minor	[3] Moderate	[3] Moderate	[3] Moderate
14	Risks to business from disruption to supply chains, distribution, transportation, energy, ICT networks, including cascading risks from impacts to infrastructure (note interdependency with infrastructure).	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
15	Risks to business from reduced employee productivity or employee health issues due to disruption associated with high temperatures (including infrastructure disruption and direct impacts affecting working environments; note interdependency with the health and built environment theme)	[1] Negligible	[2] Minor	[2] Minor	[3] Moderate
16	Risks to business from reduced employee productivity including those related to employee health issues due to healthcare disruption associated with severe weather (including infrastructure disruption and direct impacts affecting working environments; note interdependency with the health theme)	[2] Minor	[2] Minor	[2] Minor	[3] Moderate
17	Risks related to finance, investment and insurance for businesses including higher insurance premiums and reduced access to capital for businesses, including businesses relocating to other less risky areas and reduced ability to start businesses in at risk areas. Hazards include flooding, coastal erosion and subsidence (latter relevant to York where businesses required to obtain subsidence insurance)	[4] Major	[4] Major	[4] Major	[4] Major
18	International dimension: Risks to Y&NY region finance sector from climate change overseas	[1] Negligible	[2] Minor	[2] Minor	[2] Minor
19	International dimension: Risks to Y&NY region from climate change on international trade routes	[1] Negligible	[2] Minor	[2] Minor	[2] Minor
20	International dimension: Risks to Y&NY region from changes in international law and governance from climate change overseas	[1] Negligible	[1] Negligible	[1] Negligible	[1] Negligible

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Table 49 Opportunity rating scores across four climate change scenarios for climate-related Opportunities to the Business & Industry sector grouping within the YNY region.

Risk ID#	YNYCA opportunity description	2030s 1.5˚C	2050s 2˚C	2080s 2˚C	2080s 4˚C
OR1	Opportunities for **tourism** from hotter, drier summers and milder winters	[2] Minor	[3] Moderate	[3] Moderate	[4] Major
OR2	Opportunity for increases in eco-tourism related to new species moving to the region as a result of climate change (e.g., dolphins and porpoise sightings in the North York Moors are increasing; tuna has recently re-entered regional waters).	[2] Minor	[3] Moderate	[3] Moderate	[3] Moderate
OR3	Opportunities for **business** from changes in demand for goods and services due to shifting weather patterns	[2] Minor	[2] Minor	[2] Minor	[2] Minor
OR4	Opportunities for the **business** sector if climate change effects are more severe in other regions of the UK than North Yorkshire, resulting in businesses viewing the area as a more attractive business location, leading to increases in activity.	[2] Minor	[3] Moderate	[3] Moderate	[3] Moderate
OR5	Opportunities for **advanced manufacturing and Research and Development**	[2] Minor	[2] Minor	[2] Minor	[2] Minor
OR6	Benefits from changing winter **business energy demand** (e.g. reduction in demand for natural gas space heating and associated costs)	[2] Minor	[3] Moderate	[3] Moderate	[4] Major

Table 50 Risk rating scores across the four scenarios for the risks to health and communities (including the built environment) on the YNYCA

Risk ID#	YNYCA risk description	2030s 1.5˚C	2050s 2˚C	2080s 2˚C	2080s 4˚C
21	Risks to people, communities and buildings from surface water or groundwater flooding. (Interdependency to Business & Industry due to impacts on people and business premises).	[3] Moderate	[4] Major	[4] Major	[4] Major
22	Risks to people, communities and buildings from river flooding, including health and safety risks. Note that modelling indicates that, as a result of the York Flood Alleviation Scheme, the city is protected from a 1 in 100 flood until 2039. (Interdependency to Business & Industry due to impacts on people and businesses reliant on buildings for work). This can also impact the ability of residents to obtain insurance.	[4] Major	[4] Major	[4] Major	[5] Severe
23	Risks to people, communities and buildings from coastal change including erosion, land loss and sea level change (interdependency - link to climate risks to Adaptation Infrastructure).	[3] Moderate	[4] Major	[4] Major	[5] Severe

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Risk ID#	YNYCA risk description	2030s 1.5˚C	2050s 2˚C	2080s 2˚C	2080s 4˚C
24	Risks to building fabric from changing atmospheric conditions including extreme temperatures, moisture, wind and driving rain (excluding flooding and coastal erosion).	[2] Minor	[2] Minor	[2] Minor	[3] Moderate
25	Risks to people, communities and buildings from Humber Estuary inundation, (tidal flood risk), noting this is localised to a relatively small area (Interdependency to Business & Industry due to impacts on people and business premises).	[2] Minor	[3] Moderate	[4] Major	[4] Major
26	Risks to culturally valued structures and historic environment from extreme weather events, including both damages to the building that require repairs and/or loss of assets and an inability to use the building, disrupting any related processes.	[3] Moderate	[4] Major	[4] Major	[4] Major
27	Risks to integrity of cultural and historic collections including art works within museums, art galleries and storage facilities from changing environmental climate conditions within buildings, including humidity, more frequent / extreme fluctuations in temperature and flooding.	[4] Major	[4] Major	[4] Major	[5] Severe
27	Risk of loss of green amenity space in urban areas and rural settlements due to a changing climate, including flooding, extreme heat, urban wildfires, etc.) resulting in a loss of ecosystem services / natural capital such as mental/physical health benefits, amenity and other benefits such as property values (interdependency link to Infrastructure and Natural Environment, including urban trees).	[2] Minor	[3] Moderate	[3] Moderate	[4] Major
28	Risk to culturally valued structures and historic environment from measures designed to adapt to climate change risks, such as constructing flooding defences, restoring wetlands, planting forests etc. (which may damage historic structures or underground archaeology in those areas).	[2] Minor	[3] Moderate	[3] Moderate	[3] Moderate
29	Risks to prison services (e.g. Askham Grange Prison and Young Offender Institution) from extreme weather events (e.g. high temperatures, storms) and a changing climate	[2] Minor	[2] Minor	[2] Minor	[3] Moderate
30	Risk of increased demand and pressures on emergency services due to attendance at and management of other weather-related events, including floods, heat stress across the region, wildfires, storms. Warm weather increases likelihood of public grouping; while this does not cause riots it can be a contributing or enhancing factor.	[2] Minor	[2] Minor	[2] Minor	[3] Moderate
31	Risks to education services due to more challenging conditions from extreme weather events	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
32	Risk to availability of water sources for use by fire and rescue services due to changing rainfall patterns	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
33	Risk of increases in anti-social or criminal behaviour due to increasing scarcity of resources or loss of economic stability; an example could be increased competition for housing resources due to flooding damages resulting in increased deprivation and increased anti-social and criminal behaviour. Scarcity could be exacerbated by international mobility due to climate change (see risk below). (Interdependency link to Business and Industry due to link to economic stability)	[1] Negligible	[2] Minor	[2] Minor	[4] Major

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Risk ID#	YNYCA risk description	2030s 1.5˚C	2050s 2˚C	2080s 2˚C	2080s 4˚C
34	International dimension: Risks to Y&NY region from disruptions and costs due to climate-related international and domestic human mobility or international violent conflict resulting from climate change. Domestic mobility may relate to areas of the UK that become less habitable due to climate change, e.g., loss of housing due to river flooding and coastal erosion.	[2] Minor	[3] Moderate	[3] Moderate	[4] Major
35	Risks to human and community health from disruption to transport infrastructure from extreme weather events (e.g., flood disrupting access during emergency healthcare events).	[3] Moderate	[3] Moderate	[4] Major	[4] Major
36	International dimension: Risks to Y&NY region from reduced availability of safe and high-quality food due to climate change overseas (e.g. weather-related shocks to global food production and trade) (link to Natural Environment and Food)	[3] Moderate	[4] Major	[4] Major	[5] Severe
37	International dimension: Risks to Y&NY region from imported food safety risks (e.g. potential contamination with mycotoxins, pesticides, Salmonella, etc.)	[1] Negligible	[2] Minor	[2] Minor	[2] Minor
38	Risks to food security and food safety from disruptions to domestic food supply due to climate change (e.g., drought, extreme heat). (Interdependency to Natural Environment and Business Industry - latter due to loss of agricultural business revenues).	[3] Moderate	[4] Major	[4] Major	[5] Severe
39	Risks to health and wellbeing from high temperatures including exacerbation of existing health conditions (interdependency with health infrastructure).	[4] Major	[4] Major	[4] Major	[5] Severe
40	Risks to health and wellbeing from changes in indoor (e.g. housing characteristics and ventilation, and natural sources of pollution related to pollen and mould) and outdoor (e.g. traffic and industry) air quality. Note: housing air quality can also decline due to damages to building fabric under RR018)	[3] Moderate	[3] Moderate	[3] Moderate	[3] Moderate
41	Risk to mental health deterioration due to the physical effects of climate change or fear of expected future effects. (Interdependency to Business and Industry due to loss of productivity)	[2] Minor	[3] Moderate	[3] Moderate	[4] Major
42	Risks to public health from water quality, including negative impacts on water treatment from changing rainfall and temperature patterns and contaminated water bodies (interdependency to Infrastructure due to dependence on wastewater treatment).	[2] Minor	[2] Minor	[2] Minor	[3] Moderate
43	Risks to passengers from high temperatures on public transport	[2] Minor	[2] Minor	[2] Minor	[3] Moderate
44	International dimension: Risks to Y&NY region public health from incurring climate change-exacerbated illnesses while travelling overseas and requiring care once home (e.g., suffering from a disease visiting a country that pre climate change was not affected by that disease). However, this risk is difficult to quantify; disease prevalence will be dependent on other factors including affluence and number of people able to holiday to specific areas.	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
45	Risks to health from vector-borne diseases whose prevalence increases as temperatures increase and the climate continues to change.	[3] Moderate	[4] Major	[4] Major	[4] Major

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Table 51 Opportunity rating scores across the four scenarios for the opportunities to health and communities (including the built environment) on the YNYCA

Risk ID#	YNYCA opportunity description	2030s 1.5˚C	2050s 2˚C	2080s 2˚C	2080s 4˚C
OR7	Benefits for **health and wellbeing** from milder winters, noting that NHS climate modelling indicates that future reductions in cold-related fatality events due to milder winters will be outweighed by increases in heat stress-related deaths.	[2] Minor	[2] Minor	[2] Minor	[3] Moderate
OR8	Opportunities for water treatment and so **water quality** from changing rainfall patterns and temperatures.	[2] Minor	[2] Minor	[2] Minor	[2] Minor

Table 52 Risk rating scores across the four scenarios for the risks to infrastructure (including energy, water, transport and digital) on the YNYCA

Risk ID#	YNYCA risk description	2030s 1.5˚C	2050s 2˚C	2080s 2˚C	2080s 4˚C
46	Risks to industry-related infrastructure (e.g., energy production) from Humber Estuary inundation (i.e., tidal flood risk)	[2] Minor	[2] Minor	[3] Moderate	[3] Moderate
47	Risk of temporary disruption (loss of gas supply) associated with extreme weather events (e.g. storms, high winds, snowfall, wildfire, flooding, extreme heat)	[2] Minor	[2] Minor	[2] Minor	[3] Moderate
48	Risk of short/medium-term disruption (loss of gas supply) associated with significant damage to the gas infrastructure network (e.g. flooding, coastal change, landslides).	[2] Minor	[3] Moderate	[3] Moderate	[3] Moderate
49	Risks to gas infrastructure networks from cascading failures	[3] Moderate	[4] Major	[4] Major	[4] Major
50	Risk of temporary disruption (power outages <24 hrs) associated with extreme weather events (e.g. storms, incl. hail, high winds, snowfall, wildfire, lighting strikes, flooding, extreme heat)	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
51	Risk of short/medium-term disruption (power outages >24 hrs) associated with significant damage to electricity infrastructure (e.g. flooding, coastal change, landslides)	[3] Moderate	[4] Major	[4] Major	[4] Major
52	Risk of increased customer demand for electricity (e.g. air conditioning) during hot periods, coinciding with assets being derated as a result of increased heat.	[1] Negligible	[1] Negligible	[1] Negligible	[3] Moderate

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Risk ID#	YNYCA risk description	2030s 1.5˚C	2050s 2˚C	2080s 2˚C	2080s 4˚C
53	Risks to electricity infrastructure networks from cascading failures	[3] Moderate	[3] Moderate	[4] Major	[4] Major
54	Risks to subterranean and surface infrastructure from subsidence	[2] Minor	[3] Moderate	[3] Moderate	[3] Moderate
55	Risks to coastal adaptation infrastructure from flooding (coastal), coastal change, storms, landslides, subsistence/embankment failure.	[2] Minor	[3] Moderate	[3] Moderate	[4] Major
56	Risks to offshore infrastructure from storms and high waves (e.g. equipment used by the oil and gas industry, wind, tidal and wave energy, and gas pipelines and power cables on or under the seabed)	[2] Minor	[3] Moderate	[3] Moderate	[3] Moderate
57	Risk of temporary disruption (loss of ICT and communications) associated with extreme weather events (e.g. storms, high winds, snowfall, wildfire, flooding, extreme heat, cooling servers) including connectivity infrastructure such as underground cabling.	[2] Minor	[2] Minor	[3] Moderate	[3] Moderate
58	Risk of short/medium-term disruption (loss of ICT and communications) associated with significant damage to communications infrastructure (e.g. flooding, coastal change, landslides) including connectivity infrastructure such as underground cabling.	[3] Moderate	[3] Moderate	[3] Moderate	[3] Moderate
59	Risks to ICT and communications infrastructure networks from cascading climate- and extreme weather-related failures (including where services in YNYCA reliant on servers in other regions or nations).	[3] Moderate	[4] Major	[4] Major	[5] Severe
60	Risk of temporary disruption to road and rail travel due to disruption to transport networks associated with extreme weather events (e.g. storms, high winds, snowfall, wildfire, flooding, extreme heat)	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
61	Risk of short/medium-term disruption to **majors roads** associated with significant damage to the transport network (e.g. flooding, coastal change, landslides, embankment failure)	[3] Moderate	[3] Moderate	[4] Major	[4] Major
62	Risk of short/medium-term disruption to **minor/rural roads** associated with significant damage to the transport network (e.g. flooding, coastal change, landslides, embankment failure)	[2] Minor	[3] Moderate	[3] Moderate	[3] Moderate
63	Risk of short/medium-term disruption to **rail** associated with significant damage to the transport network (e.g. flooding, coastal change, landslides, embankment failure).	[3] Moderate	[3] Moderate	[4] Major	[4] Major
64	Risks to transport networks from cascading failures (note interdependency - e.g., winds impacts to electricity, resulting in rail outages and associated negative effects to services / business).	[4] Major	[4] Major	[4] Major	[5] Severe
65	Risk of temporary disruption (localised outages) to **public** water supply associated with operational disruption due to extreme weather events (e.g. storms, high winds, snowfall, cold events, wildfire, flooding, extreme heat)	[2] Minor	[2] Minor	[2] Minor	[2] Minor

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Risk ID#	YNYCA risk description	2030s 1.5˚C	2050s 2˚C	2080s 2˚C	2080s 4˚C
66	Risk of short/medium-term disruption to **public** water supply associated with significant damage to water infrastructure (e.g. flooding, coastal change, landslides).	[3] Moderate	[4] Major	[4] Major	[3] Moderate
67	Risk of reduced **public** water availability due to drought conditions (lower reservoir levels), creating pressure on supplies (e.g. need for temporary use ban, increased water pricing)	[4] Major	[4] Major	[4] Major	[5] Severe
68	Risk of increased customer demand on **public** water supply during hot dry periods, creating pressure on supplies (e.g. need for temporary use ban, increased water pricing)	[3] Moderate	[4] Major	[4] Major	[5] Severe
69	Risk to **public** water supply due to saltwater intrusion to groundwater sources	[1] Negligible	[1] Negligible	[2] Minor	[2] Minor
70	Risks to **public** water and wastewater infrastructure networks from cascading failures	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
71	Risk of reduced **public** water availability due to raw water quality deterioration	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
72	Risk of disruption to **private** water supply (i.e., residential and other properties that do not obtain their water from a utility) associated with damage to water infrastructure (e.g. erosion, coastal change, landslides, contamination)	[2] Minor	[2] Minor	[2] Minor	[2] Minor
73	Risk to **private** water supply (i.e., residential and other properties that do not obtain their water from a utility) due to low rainfall and drought conditions. Note, if there is a health risk associated with the loss of supply, LAs have a statutory responsibility to provide support. For a resident without health risk, LA would not be mandated to resolve supply issues. However, in reality, LAs may feel compelled to act beyond their statutory responsibilities.	[2] Minor	[3] Moderate	[3] Moderate	[4] Major
74	Risk to **private** water supply (i.e., residential and other properties that do not obtain their water from a utility) due to poor water quality of rivers or groundwater sources	[2] Minor	[2] Minor	[2] Minor	[2] Minor
75	Risk to **private** water supply (i.e., residential and other properties that do not obtain their water from a utility) due to saltwater intrusion to groundwater sources	[1] Negligible	[1] Negligible	[2] Minor	[2] Minor
76	Risk of temporary disruption (to **wastewater** services) associated with extreme weather events (e.g. storms, high winds, snowfall, wildfire, flooding, extreme heat, extreme rainfall)	[3] Moderate	[3] Moderate	[3] Moderate	[3] Moderate
77	Risk of short/medium-term disruption (to **wastewater** services) associated with significant damage to wastewater infrastructure (e.g. flooding, coastal change, landslides)	[1] Negligible	[2] Minor	[2] Minor	[3] Moderate
78	Risks to closed and active landfill sites, treatment centres and waste transfer sites due to extreme weather events (e.g. flooding, extreme heat).	[2] Minor	[2] Minor	[2] Minor	[3] Moderate

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Risk ID#	YNYCA risk description	2030s 1.5˚C	2050s 2˚C	2080s 2˚C	2080s 4˚C
79	Risks of **wastewater**/sewer infrastructure flooding, overflow or releases into water courses due to heavy rainfall (interdependency to Health and Natural Environment).	[4] Major	[4] Major	[4] Major	[4] Major

Table 53 Risk rating the YNY authorities and RSK scores across the four scenarios for the risks to natural environment (including agriculture, forestry and fisheries) on the YNYCA

Risk ID#	YNYCA risk description	2030s 1.5˚C	2050s 2˚C	2080s 2˚C	2080s 4˚C
80	Risks to **terrestrial** species and habitats from pests, pathogens and invasive species, including viral and parasitic diseases, where climate change improves conditions for these to spread and cause damage.	[4] Major	[4] Major	[4] Major	[5] Severe
81	Risks to **terrestrial** species and habitats from changing climatic conditions and extreme events, including temperature change, water scarcity, wildfire, flooding, wind, and altered hydrology (including water scarcity, flooding and saline intrusion)	[3] Moderate	[4] Major	[4] Major	[4] Major
82	Risk of coastal flooding and Humber Estuary inundation from sea level rise impacting **terrestrial** habitats and biodiversity, including natural capital	[2] Minor	[3] Moderate	[3] Moderate	[3] Moderate
83	Risks of wildfires and destruction of **terrestrial** habitats including forests, heathland/moors, peatlands and grasslands, where the habitat is difficult to return to its former state. (Interdependency with water supply Infrastructure)	[4] Major	[4] Major	[4] Major	[5] Severe
84	Risk of environmental drought and water scarcity to **terrestrial** habitats (Interdependency with water supply Infrastructure)	[3] Moderate	[4] Major	[4] Major	[5] Severe
85	Risk of drainage and/or sewage networks flooding and contamination of land impacting **terrestrial** habitats and biodiversity, including natural capital	[2] Minor	[2] Minor	[2] Minor	[3] Moderate
86	Risk of mine water outbreak and contamination of the natural environment and **terrestrial** habitats	[3] Moderate	[3] Moderate	[3] Moderate	[3] Moderate
87	Risk of climate-influenced river flooding impacting **terrestrial** habitats and biodiversity, including urban habitats and natural capital, noting that while flood plain habitats naturally flood and are not materially affected by normal flood levels, increasingly extreme or severe flooding may negatively impact flood plain habitats.	[2] Minor	[2] Minor	[2] Minor	[2] Minor
88	Risk of negative effects for the region's biodiversity, including changing species distributions and increased fragmentation of sensitive habitats where these cannot adapt to the rapid rate of climate change and related extreme weather.	[3] Moderate	[3] Moderate	[3] Moderate	[3] Moderate

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Risk ID#	YNYCA risk description	2030s 1.5˚C	2050s 2˚C	2080s 2˚C	2080s 4˚C
89	Risk to **soils** (including soil health and associated ecosystem services) from changing climatic conditions, including fluctuations between seasonal aridity and wetness resulting in soil loss events like erosion.	[4] Major	[4] Major	[4] Major	[5] Severe
90	Risks for natural carbon stores (e.g. peatlands, saltmarsh, kelp forests), carbon sequestration and GHG emissions from changing climatic conditions, including temperature change and water scarcity	[3] Moderate	[4] Major	[4] Major	[5] Severe
91	Risks to landscape character from a changing climate.	[3] Moderate	[4] Major	[4] Major	[4] Major
92	Risk of landslides and slope failures impacting landscape character and **terrestrial/freshwater** habitats and species (noting that risks of landslides/slope failures to Infrastructure/Built Environment is covered under different risks).	[2] Minor	[3] Moderate	[3] Moderate	[3] Moderate
93	Risks to **freshwater** species and habitats (e.g. wetlands) from changing climatic conditions and extreme events, including higher water temperatures, flooding, water scarcity and phenological shifts.	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
94	Risks to **freshwater** species and habitats from pests, pathogens and invasive species	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
95	Risk of drainage and/or sewage networks flooding and contamination to **freshwater** species and habitats (e.g. wetlands). Note, if river levels decline in dry periods the concentration of pollutant will increase if effluent is still being released.	[3] Moderate	[4] Major	[4] Major	[4] Major
96	Risks to **coastal** species and habitats due to coastal flooding, erosion and climate factors	[3] Moderate	[4] Major	[4] Major	[5] Severe
97	Risks to **marine** species, habitats and fisheries from changing climatic conditions, including ocean acidification and higher water temperatures including marine heatwaves, noting in 2025 the UK experienced severe marine heatwaves, the effects of which are at present unknown (June 2025).	[3] Moderate	[4] Major	[4] Major	[5] Severe
98	Risks to **marine** species and habitats from pests, pathogens and invasive species	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
99	Risks to **forestry** productivity from extreme events and changing climatic conditions (including temperature change, water scarcity, wildfire, flooding, coastal erosion, wind and saline intrusion).	[3] Moderate	[4] Major	[4] Major	[4] Major
100	Risks to **forestry** from pests, pathogens and invasive species	[3] Moderate	[4] Major	[4] Major	[4] Major
101	Risk to urban **trees** from extreme weather events including extreme heat and flooding. Interdependency to Health and Built Environment as urban trees provide cooling effects, mental health benefits and property value benefits.	[3] Moderate	[4] Major	[4] Major	[5] Severe

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Risk ID#	YNYCA risk description	2030s 1.5˚C	2050s 2˚C	2080s 2˚C	2080s 4˚C
102	Risks to regional **forestry** and forest planting targets (e.g., woodland creation, nature restoration targets, carbon sequestration targets, urban climate adaptation using trees) from extreme events and changing climatic conditions increasing tree mortality (including temperature change, water scarcity, wildfire, flooding, coastal erosion, wind and saline intrusion).	[2] Minor	[4] Major	[4] Major	[4] Major
103	Water shortages affecting **agricultural** practices (e.g. irrigation and livestock health)	[2] Minor	[2] Minor	[2] Minor	[3] Moderate
104	Risks to **agricultural** productivity from extreme events, unpredictable weather and changing climatic conditions such as changing seasonality (primarily water scarcity and extreme / unpredictable rainfall, but also including temperature change, wildfire, flooding, coastal erosion, wind and saline intrusion).	[4] Major	[4] Major	[4] Severe	[5] Severe
105	Risk of river flooding of **agricultural** land impacting productivity (e.g. crop damage or loss) and the potential for contamination	[2] Minor	[2] Minor	[2] Minor	[3] Moderate
106	Risks to **agricultural** crops & livestock health and productivity from pests, pathogens and invasive species, including viral and parasitic diseases	[3] Moderate	[4] Major	[4] Major	[5] Severe
107	Risks to aquifers and **agricultural** land from sea level rise, saltwater intrusion, and Humber Estuary inundation	[1] Negligible	[1] Negligible	[1] Negligible	[2] Minor
108	Risks to **agricultural** productivity from soil erosion	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
109	Risks of wildfires on or affecting **agricultural** land (e.g. arable crops)	[1] Negligible	[2] Minor	[2] Minor	[2] Minor
110	Risk of increased surface water flooding associated with choice of land management practices exacerbating flood risk	[2] Minor	[2] Minor	[2] Minor	[3] Moderate
111	Risk of short-term accessibility challenges for footpaths and rights of way (including urban footpaths and parks) associated with a changing climate (e.g. landslips, fallen trees, flooding, coastal erosion, maintenance work to remove climate-induced invasive species). (Interdependency to Infrastructure theme - walking infrastructure and transport infrastructure may be interlinked)	[3] Moderate	[3] Moderate	[3] Moderate	[3] Moderate
112	Risk of long-term accessibility challenges for footpaths and rights of way (including urban footpaths and parks) associated with a changing climate (e.g. landslips, erosion, inundation or loss of paths) (Interdependency to Infrastructure theme - walking infrastructure and transport infrastructure may be interlinked).	[2] Minor	[3] Moderate	[3] Moderate	[3] Moderate
113	Risks to public parks, parkland and garden biodiversity/ecosystem services from pests, pathogens and invasive species	[3] Moderate	[4] Major	[4] Major	[4] Major

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Table 54 Opportunity rating scores across the four scenarios for the opportunities to natural environment (including agriculture, forestry and fisheries) on the YNYCA

Risk ID#	YNYCA opportunity description	2030s 1.5˚C	2050s 2˚C	2080s 2˚C	2080s 4˚C
OR12	Benefits to **terrestrial habitats** from new species colonisation	[2] Minor	[3] Moderate	[3] Moderate	[3] Moderate
OR13	Opportunities to enhance **natural carbon stores, carbon sequestration and GHG emissions** due to more favourable conditions (e.g. rewetting or peatlands)	[2] Minor	[2] Minor	[2] Minor	[2] Minor
OR14	Benefits to **natural carbon stores and carbon sequestration** from changing climatic conditions, including temperature change	[1] Negligible	[2] Minor	[2] Minor	[2] Minor
OR15	Opportunities for **agricultural productivity** from changing climatic conditions (including temperature change, longer growing season, water availability, atmospheric CO2 concentrations etc.)	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
OR16	Opportunities for **fisheries and aquaculture productivity** from changing climatic conditions (including sea temperature change etc.)	[1] Negligible	[2] Minor	[2] Minor	[2] Minor
OR17	Opportunities for **forestry productivity** from changing climatic conditions (including temperature change, water availability, atmospheric CO2 concentrations etc.)	[3] Moderate	[3] Moderate	[3] Moderate	[3] Moderate
OR18	Benefits to marine and **coastal species and habitats** due to changing sea levels	[2] Minor	[2] Minor	[2] Minor	[2] Minor
OR19	Benefits from climate change to **landscape character** relating to features integral to Y&NY	[2] Minor	[2] Minor	[2] Minor	[2] Minor
OR20	Opportunities to **diversify the agricultural economy**	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
OR21	Opportunities for **greater tree cover** and woodland expansion	[3] Moderate	[3] Moderate	[3] Moderate	[3] Moderate

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APPENDIX 6 – YNY ORGANISATIONAL CCRA SCORES

Overall risk and opportunity scores for each sector grouping are provided below. The full scoring is contained within the YNY Climate Change Risk Register, which is held and managed by the YNYCA and partner authorities.

Table 55 Risk rating scores across the four scenarios for the risks to YNYCA constituent authority assets

Risk ID#	YNYCA risk description	2030s 1.5˚C	2050s 2˚C	2080s 2˚C	2080s 4˚C
001	Damage to buildings, infrastructure or assets from compound hazards (e.g. river flooding and surface water flooding)	[3] Moderate	[4] Major	[4] Major	[5] Severe
002	Damage to buildings, infrastructure or assets from cascading impacts (e.g. changing water tables)	[2] Minor	[3] Moderate	[3] Moderate	[4] Major
003	Damage to buildings, infrastructure or assets from drought conditions	[3] Moderate	[3] Moderate	[3] Moderate	[3] Moderate
004	Damage to buildings, infrastructure or assets from flooding (fluvial)	[4] Major	[4] Major	[4] Major	[4] Major
005	Damage to buildings, infrastructure or assets from flooding (surface water)	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
006	Damage to buildings, infrastructure or assets from flooding (groundwater)	[2] Minor	[3] Moderate	[3] Moderate	[3] Moderate
007	Damage to buildings, infrastructure or assets from inundation from the Humber / changing water tables	[2] Minor	[3] Moderate	[4] Major	[5] Severe
008	Damage to buildings, infrastructure or assets from heavy snowfall (not risk of snowfall in general)	[3] Moderate	[3] Moderate	[3] Moderate	[3] Moderate
009	Damage to buildings, infrastructure or assets from wildfire damage	[3] Moderate	[2] Minor	[2] Minor	[3] Moderate
010	Damage to buildings, infrastructure or assets from coastal erosion	[2] Minor	[3] Moderate	[4] Major	[5] Severe
011	Loss of buildings, infrastructure or assets from sea level change	[3] Moderate	[3] Moderate	[4] Major	[5] Severe
012	Damage to buildings, infrastructure or assets from high temperatures, including melting of materials such as roads	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
013	Damage to buildings, infrastructure or assets from extreme cold (e.g. pipes freeze)	[3] Moderate	[3] Moderate	[3] Moderate	[2] Minor
014	Damage to buildings, infrastructure or assets from freeze-thaw	[3] Moderate	[3] Moderate	[3] Moderate	[1] Negligible
015	Damage to buildings, infrastructure or assets from storms and high winds	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
016	Damage to buildings, infrastructure or assets from flooding (coastal)	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
017	Damage to buildings, infrastructure or assets from landslides or mass movement of soil	[2] Minor	[2] Minor	[3] Moderate	[3] Moderate
018	Damage to buildings, infrastructure or assets from subsidence	[2] Minor	[3] Moderate	[3] Moderate	[3] Moderate

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Table 56 Risk rating scores across the four scenarios for the risks to YNYCA constituent authority operations and services

Risk ID#	YNYCA risk description	2030s 1.5˚C	2050s 2˚C	2080s 2˚C	2080s 4˚C
019	Risk of disruption to Council services from acute cascading risks	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
020	Risk of disruption to Council services from staff (office and operational) unable to commute or travel into the workplace due to storms and high winds	[3] Moderate	[2] Minor	[2] Minor	[2] Minor
021	Risk of disruption to Council services from staff (office and operational) unable to commute or travel due to heavy snowfall	[3] Moderate	[2] Minor	[2] Minor	[1] Negligible
022	Risk of disruption to Council services from wildfire	[1] Negligible	[1] Negligible	[1] Negligible	[2] Minor
023	Risk of disruption to Council services from drought / water scarcity	[2] Minor	[2] Minor	[2] Minor	[3] Moderate
024	Risk of disruption to Council services from major flood events (river, surface water, groundwater)	[4] Major	[4] Major	[4] Major	[4] Major
025	Risk to Council services from storm surge and coastal flooding	[1] Negligible	[1] Negligible	[2] Minor	[2] Minor
026	Risk of disruption to Council services from chronic cascading risks	[2] Minor	[3] Moderate	[3] Moderate	[3] Moderate
027	Risk of disruption to Council services from staff unable to commute, travel or work safely due to fog	[1] Negligible	[1] Negligible	[1] Negligible	[1] Negligible
029	Risk of unsafe working conditions to undertake to conduct normal works due to storms	[2] Minor	[2] Minor	[2] Minor	[3] Moderate
030	Risk of unsafe working conditions to undertake to conduct normal works (e.g. waste services)	[2] Minor	[2] Minor	[2] Minor	[1] Negligible
031	Risk of disruption to Council services from staff unable to work safely outside in high temperatures	[2] Minor	[2] Minor	[2] Minor	[3] Moderate
032	Risk of service disruption due to changes in office-based staff wellbeing and productivity from uncomfortable conditions	[1] Negligible	[1] Negligible	[1] Negligible	[3] Moderate
033	Risk to demands on Council resources from climate-induced mass migration (domestic/international)	[1] Negligible	[3] Moderate	[3] Moderate	[4] Major
034	Risk to food supply chains (e.g. providing catering into schools, care homes) from climate events, resulting in higher costs	[3] Moderate	[4] Major	[4] Major	[4] Major
035	Risk to council services / operations from climate-related disruptions to non-food global supply chains	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
036	Risk to public health from (Council owned) trees falling over resulting in liability	[3] Moderate	[3] Moderate	[3] Moderate	[3] Moderate

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Risk ID#	YNYCA risk description	2030s 1.5˚C	2050s 2˚C	2080s 2˚C	2080s 4˚C
037	Risk of loss of income from Tax, Business Rates (e.g. flood events where buildings unoccupied for several months) or other asset income (e.g., empty car parks due to flooding impacts) due to extreme weather.	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
038	Risks of disruption or changes to requirements of some services (social care, public health, education, child services) due to extreme weather events (extreme heat, extreme cold, snowfall, storms, high winds, flooding)	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
039	Risk to provision of home to school/ social care settings transport (responsible for getting children to and from school) - special needs (stuck at school, or can't get there) due to extreme weather events	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
040	Risk of increased anti-social behaviour associated with extreme weather events (looting in floods, conflict in heatwaves)	[2] Minor	[2] Minor	[2] Minor	[3] Moderate
041	Risk to demands on Council public health services from spread of diseases	[3] Moderate	[3] Moderate	[4] Major	[4] Major
042	Risk of challenges to Council planning services from flooding (river, surface, groundwater, coastal) - i.e., increase in workload as new homes required post flooding	[1] Negligible	[2] Minor	[3] Moderate	[3] Moderate
043	Risk to provision of Council run public transport from extreme weather events	[2] Minor	[3] Moderate	[3] Moderate	[4] Major
044	Risk of air pollution and associated health and safety risks from wildfires at waste disposal sites	[1] Negligible	[1] Negligible	[1] Negligible	[2] Minor
045	Risk of air pollution and odour from waste disposal sites and associated health risks	[2] Minor	[2] Minor	[2] Minor	[3] Moderate
046	Risk of increased insurance costs as a result of an increased perceived risk of damage	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
047	Risk of higher demands on car parks and visitor centres associated with increased tourism	[1] Negligible	[2] Minor	[2] Minor	[3] Moderate

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Table 57 Risk rating scores across the four scenarios for the risks to YNYCA constituent authority staff

Risk ID#	YNYCA risk description	2030s 1.5˚C	2050s 2˚C	2080s 2˚C	2080s 4˚C
048	Risk of heat stress from heatwaves (days above 25C+) to site staff, and office and home-based staff (due to lack of air conditioning), from high temperatures	[2] Minor	[2] Minor	[2] Minor	[3] Moderate
049	Risk of moderate heat stress (30C+) to site staff, and office and home-based staff (due to lack of air conditioning), from very hot days	[2] Minor	[3] Moderate	[3] Moderate	[4] Major
050	Risk of strong/very strong heat stress (35C+) to site staff, and office and home-based staff (due to lack of air conditioning), from extreme summer days	[2] Minor	[2] Minor	[2] Minor	[2] Minor
051	Risk to health and discomfort due to tropical nights (above 20C)	[1] Negligible	[1] Negligible	[1] Negligible	[2] Minor
052	Risk to health to non-office staff from temporary cold conditions	[3] Moderate	[2] Minor	[2] Minor	[2] Minor
053	Risk to health to non-office staff from prolonged cold conditions	[3] Moderate	[3] Moderate	[3] Moderate	[3] Moderate
054	Risk of injury from incidence of flying debris and fallen trees	[1] Negligible	[1] Negligible	[1] Negligible	[1] Negligible
055	Risk of road traffic incidence for staff commuting or travelling related to storms and high winds	[2] Minor	[2] Minor	[2] Minor	[2] Minor
056	Risk of road traffic incidence for staff commuting or travelling related to snow or icy conditions	[3] Moderate	[3] Moderate	[3] Moderate	[3] Moderate
057	Direct risk to health of staff from river flash flood events	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
058	Risk to staff health from waterlogged wetlands/peatlands due to wetter winters; stakeholders noted these risks can be easily managed by risk assessment processes.	[1] Negligible	[1] Negligible	[1] Negligible	[2] Minor
059	Direct risk to health of staff from surface water flash flood events	[2] Minor	[3] Moderate	[3] Moderate	[3] Moderate
060	Direct risk to health of staff from groundwater flood events	[1] Negligible	[1] Negligible	[1] Negligible	[2] Minor
061	Risk of road traffic incidence for staff commuting or travelling from rockfalls (sheer rock faces) and landslides	[2] Minor	[2] Minor	[3] Moderate	[3] Moderate
062	Risk to staff health from rock falls (cliffs, quarries) associated with extreme weather (both inland and coastal) and erosion	[3] Moderate	[3] Moderate	[3] Moderate	[3] Moderate
063	Risk to staff health from wildfires (e.g. smoke inhalation)	[2] Minor	[2] Minor	[2] Minor	[2] Minor
064	Risk to staff working near the coast from coastal flood events	[3] Moderate	[3] Moderate	[3] Moderate	[3] Moderate
065	Risk to staff mental health from extreme weather events	[1] Negligible	[2] Minor	[2] Minor	[3] Moderate
066	Risk to staff health from increasing prevalence of diseases due to warmer temperatures (e.g. tick-borne), wildlife (adders)	[2] Minor	[2] Minor	[2] Minor	[3] Moderate

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Table 58 Risk rating scores across the four scenarios for the risks to YNYCA protected landscape authority services/operations

Risk ID#	YNYCA risk description	2030s 1.5˚C	2050s 2˚C	2080s 2˚C	2080s 4˚C
048	Risk to Protected Landscape services from cascading risks	[2] Minor	[3] Moderate	[3] Moderate	[3] Moderate
049	Risk to Protected Landscape services from storms and high winds	[2] Minor	[2] Minor	[2] Minor	[2] Minor
050	Risk to Protected Landscape services from snowfall	[3] Moderate	[2] Minor	[2] Minor	[1] Negligible
051	Risk to Protected Landscape services from wildfire	[3] Moderate	[4] Major	[4] Major	[4] Major
052	Risk of disruption to Protected Landscape services from major flood events (river, surface water, groundwater)	[2] Minor	[2] Minor	[2] Minor	[2] Minor
053	Risk to Protected Landscape services from coastal storm surges and coastal flooding	[2] Minor	[2] Minor	[3] Moderate	[3] Moderate
054	Risk to Protected Landscape services from hot days (30C+)	[2] Minor	[2] Minor	[3] Moderate	[4] Major
055	Increased demand on Protected Landscape services due to increased planning demand due to sea level change and coastal erosion	[1] Negligible	[2] Minor	[2] Minor	[3] Moderate
056	Risk to Protected Landscape services from a changing landscape character (conflict between preserve or adapt with the changes)	[2] Minor	[3] Moderate	[3] Moderate	[3] Moderate

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APPENDIX 7 - VULNERABILITY ASSESSMENT DATASETS

Table 59 Datasets used in the vulnerability assessment

Theme	Organisation	Dataset
Climate - Projected Averages - Temperature	Met Office	Annual Temperature Projections
		Summer Average Temperature Change
		Winter Average Temperature Change
Climate - Projected Averages - Precipitation		Annual Precipitation Projections
		Summer Precipitation Change
		Winter Precipitation Change
Climate - Projected Averages - Sea Level		Sea Level Rise Projections
Climate - Projected Indicators		Annual Count of Summer Days
		Annual Count of Hot Summer Days
		Annual Count of Extreme Summer Days
Climate - Observed - Temperature		Annual Temperature Observations
		Annual Max Temperature Observations
		Annual Min Temperature Observations
		Annual Count of Summer Days
Climate - Observed - Precipitation		Annual Precipitation Observations
Flood Risk	Environment Agency	Flood Map for Planning (Rivers and Sea) - Flood Zone 2
		Risk of Flooding from Rivers and Seas (RoFRS)
Coastal Erosion		National Coastal Erosion Risk Mapping (NCERM) - National (2024)
	Ordnance Survey	BGS GeoClimate UKCP18 Open
Greenspace	Natural England	Map 3 - Accessible Green Infrastructure (ADAS Layer)
Infrastructure - Transport	Ordnance Survey	OS Open Roads
	EuroMap	Regional Railroads
Infrastructure - Water	Environmental Information Data Centre	Spatial Inventory of UK Waterbodies
Habitats	Natural England	Priority Habitats Inventory
		Living England Habitat Map (Phase 4)
Social Demographics	ONS	Population by Age
		Index of Multiple Deprivation (IMD)
Infrastructure - Energy	National Grid	Network route maps (substation site, overhead lines and cables)
Infrastructure	OS	OS Built Up Areas (2024)
Infrastructure		Important Buildings
Infrastructure	Historic England	Historic England

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APPENDIX 8 – CCRA STAKEHOLDER ENGAGEMEMT

Table 60 Stakeholder organisations and roles engaged during the CCRA validation workshops

Business & Industry	Health, communities, built environment	Infrastructure	Natural Environment
City of York Council, Climate Change Team	City of York Council, Climate Change Team	City of York Council, Climate Change Team	City of York Council, Climate Change Team
North Yorkshire Council, Climate Change Business Partner	City of York Council, Information & Social Action Manager (communities and prevention)	Environment Agency, Partnerships and Strategic Overview – North Yorkshire	City of York Council, Senior Countryside and Ecology Officer
North Yorkshire Council, Head of Regeneration	City of York Council, Carbon Reduction Project Officer	North Yorkshire Council, Climate Change Manager	Environment Agency, Partnerships and Strategic Overview – North Yorkshire
North Yorkshire Council, Senior Business Advisor	City of York Council, Specialist public health practitioner	North Yorkshire Council, Waste Contract Compliance Manager	FixOurFood Commission, Agricultural researcher, soil science
North Yorkshire Council, Senior Economic Development Officer	North York Moors National Park, Head of Historic Environment	North Yorkshire Council, Flood Team Leader	FixOurFood Commission, Ecology and agriculture researcher
Visit North Yorkshire, Places Development Executive	North Yorkshire Fire & Rescue Service, Head of Estates & Sustainability	North Yorkshire Council, Planning Policy Manager	Forestry England, Forest Planner
York and North Yorkshire Growth Hub, Net Zero Lead	North Yorkshire Council, Scientific Officer (regulatory services, permitting, air quality)	North Yorkshire Council, Senior Transport Planning Officer	Howardian Hills National Landscape, Manager
YNYCA, Net Zero Project Manager	North Yorkshire Council, Public Health Manager,	North Yorkshire Council, Principal Coastal Officer	National Farmers Union, County Advisor for North Riding and County Durham
YNYCA, Financial Officer	North Yorkshire Council, Strategic Planning Officer	Northern Powergrid, System Engineer	Nidderdale National Landscape, Manager
Yorkshire and Humber Climate Commission, Leader of the Climate Adaptation Programme for Local Authorities	North Yorkshire Council, Healthy and Sustainable Homes Coordinator	YNYCA, City Leap Lead	North York Moors National Park, Head of Climate Change and Carbon Reduction

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Business & Industry	Health, communities, built environment	Infrastructure	Natural Environment
	North Yorkshire Council, Carbon Reduction Officer	YNYCA, Net Zero Project Manager	North Yorkshire Council, Climate Change Team
	North Yorkshire Council, Communities and Prevention officer	YNYCA, Rail Sector Lead	North Yorkshire Council, Ecology & Biodiversity Specialist
	YNYCA, Local Authorities Climate Action Coordinator	Yorkshire and Humber Climate Commission, Leader of the YHCC Climate Adaptation Programme for Local Authorities	North Yorkshire Council, Land and Farm Portfolio Officer
	YNYCA, Net Zero Project Manager		North Yorkshire Council, Landscape and Urban Designer
			North Yorkshire Council, Tree Operations Manager
			White Rose Forest, Green Streets Development Manager
			YNYCA, Grow Yorkshire Partnership Officer
			YNYCA, Net Zero Project Manager
			Yorkshire and Humber Climate Commission, Climate Adaptation Programme for Local Authorities Lead
			Yorkshire Dales, Head of Land Management
			Yorkshire Water, Resilience Partnership Manager

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APPENDIX 9 – RAPA PROCESS STAKEHOLDER ENGAGEMENT

List of Stakeholders who Attended the RAPA Workshops

Natural Environment		Business & Industry	
Name	**Organisation**	**Name**	**Organisation**
Piran Borlase-Hendry	NYC	Poppy Jopson	YNYCA
Poppy Jopson	YNYCA	Karen Gaby Rossell	YNYCA
Paul McCabe	NYC	Heidi Green	NYC (Selby)
John Ward-Campbell	NYC	Jack Colding	YNYCA
Matthew Millington	NY	Lisa Nyhan	York Council
Iain McDonell	National Park	Richard Saward	York Museum Trust
Andrew Mcilwraith	York City	Brittany Guymer	Make it York, comms
Muriel Bonjean Stanton	YHCC	Mark Kibblewhite	NYC
Pippa Chapman	University of Leeds	Hannah Nutsey	NYC
David Owen	Yorkshire Water		
Helen Arnold	NYC		
Ruth Everson	NYC		
Annabel Hill	Strutt & Parker		
Karen Gabby Rossel	YNYCA		
George Richmond	NYC		

Infrastructure		Built Environment	
Name	**Organisation**	**Names**	**Organisation**
Louise Anne Neale	Transport Planning NYC	**Laura Welsh**	NYC
Richard Forsyth	Northern Powergrid	**Chris Palmer**	Zero Carbon
Philip Richardson	NYC	**Jos Holmes**	NYC
Jayne Charlton	NYC	**Lucy Allis**	NYC
Robert Green	Yorkshire Water	**Tobias Lumb**	York Museums Trust
David Waters	Transport for the North	**Steve Secker**	York & North Yorkshire Economic & Property Forum
Jos Holmes	NYC	**Jonathan Dunk**	NYC
Rebecca Haslam	YNYCA	**Dylan Philpott**	NYC
Ollie Braithwaite	YNYCA	**Tim Larner**	Zero Carbon Harrogate

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Graham North	YNYCA		
Health & Communities		**Interconnected**	
Names	**Organisation**	**Names**	**Organisation**
Jos Holmes	NYC	Jason Alred	Yorkshire Water
Neil Cartwright	NHS	Robert Green	Yorkshire Water
Poppy Jopson	YNYCA	Mark Henderson	YC
Karen Gaby Rossell	NY	Shaun Berry	NYC
Rebecca Haslam	YNYCA	Merion Jones	NYC
Victoria Howse	NY Business partner	Steve Ball	YC
Fiona Strachan	NY Business partner	Joe Allen	EA
Jessica Marshall	NY	Richard Lever	EA
		Jason Alred	Yorkshire Water

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APPENDIX 10 – RAPID ADAPTATION PATHWAYS – FURTHER INFORMATION

Further Information on the RAPA Process

Through structured discussion, attendees of Rapid Adaptation Pathway workshops develop a shared understanding of climate risks, define key thresholds or tipping points, and explore a range of potential responses. This collaborative process helps build consensus, recognise trade-offs, and improve coordination across organisations.

RAPA workshops follow a clear, step-by-step process supported by guidance, templates and practical tools. The emphasis is on starting with a high-level, accessible discussion to develop initial pathways, which can then be refined and integrated into more detailed technical analysis, investment planning or policy development. The approach is flexible and can be adapted to different geographic scales, governance contexts and levels of data availability.

The toolkit was tested and refined through pilot workshops in several local authority areas, demonstrating its applicability across different settings. Key benefits identified include improved anticipation of future adaptation needs, earlier agreement on strategic direction, reduced risk of maladaptive or reactive decisions, and stronger collaboration between partners.

Rapid Adaptation Pathway Framework – supporting information

Table 62 to Table 66 in the sections below summarise a comprehensive adaptation library spanning housing, buildings, infrastructure, the natural environment, business, energy, and interconnected risks. They cover both 'C-series' actions, which are carbon reduction measures that also support adaptation and are most closely aligned with the Built Environment and Infrastructure & Transport sectors, and 'R-series' actions, which are specifically focused on resilience and adaptation and are delivered by local authorities, partnerships, and regional and national organisations The C-Series actions were obtained from the York Climate Change Action Plan (City of York Council, 2024c) and are not exhaustive carbon reduction options.

The actions described were derived from the RAPA workshops (see 'APPENDIX 10 – Rapid Adaptation Pathways – Further Information') and relate to the hazards assessed for each of the focus sectors (see Section 5.4.3). These actions span short-, medium-, and long-term timeframes, with impacts ranging from incremental improvements to significant resilience transformations. The tables for each sector summarise the full adaptive actions spreadsheet, which provides more detailed action descriptions, sector-specific metrics, and links to additional resources and relevant case studies.

A key to the abbreviations used in the adaptation action tables are provided in Table 61. The reference numbers provided in the adaptation action tables are not in consecutive order as they were derived from the order of the sectors provided in the Rapid Adaptation Pathway Framework document.

Table 61 Key to the abbreviations used in Table 62 to Table 67.

Cost Band	
£	Low cost, mainly policy, planning, engagement
££	Medium cost programmes and implementation
£££	Major infrastructure and construction projects

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Impact Band	
1	Moderate - Supporting and enabling actions
2	Significant - resilience benefits
3	Major resilience impact / vulnerability lowered
Phase / timescale	C series (York Climate Action Plan)
S	Short
M	Medium
L	Long
O	Ongoing
Phase / timescale*	R series (Adaptation Actions)
E	Early
M	Mid
L	Late

**Note: C Series actions were not developed to reflect RAPA timescales and therefore the series have differing timescale definitions.*

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Natural Environment and Farming

The identified natural environment and agricultural adaptation actions in the RAPA workshops focus on strengthening catchment-scale resilience to flooding and drought while supporting long-term agricultural productivity and ecosystem health. Major interventions such as peatland restoration, agroforestry, river restoration, natural flood management, and expanded water storage can significantly reduce flood risk, improve water retention, and enhance landscape resilience. Complementary measures including soil health improvement, sustainable land management, irrigation upgrades, and farm water storage increase agricultural productivity and reduce drought vulnerability. These are supported by coordinated catchment planning, land-use policy, and farmer training to ensure effective implementation.

Table 62 Indicative climate change adaptation actions for Natural Environment and Flooding, including a reference number, phase / timescale over which the action is recommended for implementation, impact on adaptation benefits and cost.

Ref	Action Summary	Phase	Impact	Cost Band
R49	Farming collaboration	E	2	£
R63	Rainwater harvesting	E	2	££
R64	Seasonal flooding support	E	2	££
R65	Wetland tourism assets / promotion	E	2	££
R74	Cover crop expansion	E	2	£
R77	Reservoir legislation reform	E	1	£
R78	Agricultural resilience training	E	1	£
R81	Climate-resilient species research	E	1	£
R82	On-farm reservoir pilots	E	3	££
R83	Cross-sector water planning	E	2	£
R88	IDB funding access	E	1	£
R48	Catchment planning	E,M	2	£
R50	Landscape partnerships	E,M	2	£
R51	Joint funding	E,M	1	£
R52	Agricultural training	E,M	1	£
R53	Improve livestock impact	E,M	2	£
R54	Soil aeration	E,M	2	£
R55	Expand hedgerows	E,M	2	££
R56	Adopt agroforestry	E,M	3	££
R57	Floodplain restrictions	E,M	3	£
R58	Updated land-use policy	E,M	2	£
R59	Upper-catchment tree cover	E,M	3	£
R60	Catchment partnership support	E,M	2	££
R61	River restoration	E,M	3	££
R62	Protected species habitat	E,M	2	££
R66	SuDS implementation	E,M	3	££
R67	Peatland restoration	E,M	3	££
R68	Natural flood management	E,M	3	££
R69	Blue-green strategy	E,M	2	£

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Ref	Action Summary	Phase	Impact	Cost Band
R70	Landscape rewetting	E,M	3	££
R71	Increase soil carbon	E,M	2	££
R72	Climate-smart planning	E,M	2	£
R75	Agroforestry adoption	E,M	3	££
R79	Farm tree planting	E,M	2	££
R73	Rainwater harvesting	M	2	£
R84	Soil health improvement	M	2	£
R85	Irrigation technology assessment	M	2	££
R47	New groundwater sources	M,L	2	££
R76	Coordinated abstraction planning	M,L	2	£
R80	Increase water storage	M,L	3	££
R86	Irrigation system integration	M,L	3	££

Business & Industry

The identified adaptation actions for Business & Industry in RAPA workshops focus primarily on improving resilience to flooding, extreme weather, and climate-related disruption, while strengthening preparedness, post event recovery and long-term continuity. A priority is flood resilience, including flood protection schemes, real-time flood information, property-level flood resilience measures for those businesses at risk. These are supported by strategic adaptation planning, regional and business contingency planning, and training to help businesses prepare for and respond effectively to flood events. Supply chain contingency planning, transport resilience measures, and infrastructure maintenance could further help reduce disruption and ensure business continuity.

Actions covering collaboration through business forums, resilience innovation programmes, and sustainability initiatives encourages knowledge sharing and innovation. Measures such as flexible working, resilient storage facilities (especially for cultural / artwork collections), and adaptation communications help businesses adapt operationally, while wider environmental actions such as urban tree planting, rainwater harvesting, and cooling and greening initiatives help reduce risks and improve the overall resilience of the business.

Table 63 Indicative climate change adaptation actions for Business & Industry, including a reference number, phase / timescale over which the action is recommended for implementation, impact on adaptation benefits, cost.

Ref	Action Summary	Phase	Impact	Cost Band
R111	Flood Risk Metrics	E	1	£
R112	Flood Guidance packs	E	1	£
R122	Property flood resilience	E	3	££
R131	Supply-chain contingency	E	2	£
R136	Resilience investment partnerships	E	2	£
R113	Contingency planning - Flooding	E,M	2	£
R115	Flood protection schemes	E,M	3	£££
R116	LRF adaptation support	E,M	2	££
R117	Real-time flood info	E,M	2	£

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Ref	Action Summary	Phase	Impact	Cost Band
R118	Flood-response training	E,M	1	£
R120	Business recovery guidance	E,M	1	£
R121	Resilience innovation support	E,M	2	££
R123	"York Is Open" messaging	E,M	1	£
R124	Resilient storage facilities, esp. for museum / gallery collections	E,M	2	££
R125	Infrastructure maintenance	E,M	2	££
R127	Flood action groups	E,M	2	£
R128	Extreme-weather planning	E,M	2	£
R129	Gutter/drainage upgrades	E,M	3	££
R130	Historic building maintenance	E,M	2	££
R132	Inclusive adaptation communication	E,M	1	£
R134	Business forum collaboration	E,M	1	£
R135	Funding guidance / support	E,M	1	£
R137	Water literacy promotion	E,M	1	£
R139	Resilience-forum support	E,M	1	£
R140	Business resilience guidance	E,M	1	£
R141	Contingency planning - Extreme Heat	E,M	2	£
R142	Business sustainability programme	E,M	2	££
R143	"Water Me" scheme	E,M	1	£
R144	Historic-building funding	E,M	2	£
R147	Rainwater harvesting - Business premises	E,M	2	£
R148	Cool public spaces	E,M	2	£
R150	Post-event recovery	E,M	2	££
R151	Tree-planting strategy	E,M	2	£
R119	Strategic adaptation planning	M	2	£
R114	Managed retreat	M,L	3	£££
R145	Resilient archive storage	E,M,L	2	££
R146	Flexible working	E,M,L	1	£
R149	Street-tree planting	E,M,L	3	££

Infrastructure & Transport

The identified adaptation actions for the Infrastructure & Transport sector in RAPA workshops combine major physical upgrades, improved system planning, and operational preparedness to reduce vulnerability to flooding and drought while maintaining essential services across all key stakeholders. High-impact measures include flood protection schemes, transport resilience upgrades, sustainable drainage systems (SuDS), reservoir expansion, water-grid improvements, and infrastructure hardening, which directly reduce disruption risks and strengthen long-term system reliability. Complementary actions such as transport risk registers, climate-adapted planning, infrastructure maintenance, and contingency planning improve preparedness and enable faster recovery from climate shocks. Water system resilience is strengthened through leak reduction, treatment capacity expansion, greywater reuse, and water storage measures, ensuring reliable supply

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during drought. Investment in sustainable transport, active travel infrastructure, and climate-resilient design also supports long term adaptation while reducing infrastructure exposure.

Table 64 Indicative climate change adaptation actions for Infrastructure & Transport, including a reference number, phase / timescale over which the action is recommended for implementation, impact on adaptation benefits, cost.

Ref	Action Summary		Phase	Impact	Cost Band
R1	Develop Flood-risk metrics	E	1	£	
R2	Public flood toolkit	E	1	£	
R10	Business resilience guidance	E	1	£	
R12	Property flood resilience	E	3	££	
R22	Climate-smart farming	E	2	££	
R23	Permeable surfaces promotion	E	2	£	
R26	Behavioural water savings	E	1	£	
R39	Water conservation incentives	E	1	£	
R43	Efficiency-linked incentives	E	1	£	
R3	LRF contingency planning	E,M	2	£	
R5	Flood-protection schemes	E,M	3	£££	
R6	LRF adaptation support	E,M	2	£	
R7	Visitor flood updates	E,M	1	£	
R8	Flood Group training	E,M	1	£	
R11	Resilience innovation programme	E,M	2	££	
R13	Tourism communications plan	E,M	1	£	
R15	Infrastructure maintenance	E,M	2	££	
R16	Transport resilience measures	E,M	3	££	
R17	Community resilience groups	E,M	2	£	
R18	Water awareness campaigns	E,M	1	£	
R20	Sustainable land partnership	E,M	2	££	
R21	Drought-resilient planning	E,M	2	££	
R24	Water-efficiency incentives	E,M	2	££	
R25	Landscape restoration	E,M	3	££	
R27	Climate-ready design	E,M	2	££	
R28	Reservoir approval reform	E,M	1	£	
R29	Soil moisture enhancement	E,M	2	££	
R30	Upland water storage	E,M	3	££	
R31	Greywater reuse expansion	E,M	2	££	
R32	SuDS implementation	E,M	3	££	
R36	Housing rainwater systems	E,M	2	££	
R37	Reservoir capacity restoration	E,M	3	££	
R38	Agricultural rain harvesting	E,M	2	££	
R40	Leak reduction measures	E,M	3	££	
R41	Mains renewal	E,M	3	££	
R45	Water-grid upgrades	E,M	3	££	

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Ref	Action Summary		Phase	Impact	Cost Band
C17	Develop Movement and Place plan	M	2	££	
C18	Sustainable active travel investment	M	3	£££	

Built Environment

The identified adaptation actions for the Built Environment sector in RAPA workshops below outline a coordinated programme of adaptation and resilience measures designed to help the built environment and local communities respond to the increasing impacts of climate change. These actions aim to improve the robustness, energy performance, and long-term sustainability of both new and existing buildings, while integrating climate adaptation into planning, design, construction, and asset management practices. Key priorities include delivering highly energy-efficient homes, scaling up retrofit activity, strengthening planning policies and building standards (noting that these are controlled by central government with limited local influence), and ensuring that council-owned assets and future developments are resilient to climate-related risks. Collectively, these measures seek to reduce vulnerability to overheating, flooding, and extreme weather, while supporting the transition to net-zero carbon.

The actions focus on strengthening organisational capacity, enhancing risk assessment and monitoring, and promoting collaboration between public authorities, private sector partners, and local communities. Initiatives such as creating risk registers, supporting the development of green construction skills, improving drainage and flood management systems, expanding urban green infrastructure, and increasing community preparedness will help improve resilience at both property and city scales.

Overall, the programme reflects the need for coordinated policy, targeted investment, and effective stakeholder engagement to ensure adaptation measures are delivered efficiently and sustainably.

Table 65 Indicative climate change adaptation actions for Built Environment, including a reference number, phase / timescale over which the action is recommended for implementation, impact on adaptation benefits, cost.

Ref	Action Summary	Phase	Impact	Cost band
C06	Proactive landlord regulatory engagement	O	2	££
C07	Engage landlords on efficiency	O	2	££
C12	Give climate-smart planning advice	O	2	£
C15	Issue retrofit planning guidance	O	2	£
C16	Grow sustainable construction skills	O	2	££
C22	Funding bids for Net Zero	O	3	£
C24	Mainstream adaptation in governance	O	2	£
C26	Support York Climate Commission	O	2	£
C27	Promote citywide sustainability	O	2	£
C29	Promote zero-waste businesses	O	1	£
C30	Enable circular economy growth	O	2	££
C32	Support business emissions reduction	O	3	£
C33	Develop green skills workforce	O	2	££
C34	Support business climate adaptation	O	2	£

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C35	Promote regenerative local agriculture	O	2	£
C37	Facilitate business collaboration	O	2	££
C38	Deliver tourism strategy	O	2	£
C39	Implement biodiversity net gain	O	2	££
C47	Upgrade flood defences	O	3	£££
C50	Identify district heating opportunities	O	1	£
C52	Optimise electric grid capacity	O	1	£
C53	Explore renewable generation opportunities	O	3	££
C54	Increase solar capacity deployment	O	2	£
R152	Resilience investment partnership	E	2	£
R157	Property heat / humidity monitoring	E	1	£
R159	Tree-planting guidance	E	1	£
R164	Private rental heat policy	E	1	£
R167	Stronger building standards	E	2	£
R172	Biodiversity Net Gain	E	2	££
R176	Climate-informed funding	E	2	££
R177	New home guidance	E	1	£
R178	Stronger building standards - Flooding	E	3	£
R187	Developer engagement	E	1	£
R191	Climate-ready park planning	E	2	££
R156	Contractor heat-mitigation upskilling	E,M	2	££
R160	Homeowner heat advice	E,M	1	£
R168	National SuDS consistency	E,M	2	£
R169	Mandatory YNYCA SuDS	E,M	2	£
R170	Catchment-scale joint SFRA	E,M	2	£
R171	Resilient development advocacy	E,M	1	£
R173	Enhanced drainage maintenance	E,M	2	££
R174	Community flood preparedness	E,M	2	£
R179	Multifunctional SuDS design	E,M	2	££
R180	Future Homes Standards	E,M	2	£
R181	Climate-ready long-term planning	E,M	2	£
R182	LNRS flood integration	E,M	2	£
R183	Cross-LRF collaboration	E,M	1	£
R184	Humber 2100 support	E,M	2	£
R185	Resilient development strategy	E,M	2	£
R186	Land-use policy monitoring	E,M	1	£
R189	Property flood retrofits	E,M	2	££
R190	Climate-adaptive SFRA	E,M	2	£
R188	Retrofit SuDS	E,M,L	2	££
R192	Resilient archive storage	E,M,L	2	££
C04	Stock Condition Survey	E	2	££
C05	Identify routine retrofit opportunities	E	1	££
C13	Produce sustainability planning SPD	E	2	£
C14	Raise commercial environmental standards	E	2	£
C25	Expand climate-change communications	E	1	£

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C31	Support SME decarbonisation	E	1	££
C43	Map natural capital opportunities	E	1	£
C45	Map ecosystem health	E	1	£
C02	Develop large-scale retrofit mechanisms	M	3	£££
C03	Provide home-retrofit funding	M	2	££
C08	Run low-carbon retrofit pilots	M	3	£££
C09	Plan council-building decarbonisation	M	1	££
C10	Improve health Care building Sustainability	M	1	£
C11	Create building risk register	M	1	£
C21	Monitor weather and flood costs	M	1	££
C23	Implement heat–cold response plans	M	1	£
C28	Share circular case studies	M	1	£
C36	Promote local supply chains	M	3	£
C40	Assess carbon sequestration opportunities	M	3	££
C41	Protect and manage trees	M	2	££
C44	Develop nature recovery strategy	M	2	££
C46	Develop carbon offsetting strategy	M	3	££
C48	Promote natural flood management	M	3	£££
C49	Monitor river water quality	M	2	££
C51	Deliver City LEAP project	M	3	£££
C55	Assess Green Energy Park	M	3	£££
R158	Urban tree planting	M	2	££
R165	Designated cool spaces	M	1	£
R166	Cooling focused master planning	M	2	££
R153	Flexible (siesta) working	M,L	1	£
R154	Combined retrofit net zero / adaptation	M,L	3	££
R155	Air-conditioning installation	M,L	2	££
R161	Increased CAPEX	M,L	3	££
R162	Passive cooling adoption	M,L	2	££
R163	Extensions - Upgrade ventilation	M,L	2	£
R175	Managed retreat approach	M,L	3	£££
C01	Deliver 600 Passivhaus homes	L	3	£££

Health & Communities

The adaptation actions identified for the Health & Communities sector in RAPA workshops strengthens the resilience of healthcare services, care facilities, and vulnerable populations to flooding and extreme heat through infrastructure upgrades, emergency preparedness, and improved monitoring and governance. Major interventions include flood-proofing healthcare facilities, ensuring backup power and resilient ambulance services, protecting critical NHS operations, and developing cooling spaces and long-term cooling solutions, all of which directly reduce disruption risks and protect patient safety. These are supported by strengthened emergency planning, flood and heat alert systems, climate risk integration into healthcare planning, and enhanced climate-health monitoring to improve preparedness and response. Additional measures such as care-home funding support, adaptation training, climate-resilient procurement, and public communication ensure frontline services and communities can adapt effectively.

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Table 66 Indicative climate change adaptation actions for Health & Communities, including a reference number, phase / timescale over which the action is recommended for implementation, impact on adaptation benefits, cost.

Ref	Action Summary	Phase	Impact	Cost Band
R193	Flooding stakeholder engagement	E	1	£
R194	Prioritise essential services	E,M,L	3	£
R195	Unified severe-weather plan	E,M	2	£
R196	Advocate climate-resilient funding	E,M	1	£
R197	LRF climate subcommittee	E,M	1	£
R198	Strengthen flood-alert systems	E,M	2	£
R199	Embed climate impacts	E,M	2	£
R200	Integrate climate risks	E,M	2	£
R201	Check and manage floods	E,M	2	£
R202	Guidance and monitor resilience	E,M	1	£
R203	Adaptation awareness stories	E	1	£
R204	Structured adaptation training	E	1	£
R205	Resilient ambulance power	E,M,L	3	££
R206	Resilient emergency plans	E,M	2	£
R207	Retrofit and flood-proof	E,M	3	£££
R208	Care-home sustainability grants	E	2	££
R209	Climate-resilient procurement	E,M	2	££
R210	Apply adaptation framework - Flooding	E,M	2	£
R211	Assign adaptation responsibility	E	1	£
R212	Lobby care-home funding - Flooding	E,M	1	£
R213	Communicate heat-health risks	E,M	1	£
R214	Issue heat alerts	E,M	2	£
R215	Install climate monitors	E	2	£
R216	Apply adaptation framework - High Temperatures	E,M	2	£
R217	Guide and monitor resilience	E,M	1	£
R218	Track heat-related cancellations	E	1	£
R219	Embed resilience in plans	E,M,L	2	£
R220	Provide adaptation training	E	1	£
R221	Share case studies	E	1	£
R222	Consider long-term cooling costs	E,M,L	3	££
R223	Monitor vector-borne diseases	E	2	££
R224	Unified severe-weather planning	E,M	2	£
R225	Develop cooling spaces	E,M,L	3	£
R226	Assign adaptation leadership	E	1	£
R227	Coordinate LRF adaptation	E,M,L	2	£
R228	Protect critical services	E,M,L	3	£
R229	Use procurement for resilience	M	2	££
R230	Advocate better building standards	E,M	2	£
R231	Ensure backup power	E,M,L	3	££

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Ref	Action Summary	Phase	Impact	Cost Band
R232	Lobby care-home funding - High temperatures	E,M	1	£
R233	Combine net-zero retrofits	E,M,L	2	££
R234	Expand climate-health monitoring	E,M,L	2	£
R235	Grant support for care homes	E,M	2	££

Interconnected Risks

The adaptation actions summarised in Table 67 below are aimed to strengthen cross-sector resilience to cascading risks, particularly where flooding, drought, infrastructure failure, and emergency response systems interact. The emphasis is on improving coordination, planning integration, infrastructure robustness, and governance alignment across organisations and systems.

Table 67 Indicative climate change adaptation actions for Interconnected Risks, including a reference number, phase / timescale over which the action is recommended for implementation, impact on adaptation benefits, and cost.

Ref	Action Summary	Phase	Impact	Cost Band
R237	Establish shared resilience targets	E,M	1	£
R238	Collaborate on flood management	E,M	2	£
R239	Report climate adaptation progress	E,M	1	£
R240	Develop integrated water plans	E,M	2	£
R241	Align partner investment timing	E,M	1	£
R242	Implement strategic catchment planning	E,M	2	£
R243	Integrate climate in emergencies	E,M	2	£
R244	Plan for higher maintenance	E,M	2	££
R250	Apply updated climate allowances	E,M	2	£
R251	Continue collaborative reporting	E,M	1	£
R245	Coordinate LRF and utilities	E,M,L	2	£
R246	Maintain underground asset register	E,M,L	2	£
R247	Map critical infrastructure assets	E,M,L	2	£
R252	Co-ordinate drought-flood planning	M	2	£
R248	Harden and add redundancy	M,L	3	££
R249	Avoid high-risk infrastructure sites	M,L	3	£

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APPENDIX 11 – ADAPTATION STRATEGY GOVERNANCE

Recommendations

Strategic Ownership (YNYCA and Constituent Authorities) - Overall ownership of the Climate Adaptation Strategy should sit with York and North Yorkshire Combined Authority (YNYCA) and its constituent authorities, City of York Council and North Yorkshire Council. Together, they should provide the strategic leadership for climate adaptation across the region, responsible for:

- Setting regional adaptation priorities and objectives;
- Coordinating action across organisational and geographic boundaries;
- Aligning adaptation with investment, infrastructure, planning and economic development programmes;
- Maintaining the regional climate risk assessment, climate risk register and adaptation evidence base;
- Monitoring delivery and reporting progress;
- Identifying and coordinating funding opportunities.

Decision-Making Structure - A Regional Adaptation Steering Group should be established and jointly overseen by YNYCA and the constituent authorities. Membership should include senior representatives from local authorities, the Environment Agency, water companies, National Park Authorities, infrastructure operators, health partners and the Local Resilience Forum. The group should provide strategic oversight, approve priorities, review delivery performance and resolve cross-sector issues.

Reporting and Accountability - A formal monitoring and reporting framework should be established to track delivery, outcomes and changes in climate risk over time. This should include:

- A live regional climate risk register maintained by YNYCA and the constituent authorities and reviewed regularly to reflect changes in climate projections, risk exposure, vulnerability and adaptive capacity;
- A structured Climate Adaptation Action Plan containing clearly defined actions, delivery timescales, responsible organisations, performance indicators and implementation status;
- A live database of adaptation actions with named action owners and delivery partners;
- Annual progress reporting by delivery organisations;
- A consolidated annual adaptation progress report prepared by YNYCA and constituent authorities;
- Regular review of adaptation priorities, risks and actions through the Regional Adaptation Steering Group;
- Full review and update of the Climate Adaptation Strategy every three to five years.

The climate risk register and Adaptation Action Plan should be treated as live management tools rather than static documents, enabling the region to respond to emerging evidence, changing risks and evolving policy requirements.

Resources and Capacity - Delivering the strategy will require dedicated coordination capacity, technical expertise and sustained investment. YNYCA and the constituent authorities should work together to align funding streams, secure external investment and build adaptation capability across partner organisations. Adaptation should be integrated into existing infrastructure, regeneration, environmental and community investment programmes to maximise efficiency and long-term resilience outcomes.

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APPENDIX 12 – YORKSHIRE DALES NATIONAL PARK AND NIDDERDALE NATIONAL LANDSCAPE SUBSECTION

Yorkshire Dales National Park and Nidderdale National Landscape

Risks to Protected Landscape Natural Environment – Summary

The Yorkshire Dales National Park and Nidderdale National Landscape face increasing climate risks throughout this century, with the most significant challenges already emerging by the 2030s. The study clearly shows that climate change is not a future concern but a current and escalating risk to the region's natural environment, land management systems and ecological resilience. The landscape's important peatlands, species-rich grasslands, upland heath and moorland habitats are particularly exposed to the combined effects of climate change and existing environmental pressures.

By the 2030s, the risk to agricultural productivity is already assessed as major under a 1.5°C warming scenario. More frequent weather extremes, shifting seasonal patterns, prolonged dry periods and intense rainfall are likely to reduce livestock and crop productivity across the uplands and in-bye farmland. Agriculture underpins both the local economy and the distinctive character of the Yorkshire Dales and Nidderdale, meaning that impacts on farm viability may have wider consequences for landscape management and biodiversity. At the same time, major risks are already projected for terrestrial habitats from pests, pathogens and invasive non-native species. Warmer temperatures and longer growing seasons are likely to favour the spread of existing threats while enabling the establishment of new species, diseases and parasites. These pressures compound existing challenges facing protected habitats and species, many of which are already fragmented and in unfavourable condition.

By the 2050s and under a 2.0°C global heating scenario, climate risks become more widespread and more severe across natural systems. Many risks that are moderate today become major, indicating a narrowing window for adaptation. Droughts, wildfires and water scarcity emerge as a major threat to terrestrial habitats, as do risks to soils, natural carbon stores and landscape character. The Yorkshire Dales and Nidderdale contain some of England's most extensive upland peat deposits, and deterioration of these systems would not only damage biodiversity but could reduce carbon sequestration, increasing greenhouse gas emissions. Freshwater species and habitats face major risk of contamination from sewage networks and pollutants. Such impacts could undermine ecological recovery efforts in river catchments and further reduce resilience to climate change. Climate pressures also extend into forestry. Risks to forestry productivity, and woodland creation programmes from pests and diseases all become major by mid-century. This raises concerns for ambitions to expand woodland cover and deliver nature recovery and net zero objectives.

Under higher warming pathways, by the 2080s and approaching a 4.0°C global heating scenario, several risks escalate from major to severe, reflecting the profound change expected for the UK and the potential for widespread and potentially irreversible environmental change. Agricultural productivity becomes one of the most severe risks facing the region, with sustained impacts on livestock health and crop production. Risks from pests, pathogens and invasive species also become severe for both agriculture and terrestrial biodiversity and habitats, highlighting the growing challenge of managing landscapes in a warmer climate. Environmental drought could reach severe levels, even in this part of North Yorkshire which was historically very wet, placing exceptional pressure on habitats dependent on reliable soil moisture and water availability. Large destructive wildfires may become a recurring issue. The deterioration of soils and natural carbon stores represents another severe long-term risk. Drying, erosion and degradation of peatlands could fundamentally alter ecosystem function across large areas of the uplands, reducing carbon storage, increasing downstream water management challenges and affecting the characteristic appearance of the landscape. Freshwater ecosystems are also projected to face major impacts by the end of the century, as warmer

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temperatures, altered hydrological regimes and ecological disruption exceed the adaptive capacity of some species and habitats.

Overall, the assessment indicates that the Yorkshire Dales National Park and Nidderdale National Landscape will experience a progressive increase in climate-related risks, with agriculture, peatlands, soils, biodiversity and water resources emerging as the most vulnerable systems. The pattern of risk reflects a shift from managing isolated climate impacts towards addressing systemic pressures that affect the ecological, economic and cultural fabric of these protected landscapes. Adaptation measures that improve ecosystem condition, restore peatlands, enhance habitat connectivity, increase landscape-scale resilience and support climate-resilient land management are therefore likely to deliver the greatest benefits in reducing future risks.

Risks – Register Scores

A preliminary list of risks and risk rating scores for the Yorkshire Dales National Park and Nidderdale National Landscape are outlined in **Table 68** below.

Table 68. Risk rating scores across the four scenarios for the risks to Yorkshire Dales National Park and Nidderdale National Landscape

Risk ID#	YNYCA risk description	2030s 1.5˚C	2050s 2˚C	2080s 2˚C	2080s 4˚C
80	Risks to **terrestrial** species and habitats from pests, pathogens and invasive species, including viral and parasitic diseases, where climate change improves conditions for these to spread and cause damage.	[4] Major	[4] Major	[4] Major	[5] Severe
81	Risks to **terrestrial** species and habitats from changing climatic conditions and extreme events, including temperature change, water scarcity, wildfire, flooding, wind, and altered hydrology (including water scarcity, flooding and saline intrusion)	[3] Moderate	[4] Major	[4] Major	[4] Major
83	Risks of wildfires and destruction of **terrestrial** habitats including forests, heathland/moors, peatlands and grasslands, where the habitat is difficult to return to its former state. (Interdependency with water supply Infrastructure)	[3] Moderate	[4] Major	[4] Major	[5] Severe
84	Risk of environmental drought and water scarcity to **terrestrial** habitats (Interdependency with water supply Infrastructure)	[3] Moderate	[4] Major	[4] Major	[5] Severe
85	Risk of drainage and/or sewage networks flooding and contamination of land impacting **terrestrial** habitats and biodiversity, including natural capital	[2] Minor	[2] Minor	[2] Minor	[3] Moderate
86	Risk of mine water outbreak and contamination of the natural environment and **terrestrial** habitats	[3] Moderate	[3] Moderate	[3] Moderate	[3] Moderate
87	Risk of climate-influenced river flooding impacting **terrestrial** habitats and biodiversity, including urban habitats and natural capital, noting that while flood plain habitats naturally flood and are not materially affected by normal flood levels, increasingly extreme or severe flooding may negatively impact flood plain habitats.	[2] Minor	[2] Minor	[2] Minor	[2] Minor
88	Risk of negative effects for the region's biodiversity, including changing species distributions and increased fragmentation of sensitive habitats where these cannot adapt to the rapid rate of climate change and related extreme weather.	[3] Moderate	[3] Moderate	[3] Moderate	[3] Moderate

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Risk ID#	YNYCA risk description	2030s 1.5˚C	2050s 2˚C	2080s 2˚C	2080s 4˚C
89	Risk to **soils** (including soil health and associated ecosystem services) from changing climatic conditions, including fluctuations between seasonal aridity and wetness resulting in soil loss events like erosion.	[3] Moderate	[4] Major	[4] Major	[5] Severe
90	Risks for natural carbon stores (e.g. peatlands, woodland), carbon sequestration and GHG emissions from changing climatic conditions, including temperature change and water scarcity	[3] Moderate	[4] Major	[4] Major	[5] Severe
91	Risks to landscape character from a changing climate.	[3] Moderate	[4] Major	[4] Major	[4] Major
92	Risk of landslides and slope failures impacting landscape character and **terrestrial/freshwater** habitats and species (noting that risks of landslides/slope failures to Infrastructure/Built Environment is covered under different risks).	[2] Minor	[3] Moderate	[3] Moderate	[3] Moderate
93	Risks to **freshwater** species and habitats (e.g. wetlands) from changing climatic conditions and extreme events, including higher water temperatures, flooding, water scarcity and phenological shifts.	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
94	Risks to **freshwater** species and habitats from pests, pathogens and invasive species	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
95	Risk of drainage and/or sewage networks flooding and contamination to **freshwater** species and habitats (e.g. wetlands). Note, if river levels decline in dry periods the concentration of pollutant will increase if effluent is still being released.	[3] Moderate	[4] Major	[4] Major	[4] Major
99	Risks to **forestry** productivity from extreme events and changing climatic conditions (including temperature change, water scarcity, wildfire, flooding, coastal erosion, wind and saline intrusion).	[3] Moderate	[4] Major	[4] Major	[4] Major
100	Risks to **forestry** from pests, pathogens and invasive species	[3] Moderate	[4] Major	[4] Major	[4] Major
102	Risks to regional **forestry** and forest planting targets (e.g., woodland creation, nature restoration targets, carbon sequestration targets, urban climate adaptation using trees) from extreme events and changing climatic conditions increasing tree mortality (including temperature change, water scarcity, wildfire, flooding, coastal erosion, wind and saline intrusion).	[2] Minor	[4] Major	[4] Major	[4] Major
103	Water shortages affecting **agricultural** practices (e.g. irrigation and livestock health)	[2] Minor	[2] Minor	[2] Minor	[3] Moderate
104	Risks to **agricultural** productivity from extreme events, unpredictable weather and changing climatic conditions such as changing seasonality (primarily water scarcity and extreme / unpredictable rainfall, but also including temperature change, wildfire, flooding, coastal erosion, wind and saline intrusion).	[4] Major	[4] Major	[4] Severe	[5] Severe
105	Risk of river flooding of **agricultural** land impacting productivity (e.g. crop damage or loss) and the potential for contamination	[2] Minor	[2] Minor	[2] Minor	[3] Moderate
106	Risks to **agricultural** crops & livestock health and productivity from pests, pathogens and invasive species, including viral and parasitic diseases	[3] Moderate	[4] Major	[4] Major	[5] Severe
108	Risks to **agricultural** productivity from soil erosion	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major

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Risk ID#	YNYCA risk description	2030s 1.5˚C	2050s 2˚C	2080s 2˚C	2080s 4˚C
109	Risks of wildfires on or affecting **agricultural** land (e.g. arable crops)	[1] Negligible	[2] Minor	[2] Minor	[2] Minor
110	Risk of increased surface water flooding associated with choice of land management practices exacerbating flood risk	[2] Minor	[2] Minor	[2] Minor	[3] Moderate
111	Risk of short-term accessibility challenges for footpaths and rights of way (including urban footpaths and parks) associated with a changing climate (e.g. landslips, fallen trees, flooding, maintenance work to remove climate-induced invasive species). (Interdependency to Infrastructure theme - walking infrastructure and transport infrastructure may be interlinked)	[3] Moderate	[3] Moderate	[3] Moderate	[3] Moderate
112	Risk of long-term accessibility challenges for footpaths and rights of way (including urban footpaths and parks) associated with a changing climate (e.g. landslips, erosion, inundation or loss of paths) (Interdependency to Infrastructure theme - walking infrastructure and transport infrastructure may be interlinked).	[2] Minor	[3] Moderate	[3] Moderate	[3] Moderate
113	Risks to public parks, parkland and garden biodiversity/ecosystem services from pests, pathogens and invasive species	[3] Moderate	[4] Major	[4] Major	[4] Major

Risks to Protected Landscape Services – Summary

The proportion of risks to YNYCA protected landscape authority services/operations assigned to each risk rating across the four climate scenarios (2020s, 2050s under 2°C of global warming, 2080s under 2°C and 2080s under 4°C) are shown in **Error! Reference source not found.**.

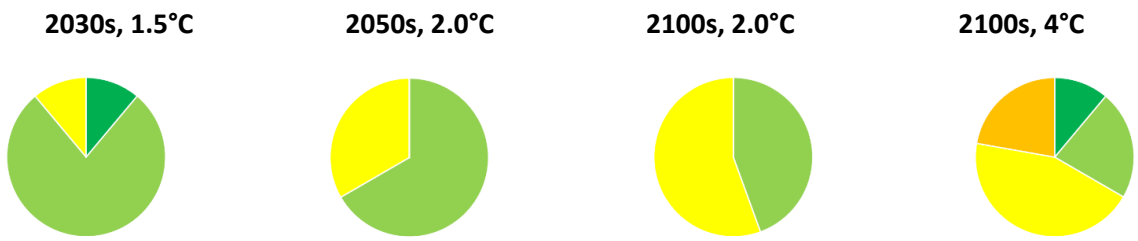

Figure 44. Proportion of risks to YNYCA protected landscape authority services/operations for each risk rating across the four climate scenarios. Source: ADAS, 2025

Key to pie chart figure above.

Colour	Risk scoring level
Dark green	Negligible
Light green	Minor
Yellow	Moderate
Orange	Major
Red	Severe

The CCRA indicates that, for both the North York Moors and the Yorkshire Dales National Parks, risks to Protected Landscape services in the 2030s remain relatively contained, but already reflect the specific operational challenges of managing large, accessible and environmentally sensitive landscapes under a changing climate. At this stage, the most immediate moderate risk relates to

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snowfall, which continues to affect access, visitor safety and the delivery of land management activities. This is particularly relevant for both National Parks given their upland topography and reliance on often limited transport networks. However, the nature of this risk differs slightly between them: in the Yorkshire Dales, with its higher elevations and more extensive upland road exposure, snowfall may continue to present more persistent disruption to access and rural service delivery, whereas in the North York Moors its effects are often more episodic but still significant for visitor management and safety.

Beyond snowfall, the 2030s profile for both Parks is characterised largely by risks currently assessed below moderate but with clear potential to intensify. These include wildfire, changing landscape character and cascading risks. In the North York Moors, the extensive heather moorland and peat soils are particularly sensitive to drying, meaning that even in the 2030s there is an emerging service challenge in managing land access, fire risk and habitat condition during dry summers. In the Yorkshire Dales, by contrast, the landscape is more dominated by grassland, limestone pavements and valley systems, which are less immediately flammable but highly sensitive to hydrological change. As a result, early risks in the Dales are more likely to manifest through water management pressures, soil erosion and impacts on footpaths, rather than fire.

By the 2050s, several risks become moderate across both National Parks, reflecting the increasing influence of warmer temperatures and more variable precipitation patterns. Given that the CCC estimate that heatwave summers such as 2025 will become the new normal (Climate Change Committee, 2026), wildfires are likely to becomes a major risk, but remains more structurally significant in the North York Moors due to the presence of continuous tracts of heather, degraded peat and lower rainfall which can support larger and more difficult-to-control fires. In the Yorkshire Dales, wildfire risk does increase but is likely to be more localised, although still capable of disrupting services such as access management, conservation work and visitor safety, particularly during prolonged dry periods.

Cascading risks also reach moderate levels by mid-century, highlighting the growing complexity of service delivery in both Parks. In the North York Moors, this is likely to arise through interactions between drought, wildfire, visitor pressures and habitat degradation. In the Yorkshire Dales, cascading risks are more closely linked to the interaction between intense rainfall events, flooding in valley bottoms, and damage to infrastructure such as drystone walls, footpaths and minor roads. These differences reflect contrasting landscape characteristics, but in both cases, they translate into increased operational demands on National Park services, including maintenance, visitor management and conservation interventions.

A further shared area of increasing risk is the changing character of the landscape, which becomes moderate from the 2050s onwards. In both Parks, climate change is expected to drive shifts in vegetation, species composition and land use viability. However, the implications differ. In the North York Moors, there is a particular tension around the future of heather moorland, which is culturally and ecologically significant but potentially less resilient under hotter and drier conditions. In the Yorkshire Dales, changes may affect traditional pastoral systems, upland hay meadows and karst-related habitats, with implications for biodiversity and the visual character of the landscape. For both Authorities, this presents a strategic service challenge in balancing conservation objectives with the need to adapt to changing environmental baselines.

By the 2080s, under higher warming scenarios, the divergence in risk profiles between the two National Parks becomes more pronounced, although both experience an overall increase in service pressures. Wildfire risk continues to escalate, particularly in the North York Moors, where prolonged dry periods, higher temperatures and increased fuel availability combine to create conditions for more frequent and severe fires. In the Yorkshire Dales, wildfire also becomes more significant, but remains relatively less dominant as a service risk compared to issues such as water management, erosion and habitat change.

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Heat-related risks also become more prominent by the end of the century. Hot days become a major source of disruption to Protected Landscape services, affecting visitor safety, staff capacity and infrastructure performance in both Parks. However, the implications again differ. The North York Moors, with its open, exposed landscapes and high visitor numbers during peak periods, may face increased challenges in managing heat-related health risks and fire ignition. The Yorkshire Dales, while also exposed, may experience greater pressure on water resources, ecosystems and agricultural systems, with knock-on effects for landscape management and service provision.

Coastal processes represent a key point of difference between the two National Parks. In the North York Moors, the presence of a coastal boundary introduces additional risks from storm surges, erosion and sea level rise, which become moderate over time. These processes have direct implications for services related to access, heritage management and planning, particularly along the coastline and associated infrastructure such as the Cleveland Way. The Yorkshire Dales, being entirely inland, does not face these coastal risks, but instead experiences greater exposure to fluvial processes and intense rainfall, which can drive flooding and erosion in valley systems.

Finally, both Parks experience increasing demand-related pressures over time, although these remain moderate. In the North York Moors, coastal change may drive additional planning and management demands, while in the Yorkshire Dales, increased visitor pressure and changing land use patterns may place greater strain on services. In both cases, climate change is likely to increase the complexity and volume of service provision, even where risks do not reach the highest severity categories.

Overall, the CCRA suggests that while risks to Protected Landscape services in both the North York Moors and Yorkshire Dales are relatively limited in the 2030s, they increase steadily over time and become more differentiated according to landscape characteristics. The North York Moors faces a more pronounced trajectory of risk associated with wildfire, heat and coastal change, while the Yorkshire Dales is more strongly affected by hydrological variability, erosion and the impacts of changing agricultural and ecological systems. In both cases, the key challenge for National Park Authorities lies not in responding to single hazards, but in managing the cumulative and interacting effects of climate change on the delivery of conservation, access and land management services.

The full list of risks and risk rating scores are outlined in **APPENDIX 6 – YNY Organisational CCRA Scores**.

Indicative Rapid Adaptation Pathway - Natural Environment and Farming

Preliminary Rapid Adaptation Pathway Assessment (RAPA) workshops were held in November 2025 to identify potential pathways within the Natural Environment and Farming sector. Due to project constraints, these focused on two hazards that emerged as a priority during the adaptation study: declining agricultural productivity and flooding. However, the Natural Environment and Farming RAPA workshop focused on how climate change more broadly is already placing pressure on habitats and ecosystems. Stakeholders discussed issues such as increased wildfire risk during drought periods, declining river levels, and the vulnerability of certain species to changing conditions. The group highlighted the importance of nature-based solutions, better soil and water management, and coordination between existing environmental programmes. Key thresholds were linked to ecosystem degradation and loss of habitat functionality. Opportunities included expanding natural flood management, improving landscape connectivity and embedding ecological resilience into Local Nature Recovery Strategies.

The adaptation pathways provided in Figure 45 and Figure 46 below are a diagrammatic extract from the YNY Adaptation Framework document, which has been issued the YNY authorities separately.

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Rapid Adaptation Pathway - Agricultural Productivity

Workshop Insights

The workshop highlighted that climate risks to agricultural productivity are increasingly being driven by changes in the timing, intensity and distribution of rainfall, alongside rising temperatures and growing pressure on water resources. Stakeholders identified that both excess water and water scarcity are already affecting farm operations, reducing opportunities for planting and harvesting, increasing irrigation demand and creating uncertainty for long-term business planning. There was broad agreement that improving soil health, increasing soil organic carbon, enhancing on-farm water storage and adopting more resilient farming systems can strengthen resilience to both flooding and drought while supporting long-term productivity. However, barriers relating to planning policy, funding, skills and knowledge continue to constrain implementation. The discussion emphasised the need for greater collaboration between farmers, water companies, regulators and supply chains to support the transition towards more climate-resilient agricultural systems. Capacity building, demonstration projects and knowledge exchange were identified as important enablers, alongside integrated water resource planning and more flexible approaches to water storage and abstraction.

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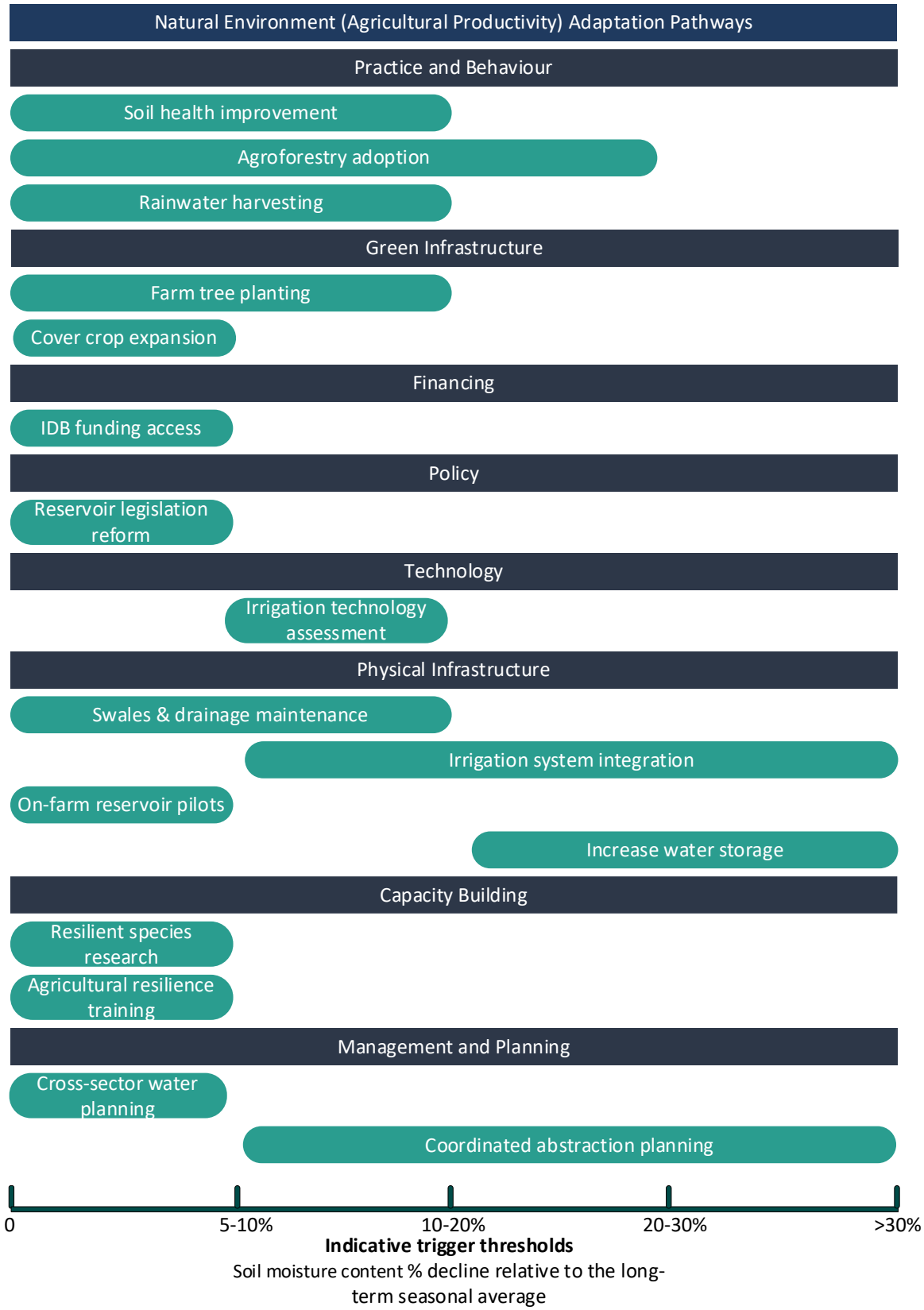

Figure 45 An indicative adaptation pathway for agricultural productivity in the York and North Yorkshire protected landscapes. Developed through a Rapid Adaptation Pathway Assessment (RAPA) workshop, the pathway illustrates potential adaptation actions that could be implemented as climate pressures on farming increase. Actions are grouped by theme and positioned along an indicative adaptation scale based on increasing indicative threshold, representing escalating climate

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stress and the corresponding level of adaptation response required. The pathway is intended to support discussion and strategic planning and does not represent agreed policy or investment commitments. Pathways can be refined through further analysis.

Adaptation Pathway -Agricultural Productivity - Summary

The adaptation pathway for agricultural productivity in York and North Yorkshire illustrates how a progressive response to declining metrics of agricultural productivity (soil moisture declines are used as an indicative measure in the RAPA diagram above) can help maintain the viability of farming systems as climate change intensifies. The pathway recognises that adaptation is not a single intervention but a sequence of actions. As the metric declines relative to historic conditions, measures that are low-cost, flexible and capable of delivering multiple benefits are implemented first, before more transformative and capital-intensive interventions become necessary. Responsibility for these adaptation actions is not specifically assigned to a given entity, but is rather provided as relevant actions that local partners could undertake to enhance resilience.

At lower levels of agricultural productivity impacts, the emphasis is on improving the resilience of farmed landscapes through better land management, knowledge development and ensuring enabling conditions, such as access to funding, are provided. Soil health improvement is a particularly important early action given its ability to enhance water retention, reduce erosion and preserve productivity during both drought and periods of intense rainfall. Expanding cover cropping, introducing farm tree planting and beginning the transition towards agroforestry systems can help build natural resilience while delivering wider benefits for biodiversity, carbon storage and water regulation. Early investment in agricultural resilience training, research into climate-resilient crop varieties and livestock breeds, cross-sector water planning and lobbying for central government reform of reservoir legislation (to help reservoir construction become easier and more profitable, e.g., via water trading) can help prepare the sector before more severe constraints emerge.

As soil moisture deficits further increase, adaptation shifts towards strengthening water management and integrating climate risk into operational decision-making. Rainwater harvesting and swale and drainage maintenance could help farms better manage increasingly variable rainfall patterns. Climate projections for the region indicate a trend towards drier summers combined with more intense winter rainfall, meaning that capturing and retaining water when it is available becomes increasingly important. While irrigation is not currently needed for livestock farm pastures, increased summer droughts driven by climate change may make these practices necessary in the longer-term future. Furthermore, some climate change projections indicate that arable areas could spread into the cooler, wetter west of the country, which is currently mostly grassland, especially over longer-term time horizons (Ritchie et al., 2019). These areas may require irrigation, especially for certain crops like potatoes. The development of agroforestry systems also continues through this period, reflecting the long timeframes required for establishment and the growing benefits that tree cover can provide in reducing evapotranspiration, improving soil structure and moderating local microclimates.

Beyond more severe agricultural productivity losses, such as an indicative soil moisture decline, the pathway becomes more transformative. The focus moves from improving resilience within existing systems towards securing sufficient water resources to sustain agricultural production under substantially altered climatic conditions. Irrigation systems may become increasingly important, requiring greater coordination between farms, abstractors and catchment managers. Coordinated abstraction planning reflects the likelihood of intensified competition for water between agriculture, public water supply, industry and the natural environment. On-farm reservoir pilots implemented earlier in the pathway provide the evidence base for larger-scale deployment, while major increases in water storage capacity become necessary where climatic conditions continue to deteriorate. These interventions are likely to involve significantly higher costs, longer planning horizons and greater institutional coordination than earlier adaptation measures.

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The pathway therefore reflects a logical sequence of escalating responses to increasing climate hazard. Early actions focus on maintaining healthy soils, improving natural capital and strengthening adaptive capacity. As thresholds are crossed, the emphasis shifts towards enhanced water management and technological adaptation. Under the highest levels of soil moisture decline, maintaining agricultural productivity increasingly depends on strategic infrastructure investment and coordinated regional water governance. This progression highlights the value of pursuing specific pathways that adapt to changes that are certain in the nearer-term, preserving flexibility to pursue more ambitious actions in the future as uncertainty declines. Measures implemented at lower threshold levels not only provide immediate benefits but can also delay or reduce the need for more expensive interventions later. For the Yorkshire Dales National park and Nidderdale National Landscape, where agriculture plays a central role in the economy, landscape character and food production, timely implementation of these adaptation pathways will be critical to maintaining resilience in the face of a warmer, drier and more climate-variable future.

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Rapid Adaptation Pathway - Flooding

Workshop Insights

The workshop highlighted that land management has an important role to play in reducing flood risk and enhancing resilience across catchments. Stakeholders identified significant opportunities to slow the flow of water through measures such as improving soil condition, increasing tree and hedgerow cover, restoring peatlands and wetlands, rewetting landscapes and implementing natural flood management interventions. These measures can deliver multiple benefits, including reduced downstream flood risk, improved water quality, enhanced biodiversity and increased resilience to drought. However, the discussion also highlighted challenges associated with aligning incentives, funding and decision-making across catchments, particularly where the costs of adaptation are incurred by land managers while many of the benefits are realised elsewhere. Delivering effective adaptation will therefore require greater coordination between landowners, farmers, water companies, local authorities and environmental organisations, supported by catchment-scale planning and long-term investment.

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Natural Environment (Flooding) Adaptation Pathways
Practice and Behaviour
Rainwater harvesting
Soil aeration
Improve livestock impact
Financing
Joint funding
Policy
Updated land-use policy
Green Infrastructure
Increase soil carbon
Landscape rewetting
Natural flood management
Peatland restoration
River restoration
Upper-catchment tree cover
Adopt agroforestry
Expand hedgerows
Capacity Building
Catchment partnership support
Agricultural training
Landscape partnerships
Farming collaboration
Physical Infrastructure
SuDS implementation
0 –2%
2–5%
5–10%
10 – 20%
> 20%
Indicative trigger thresholds
% increase in properties at higher risk

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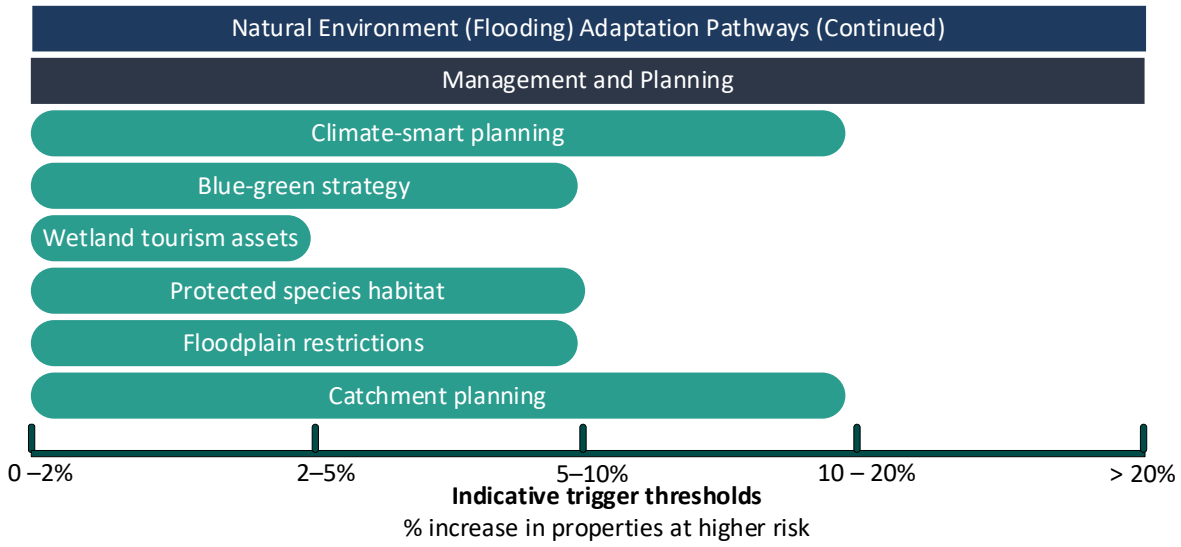

Figure 46 Indicative adaptation pathway for flooding resilience in the natural environment of York and North Yorkshire protected landscapes. Developed through a Rapid Adaptation Pathway Assessment (RAPA) workshop, the pathway illustrates potential adaptation actions that could be implemented as flood risk increases. Actions are grouped by theme and positioned along an indicative adaptation scale based on the increasing number of properties at higher flood risk relative to a baseline year representing escalating flood risk and the corresponding level of adaptation response required. The pathway is intended to support discussion and strategic planning and does not represent agreed policy or investment commitments.

Adaptation Pathway – Flooding - Summary

The adaptation pathway for flood resilience in the Yorkshire Dales and Nidderdale can help manage risk initially, but increasingly ambitious interventions are required as climate hazards intensify. Climate change is projected to bring more intense rainfall, wetter winters and more frequent extreme weather events, increasing flood risk across river catchments including the Ouse, Swale, Ure and Nidd. At the same time, agricultural land occupies much of the landscape and plays an important role in determining how water moves through catchments. . Nature-based solutions pursued within these protected landscapes can reduce broader regional risks. Responsibility for these adaptation actions is not specifically assigned to a given entity, but is rather provided as relevant actions that local partners could undertake to enhance resilience.

At lower levels of risk adaptation focuses on improving the ability of agricultural landscapes to absorb, store and slow water. Measures such as rainwater harvesting, soil aeration and improved livestock management can reduce soil compaction and increase infiltration, helping farmland function more effectively as part of the wider catchment drainage system. Expanding hedgerows, promoting agroforestry and increasing soil carbon also strengthen the capacity of agricultural soils to retain water during heavy rainfall while improving resilience to periods of drought. Landscape rewetting and peatland restoration, along with other natural flood management practices are important early interventions across the wider landscape; a range of peatland restoration programmes are already underway. Alongside physical measures, early investment in agricultural training, farming collaboration, landscape partnerships and catchment partnership support helps build the knowledge, governance arrangements and shared understanding needed for more ambitious adaptation later. Joint funding approaches and early land-use policy updates provide important enabling conditions, helping align public and private investment around shared flood resilience objectives.

As flood exposure increases, adaptation broadens from individual farm-scale interventions towards landscape and catchment-scale management. Natural flood management becomes increasingly

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important, alongside further peatland restoration, river restoration and landscape rewetting. These measures are particularly relevant to the Yorkshire Dales and Nidderdale, where degraded peatlands and modified headwaters can accelerate runoff into downstream communities. Restoring natural hydrology helps slow the movement of water through catchments, reducing flood peaks while improving habitats, water quality and carbon storage. Expansion of upper catchment tree cover (as is already underway in parts of these protected landscapes) contributes further to water retention and interception. At the same stage, climate-smart planning, blue-green infrastructure strategies, floodplain restrictions and protected habitat management become increasingly important components of adaptation. Sustainable Drainage Systems (SuDS) are implemented more extensively, helping to manage runoff from developed areas and reducing pressure on watercourses during extreme rainfall events. These interventions reflect a transition from improving resilience within existing systems towards actively reshaping landscapes to manage a changing climate.

As thresholds approach and exceed more severe flood risk thresholds, adaptation becomes more strategic and transformative. Formal catchment planning emerges as a long-duration response extending into higher risk levels, reflecting the need for coordinated action across multiple sectors, landowners and administrative boundaries. At this stage, isolated interventions are unlikely to be sufficient. Instead, flood resilience increasingly depends on integrated management of entire river catchments, balancing agricultural production, flood regulation, biodiversity recovery and water resource management. Updated land-use policies become critical in guiding development away from areas of increasing risk while mandating land uses that enhance catchment resilience. River restoration, landscape rewetting and large-scale natural flood management measures play an increasingly prominent role in reducing downstream flood impacts as climate pressures intensify.

The pathway illustrates that early interventions focused on soil health, land management and partnership working can help reduce future risk while delivering wider environmental benefits. However, as the threshold of exposure rises and more properties become vulnerable to flooding, adaptation must progressively shift towards larger-scale catchment restoration, integrated planning and long-term landscape transformation. The evidence suggests that acting early will be crucial. Measures that improve the capacity of landscapes to store and regulate water today can reduce the scale, cost and complexity of interventions that may otherwise be required as climate change drives increasingly severe flood risks across the region.

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APPENDIX 13 – NORTH YORK MOORS NATIONAL PARK AND HOWARDIAN HILLS NATIONAL LANDSCAPE SUBSECTION

North York Moors National Park and Howardian Hills National Landscape

Risks to Protected Landscape Natural Environment – Summary

The climate risk profile for the North York Moors National Park (NYM) and Howardian Hills National Landscape highlights the growing vulnerability of some of northern England's most important natural assets to a changing climate. Climate change is increasingly acting as a threat multiplier, exacerbating existing pressures on habitats, species, landscapes and land management systems. The assessment suggests that significant impacts are already emerging by the 2030s and become increasingly widespread and severe through the century, particularly under higher warming scenarios.

The most significant risks in the 2030s are already apparent for agricultural productivity, terrestrial habitats affected by pests, pathogens and invasive species and the destruction of terrestrial habitats by wildfires, all assessed as major even under a 1.5°C warming pathway. Agriculture remains central to the management and economy of both landscapes, from upland grazing systems across the North York Moors to mixed farming in the Howardian Hills. Wetter winters, hotter summers and greater frequency of extreme events are likely to disrupt production, reduce reliability of yields and place increasing pressure on livestock systems. At the same time, warmer conditions are expected to favour the spread of invasive plants, insect pests, livestock diseases and woodland pathogens. These risks are particularly concerning because they interact with existing ecological pressures, reducing the ability of species and ecosystems to adapt naturally. The hot, exceptionally dry conditions that exacerbated the 2025 NYM wildfires (the most severe in NYC history) are likely to become more frequent, even by the 2030s, representing a risk of further major incidents.

By the 2050s and under 2°C warming scenario, many risks transition from moderate to major, indicating a substantial escalation in climate impacts. Drought and water scarcity become major concerns for terrestrial habitats, while soils, natural carbon stores and landscape character all reach major risk levels. This is particularly important for the North York Moors, where healthy peatlands underpin biodiversity conservation, carbon sequestration and downstream flood regulation. Continued drying of peat soils could lead to habitat degradation, increased carbon emissions and greater susceptibility to wildfire. Risks from wildfires themselves continue to become more severe, reflecting projections of hotter, drier summer conditions and longer periods of elevated fire weather. By the 2050s, severe wildfires could become an annual occurrence for the North York Moors and the Howardian Hills.

The condition of freshwater environments is also likely to deteriorate as lower summer flows, warmer water temperatures and pollution pressures combine. Risks associated with sewage and drainage system overflows become major for freshwater habitats, particularly during periods when reduced river flows increase pollutant concentrations. Forestry faces a similarly challenging outlook. Risks to woodland productivity and forestry from pests and diseases all become major by mid-century. This may constrain efforts to expand woodland cover and deliver nature recovery and carbon sequestration objectives across both protected landscapes. Distinctive coastal and marine risks also become increasingly important by the 2050s. Coastal habitats face major threats from erosion, flooding and changing environmental conditions, while marine species and fisheries are increasingly exposed to warming seas and wider ecological change, the effects of which are uncertain but which could be highly negative.

By the 2080s and under a 4°C warming scenario, extreme weather is likely to become a systemic risk to the landscapes and natural capital of the NYM and the Howardian Hills. Several risks escalate further to severe levels. Agricultural productivity becomes one of the most significant concerns, reflecting the

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cumulative effects of drought, extreme weather, changing seasonality and biological threats. Risks to crops and livestock from pests, pathogens and invasive species also become severe, creating further challenges for farm viability and rural economies. Drought emerges as a severe threat to terrestrial habitats, while risks to soils and natural carbon stores likewise become severe. The degradation of peatlands and associated carbon-rich habitats could fundamentally alter ecosystem functioning across large parts of the National Park. In parallel, risks to terrestrial species and habitats from invasive species and disease become severe, raising concerns about the long-term resilience of internationally important habitats and protected species.

The coastal and marine environment experiences some of the most pronounced increases in risk by the end of the century. Risks to coastal habitats from erosion and climate change become severe, while marine species, habitats and fisheries face severe impacts from higher sea temperatures, marine heatwaves and wider oceanic change. Freshwater habitats also reach major risk levels, reflecting growing pressure from warming waters, altered hydrology and ecological disruption that may exceed the adaptive capacity of some species.

Overall, the assessment points towards a future in which climate change increasingly affects every component of the North York Moors and Howardian Hills environment, from upland peatlands and moorland habitats to agricultural systems, woodlands, rivers, coastlines and marine ecosystems. The progression of risk from the 2030s onwards highlights the importance of early adaptation focused on improving ecosystem condition, restoring peatlands and rivers, increasing habitat connectivity, strengthening climate-resilient land management and enhancing the resilience of coastal and marine environments. Without sustained adaptation, many of the landscapes and ecological characteristics defining these nationally important protected areas are likely to face increasingly severe pressures throughout the century.

Risks – Register Scores

A preliminary list of risks and risk rating scores for the North York Moors National Park and Howardian Hills National Landscape are outlined in **Table 69** below.

Table 69 Risk rating scores across the four scenarios for the risks to North York Moors National Park and Howardian Hills National Landscape on the YNYCA

Risk ID#	YNYCA risk description	2030s 1.5˚C	2050s 2˚C	2080s 2˚C	2080s 4˚C
80	Risks to **terrestrial** species and habitats from pests, pathogens and invasive species, including viral and parasitic diseases, where climate change improves conditions for these to spread and cause damage.	[4] Major	[4] Major	[4] Major	[5] Severe
81	Risks to **terrestrial** species and habitats from changing climatic conditions and extreme events, including temperature change, water scarcity, wildfire, flooding, wind, and altered hydrology (including water scarcity, flooding and saline intrusion)	[3] Moderate	[4] Major	[4] Major	[4] Major
82	Risk of coastal flooding from sea level rise impacting **terrestrial** habitats and biodiversity, including natural capital	[2] Minor	[3] Moderate	[3] Moderate	[3] Moderate
83	Risks of wildfires and destruction of **terrestrial** habitats including forests, heathland/moors, peatlands and grasslands, where the habitat is difficult to return to its former state. (Interdependency with water supply Infrastructure)	[4] Major	[4] Major	[4] Major	[5] Severe
84	Risk of environmental drought and water scarcity to **terrestrial** habitats (Interdependency with water supply Infrastructure)	[3] Moderate	[4] Major	[4] Major	[5] Severe

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Risk ID#	YNYCA risk description	2030s 1.5˚C	2050s 2˚C	2080s 2˚C	2080s 4˚C
85	Risk of drainage and/or sewage networks flooding and contamination of land impacting **terrestrial** habitats and biodiversity, including natural capital	[2] Minor	[2] Minor	[2] Minor	[3] Moderate
86	Risk of mine water outbreak and contamination of the natural environment and **terrestrial** habitats	[3] Moderate	[3] Moderate	[3] Moderate	[3] Moderate
87	Risk of climate-influenced river flooding impacting **terrestrial** habitats and biodiversity, including urban habitats and natural capital, noting that while flood plain habitats naturally flood and are not materially affected by normal flood levels, increasingly extreme or severe flooding may negatively impact flood plain habitats.	[2] Minor	[2] Minor	[2] Minor	[2] Minor
88	Risk of negative effects for the region's biodiversity, including changing species distributions and increased fragmentation of sensitive habitats where these cannot adapt to the rapid rate of climate change and related extreme weather.	[3] Moderate	[3] Moderate	[3] Moderate	[3] Moderate
89	Risk to **soils** (including soil health and associated ecosystem services) from changing climatic conditions, including fluctuations between seasonal aridity and wetness resulting in soil loss events like erosion.	[3] Moderate	[4] Major	[4] Major	[5] Severe
90	Risks for natural carbon stores (e.g. peatlands, woodland, saltmarsh, kelp forests), carbon sequestration and GHG emissions from changing climatic conditions, including temperature change and water scarcity	[3] Moderate	[4] Major	[4] Major	[5] Severe
91	Risks to landscape character from a changing climate.	[3] Moderate	[4] Major	[4] Major	[4] Major
92	Risk of landslides and slope failures impacting landscape character and **terrestrial/freshwater** habitats and species (noting that risks of landslides/slope failures to Infrastructure/Built Environment is covered under different risks).	[2] Minor	[3] Moderate	[3] Moderate	[3] Moderate
93	Risks to **freshwater** species and habitats (e.g. wetlands) from changing climatic conditions and extreme events, including higher water temperatures, flooding, water scarcity and phenological shifts.	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
94	Risks to **freshwater** species and habitats from pests, pathogens and invasive species	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
95	Risk of drainage and/or sewage networks flooding and contamination to **freshwater** species and habitats (e.g. wetlands). Note, if river levels decline in dry periods the concentration of pollutant will increase if effluent is still being released.	[3] Moderate	[4] Major	[4] Major	[4] Major
96	Risks to **coastal** species and habitats due to coastal flooding, erosion and climate factors	[3] Moderate	[4] Major	[4] Major	[5] Severe
97	Risks to **marine** species, habitats and fisheries from changing climatic conditions, including ocean acidification and higher water temperatures including marine heatwaves, noting in 2025 the UK experienced severe marine heatwaves, the effects of which are at present unknown (June 2025).	[3] Moderate	[4] Major	[4] Major	[5] Severe
98	Risks to **marine** species and habitats from pests, pathogens and invasive species	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major

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Risk ID#	YNYCA risk description	2030s 1.5˚C	2050s 2˚C	2080s 2˚C	2080s 4˚C
99	Risks to **forestry** productivity from extreme events and changing climatic conditions (including temperature change, water scarcity, wildfire, flooding, coastal erosion, wind and saline intrusion).	[3] Moderate	[4] Major	[4] Major	[4] Major
100	Risks to **forestry** from pests, pathogens and invasive species	[3] Moderate	[4] Major	[4] Major	[4] Major
102	Risks to regional **forestry** and forest planting targets (e.g., woodland creation, nature restoration targets, carbon sequestration targets, urban climate adaptation using trees) from extreme events and changing climatic conditions increasing tree mortality (including temperature change, water scarcity, wildfire, flooding, coastal erosion, wind and saline intrusion).	[2] Minor	[4] Major	[4] Major	[4] Major
103	Water shortages affecting **agricultural** practices (e.g. irrigation and livestock health)	[2] Minor	[2] Minor	[2] Minor	[3] Moderate
104	Risks to **agricultural** productivity from extreme events, unpredictable weather and changing climatic conditions such as changing seasonality (primarily water scarcity and extreme / unpredictable rainfall, but also including temperature change, wildfire, flooding, coastal erosion, wind and saline intrusion).	[4] Major	[4] Major	[4] Severe	[5] Severe
105	Risk of river flooding of **agricultural** land impacting productivity (e.g. crop damage or loss) and the potential for contamination	[2] Minor	[2] Minor	[2] Minor	[3] Moderate
106	Risks to **agricultural** crops & livestock health and productivity from pests, pathogens and invasive species, including viral and parasitic diseases	[3] Moderate	[4] Major	[4] Major	[5] Severe
107	Risks to aquifers and **agricultural** land from sea level rise, saltwater intrusion, and Humber Estuary inundation	[1] Negligible	[1] Negligible	[1] Negligible	[2] Minor
108	Risks to **agricultural** productivity from soil erosion	[3] Moderate	[3] Moderate	[3] Moderate	[4] Major
109	Risks of wildfires on or affecting **agricultural** land (e.g. arable crops)	[1] Negligible	[2] Minor	[2] Minor	[2] Minor
110	Risk of increased surface water flooding associated with choice of land management practices exacerbating flood risk	[2] Minor	[2] Minor	[2] Minor	[3] Moderate
111	Risk of short-term accessibility challenges for footpaths and rights of way (including urban footpaths and parks) associated with a changing climate (e.g. landslips, fallen trees, flooding, coastal erosion, maintenance work to remove climate-induced invasive species). (Interdependency to Infrastructure theme - walking infrastructure and transport infrastructure may be interlinked)	[3] Moderate	[3] Moderate	[3] Moderate	[3] Moderate
112	Risk of long-term accessibility challenges for footpaths and rights of way (including urban footpaths and parks) associated with a changing climate (e.g. landslips, erosion, inundation or loss of paths) (Interdependency to Infrastructure theme - walking infrastructure and transport infrastructure may be interlinked).	[2] Minor	[3] Moderate	[3] Moderate	[3] Moderate
113	Risks to public parks, parkland and garden biodiversity/ecosystem services from pests, pathogens and invasive species	[3] Moderate	[4] Major	[4] Major	[4] Major

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Risks to Protected Landscape Services – Summary

The proportion of risks to YNYCA protected landscape authority services/operations assigned to each risk rating across the four climate scenarios (2020s, 2050s under 2°C of global warming, 2080s under 2°C and 2080s under 4°C) are shown in **Error! Reference source not found.**.

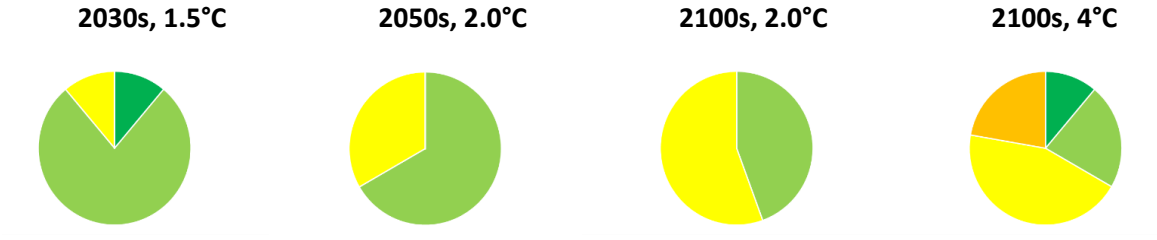

Figure 47. Proportion of risks to YNYCA protected landscape authority services/operations for each risk rating across the four climate scenarios. Source: ADAS, 2025

Key to pie chart figure above.

Colour	Risk scoring level
Dark green	Negligible
Light green	Minor
Yellow	Moderate
Orange	Major
Red	Severe

The CCRA indicates that, for both the North York Moors and the Yorkshire Dales National Parks, risks to Protected Landscape services in the 2030s remain relatively contained, but already reflect the specific operational challenges of managing large, accessible and environmentally sensitive landscapes under a changing climate. At this stage, the most immediate moderate risk relates to snowfall, which continues to affect access, visitor safety and the delivery of land management activities. This is particularly relevant for both National Parks given their upland topography and reliance on often limited transport networks. However, the nature of this risk differs slightly between them: in the Yorkshire Dales, with its higher elevations and more extensive upland road exposure, snowfall may continue to present more persistent disruption to access and rural service delivery, whereas in the North York Moors its effects are often more episodic but still significant for visitor management and safety.

Beyond snowfall, the 2030s profile for both Parks is characterised largely by risks currently assessed below moderate but with clear potential to intensify. These include wildfire, changing landscape character and cascading risks. In the North York Moors, the extensive heather moorland and peat soils are particularly sensitive to drying, meaning that even in the 2030s there is an emerging service challenge in managing land access, fire risk and habitat condition during dry summers. In the Yorkshire Dales, by contrast, the landscape is more dominated by grassland, limestone pavements and valley systems, which are less immediately flammable but highly sensitive to hydrological change. As a result, early risks in the Dales are more likely to manifest through water management pressures, soil erosion and impacts on footpaths, rather than fire.

By the 2050s, several risks become moderate across both National Parks, reflecting the increasing influence of warmer temperatures and more variable precipitation patterns. Given that the CCC estimate that heatwave summers such as 2025 will become the new normal (Climate Change Committee, 2026), wildfires are likely to becomes a major risk, but remains more structurally significant in the North York Moors due to the presence of continuous tracts of heather, degraded peat and lower rainfall which can support larger and more difficult-to-control fires. In the Yorkshire Dales, wildfire risk does increase but is likely to be more localised, although still capable of disrupting

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services such as access management, conservation work and visitor safety, particularly during prolonged dry periods.

Cascading risks also reach moderate levels by mid-century, highlighting the growing complexity of service delivery in both Parks. In the North York Moors, this is likely to arise through interactions between drought, wildfire, visitor pressures and habitat degradation. In the Yorkshire Dales, cascading risks are more closely linked to the interaction between intense rainfall events, flooding in valley bottoms, and damage to infrastructure such as drystone walls, footpaths and minor roads. These differences reflect contrasting landscape characteristics, but in both cases, they translate into increased operational demands on National Park services, including maintenance, visitor management and conservation interventions.

A further shared area of increasing risk is the changing character of the landscape, which becomes moderate from the 2050s onwards. In both Parks, climate change is expected to drive shifts in vegetation, species composition and land use viability. However, the implications differ. In the North York Moors, there is a particular tension around the future of heather moorland, which is culturally and ecologically significant but potentially less resilient under hotter and drier conditions. In the Yorkshire Dales, changes may affect traditional pastoral systems, upland hay meadows and karst-related habitats, with implications for biodiversity and the visual character of the landscape. For both Authorities, this presents a strategic service challenge in balancing conservation objectives with the need to adapt to changing environmental baselines.

By the 2080s, under higher warming scenarios, the divergence in risk profiles between the two National Parks becomes more pronounced, although both experience an overall increase in service pressures. Wildfire risk continues to escalate, particularly in the North York Moors, where prolonged dry periods, higher temperatures and increased fuel availability combine to create conditions for more frequent and severe fires. In the Yorkshire Dales, wildfire also becomes more significant, but remains relatively less dominant as a service risk compared to issues such as water management, erosion and habitat change.

Heat-related risks also become more prominent by the end of the century. Hot days become a major source of disruption to Protected Landscape services, affecting visitor safety, staff capacity and infrastructure performance in both Parks. However, the implications again differ. The North York Moors, with its open, exposed landscapes and high visitor numbers during peak periods, may face increased challenges in managing heat-related health risks and fire ignition. The Yorkshire Dales, while also exposed, may experience greater pressure on water resources, ecosystems and agricultural systems, with knock-on effects for landscape management and service provision.

Coastal processes represent a key point of difference between the two National Parks. In the North York Moors, the presence of a coastal boundary introduces additional risks from storm surges, erosion and sea level rise, which become moderate over time. These processes have direct implications for services related to access, heritage management and planning, particularly along the coastline and associated infrastructure such as the Cleveland Way. The Yorkshire Dales, being entirely inland, does not face these coastal risks, but instead experiences greater exposure to fluvial processes and intense rainfall, which can drive flooding and erosion in valley systems.

Finally, both Parks experience increasing demand-related pressures over time, although these remain moderate. In the North York Moors, coastal change may drive additional planning and management demands, while in the Yorkshire Dales, increased visitor pressure and changing land use patterns may place greater strain on services. In both cases, climate change is likely to increase the complexity and volume of service provision, even where risks do not reach the highest severity categories.

Overall, the CCRA suggests that while risks to Protected Landscape services in both the North York Moors and Yorkshire Dales are relatively limited in the 2030s, they increase steadily over time and become more differentiated according to landscape characteristics. The North York Moors faces a

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more pronounced trajectory of risk associated with wildfire, heat and coastal change, while the Yorkshire Dales is more strongly affected by hydrological variability, erosion and the impacts of changing agricultural and ecological systems. In both cases, the key challenge for National Park Authorities lies not in responding to single hazards, but in managing the cumulative and interacting effects of climate change on the delivery of conservation, access and land management services.

The full list of risks and risk rating scores are outlined in **APPENDIX 6 – YNY Organisational CCRA Scores**.

Indicative Rapid Adaptation Pathway - Natural Environment and Farming

Preliminary Rapid Adaptation Pathway Assessment (RAPA) workshops were held in November 2025 to identify potential pathways within the Natural Environment and Farming sector. Due to project constraints, these focused on two hazards that emerged as a priority during the adaptation study: declining agricultural productivity and flooding. However, the Natural Environment and Farming RAPA workshop focused on how climate change more broadly is already placing pressure on habitats and ecosystems. Stakeholders discussed issues such as increased wildfire risk during drought periods, declining river levels, and the vulnerability of certain species to changing conditions. The group highlighted the importance of nature-based solutions, better soil and water management, and coordination between existing environmental programmes. Key thresholds were linked to ecosystem degradation and loss of habitat functionality. Opportunities included expanding natural flood management, improving landscape connectivity and embedding ecological resilience into Local Nature Recovery Strategies.

The adaptation pathways provided in Figure 48 and Figure 49 below are a diagrammatic extract from the YNY Adaptation Framework document, which has been issued the YNY authorities separately.

Rapid Adaptation Pathway - Agricultural Productivity

Workshop Insights

The workshop highlighted that climate risks to agricultural productivity are increasingly being driven by changes in the timing, intensity and distribution of rainfall, alongside rising temperatures and growing pressure on water resources. Stakeholders identified that both excess water and water scarcity are already affecting farm operations, reducing opportunities for planting and harvesting, increasing irrigation demand and creating uncertainty for long-term business planning. There was broad agreement that improving soil health, increasing soil organic carbon, enhancing on-farm water storage and adopting more resilient farming systems can strengthen resilience to both flooding and drought while supporting long-term productivity. However, barriers relating to planning policy, funding, skills and knowledge continue to constrain implementation. The discussion emphasised the need for greater collaboration between farmers, water companies, regulators and supply chains to support the transition towards more climate-resilient agricultural systems. Capacity building, demonstration projects and knowledge exchange were identified as important enablers, alongside integrated water resource planning and more flexible approaches to water storage and abstraction.

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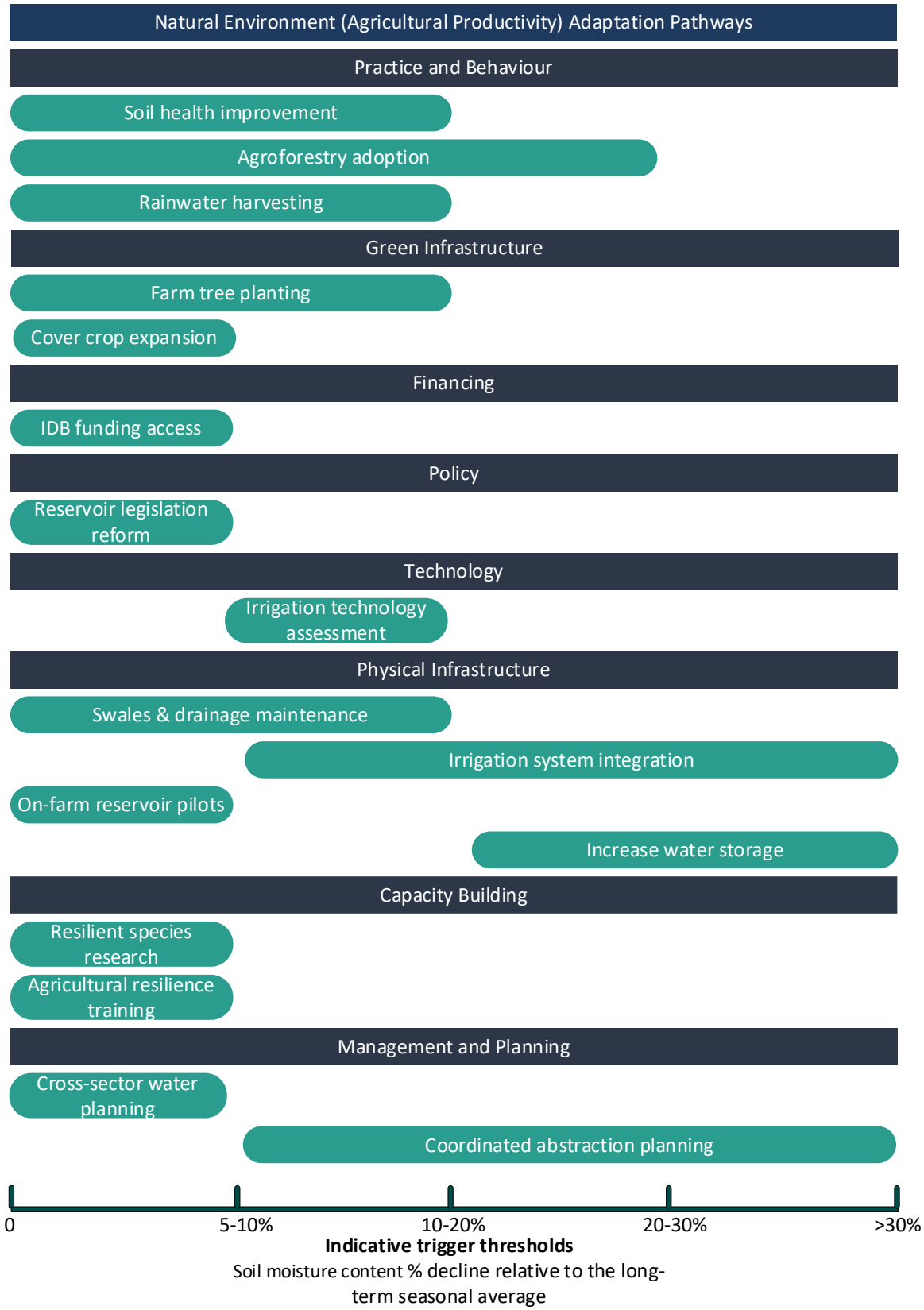

Figure 48 An indicative adaptation pathway for agricultural productivity in the York and North Yorkshire protected landscapes. Developed through a Rapid Adaptation Pathway Assessment (RAPA) workshop, the pathway illustrates potential adaptation actions that could be implemented as climate pressures on farming increase. Actions are grouped by theme and positioned along an indicative adaptation scale based on increasing indicative threshold, representing escalating climate

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stress and the corresponding level of adaptation response required. The pathway is intended to support discussion and strategic planning and does not represent agreed policy or investment commitments. Priorities, trigger thresholds and implementation pathways will be refined through future adaptation strategies, monitoring of environmental indicators, and stakeholder engagement.

Adaptation Pathway – Agricultural Productivity - Summary

The adaptation pathway for agricultural productivity in the North York Moors National Park and Howardian Hills National Landscape illustrates how a progressive response to increasing soil moisture deficits can help sustain farming viability as climate change intensifies. Consistent with the adaptation pathways approach, the pathway recognises that adaptation is an ongoing process rather than a single intervention. As soil moisture declines move further beyond historic conditions, adaptation actions become progressively more substantial, shifting from low-regret measures that strengthen resilience within existing farming systems towards more transformative responses that address increasingly severe climatic constraints. Responsibility for these adaptation actions is not specifically assigned to a given entity, but is rather provided as relevant actions that local partners could undertake to enhance resilience. Actions could be taken by a range of land managers, conservation organisations, water companies, local authorities and other regional partners

At the earliest thresholds of soil moisture decline, adaptation is focused on strengthening the resilience of agricultural landscapes through improved land management and enhanced adaptive capacity. This is particularly important in the North York Moors and Howardian Hills, where farming supports internationally important landscapes, biodiversity and cultural heritage. Improving soil health through practices such as increasing organic matter, reducing compaction and expanding cover cropping can enhance water retention during increasingly frequent summer dry periods while reducing erosion during more intense winter rainfall events. Farm woodland creation, hedgerow restoration and the gradual expansion of agroforestry systems can help moderate microclimates, reduce wind exposure on more exposed moorland fringes and improve resilience to both drought and heavy rainfall. Early investment in farmer training, climate services, research into resilient livestock breeds and crop varieties, and mechanisms that improve access to adaptation funding can strengthen preparedness before more significant productivity impacts emerge. At these lower hazard thresholds, such measures are likely to deliver multiple benefits for nature recovery, carbon storage, water quality and landscape resilience while maintaining flexibility for future decision-making.

As soil moisture deficits become more pronounced and thresholds are crossed, adaptation increasingly focuses on water management and operational responses to a more variable climate. Climate projections suggest that the North York Moors and Howardian Hills are likely to experience hotter, drier summers alongside wetter winters and more intense rainfall events. In this context, measures such as rainwater harvesting, restoration and maintenance of drainage infrastructure where appropriate, and the use of natural water retention features become increasingly important. The restoration of peatlands in the North York Moors can play a particularly significant role by improving water storage, reducing downstream flood risk and helping maintain more stable catchment hydrology. At the farm scale, retaining water within the landscape through ponds, swales and small-scale storage systems can help reduce exposure to increasingly frequent summer water shortages. Continued expansion of agroforestry systems is also likely during this stage, reflecting the long lead times required for establishment and the growing importance of tree cover in supporting soil moisture retention and reducing climate-related stresses. In parts of the Howardian Hills, where productive arable farming forms a larger component of the agricultural economy, changing climatic conditions may also increase demand for irrigation, particularly for higher-value and more drought-sensitive crops.

Under more severe levels of soil moisture decline, the pathway becomes increasingly transformative. At these higher hazard thresholds, maintaining agricultural productivity may depend on securing additional water resources and implementing more coordinated approaches to water governance

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across catchments. Irrigation infrastructure may become necessary for a growing proportion of agricultural land, increasing competition for water between farming, public water supply, industry and the natural environment. Earlier pilot projects involving on-farm reservoirs and water storage schemes can provide the evidence base for wider deployment, while larger-scale investment in water storage and distribution infrastructure may be required where climatic conditions continue to deteriorate. Coordinated abstraction management, catchment-scale planning and stronger collaboration between farmers, regulators and water companies are likely to become increasingly important. These measures involve substantially greater costs, longer implementation timescales and more complex governance arrangements than those required at lower levels of climate risk.

The pathway therefore represents a sequence of escalating responses to increasing climate hazard. Initial actions focus on improving soil condition, strengthening natural capital and building adaptive capacity across protected landscapes. As increasingly severe soil moisture deficits are experienced, adaptation shifts towards enhanced water management, landscape-scale resilience measures and operational changes within agricultural systems. At the highest thresholds, sustaining agricultural productivity may require significant investment in infrastructure and more strategic management of regional water resources. For the North York Moors National Park and Howardian Hills National Landscape, where farming underpins landscape character, biodiversity value and local economies, timely implementation of adaptation measures will be critical. Early action can deliver immediate resilience benefits while helping to delay, reduce or avoid the need for more costly interventions in the future, supporting the long-term ability of these protected landscapes to adapt to a warmer, drier and more climate-variable climate.

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Rapid Adaptation Pathway - Flooding

Workshop Insights

The workshop highlighted that land management has an important role to play in reducing flood risk and enhancing resilience across catchments. Stakeholders identified significant opportunities to slow the flow of water through measures such as improving soil condition, increasing tree and hedgerow cover, restoring peatlands and wetlands, rewetting landscapes and implementing natural flood management interventions. These measures can deliver multiple benefits, including reduced downstream flood risk, improved water quality, enhanced biodiversity and increased resilience to drought. However, the discussion also highlighted challenges associated with aligning incentives, funding and decision-making across catchments, particularly where the costs of adaptation are incurred by land managers while many of the benefits are realised elsewhere. Delivering effective adaptation will therefore require greater coordination between landowners, farmers, water companies, local authorities and environmental organisations, supported by catchment-scale planning and long-term investment.

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Natural Environment (Flooding) Adaptation Pathways
Practice and Behaviour
Rainwater harvesting
Soil aeration
Improve livestock impact
Financing
Joint funding
Policy
Updated land-use policy
Green Infrastructure
Increase soil carbon
Landscape rewetting
Natural flood management
Peatland restoration
River restoration
Upper-catchment tree cover
Adopt agroforestry
Expand hedgerows
Capacity Building
Catchment partnership support
Agricultural training
Landscape partnerships
Farming collaboration
Physical Infrastructure
SuDS implementation
0 –2%
2–5%
5–10%
10 – 20%
> 20%
Indicative trigger thresholds
% increase in properties at higher risk

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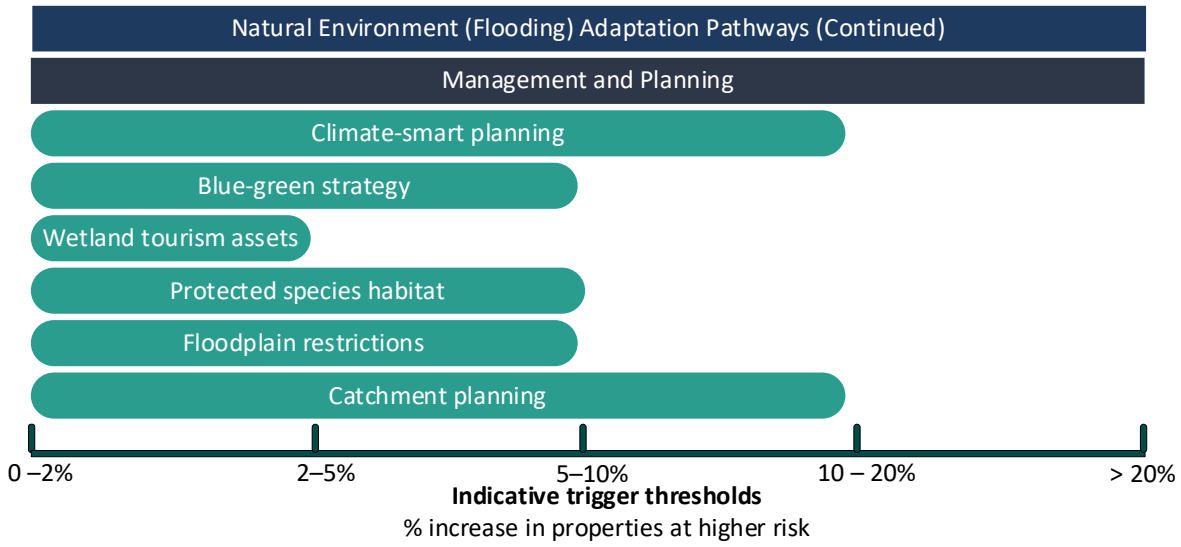

Figure 49 Indicative adaptation pathway for flooding resilience in the natural environment of York and North Yorkshire protected landscapes. Developed through a Rapid Adaptation Pathway Assessment (RAPA) workshop, the pathway illustrates potential adaptation actions that could be implemented as flood risk increases. Actions are grouped by theme and positioned along an indicative adaptation scale based on the increasing number of properties at higher flood risk relative to a baseline year representing escalating flood risk and the corresponding level of adaptation response required. The pathway is intended to support discussion and strategic planning and does not represent agreed policy or investment commitments. Pathway can be updated in the future.

Adaptation Pathway – Flooding - Summary

The adaptation pathway for flood resilience in the North York Moors National Park and Howardian Hills National Landscape illustrates how responses must evolve as the number of properties exposed to higher flood risk increases. The pathway recognises that adaptation is a progressive process in which early, low-regret actions help build resilience and preserve future options, while increasingly severe climate hazards require more coordinated and transformative responses. Climate projections indicate that both protected landscapes are likely to experience more intense rainfall events, wetter winters and greater hydrological variability. These changes are expected to increase flood risk across local catchments such as the Esk, Derwent and Rye while also increasing pressure on communities, infrastructure, agricultural land and natural habitats. Given the important role that land management plays in regulating water flows, adaptation requires coordinated action across farmers, landowners, environmental organisations, local authorities and water managers. Responsibility for these adaptation actions is not specifically assigned to a given entity, but is rather provided as relevant actions and pathways that local partners could undertake to enhance resilience. Pursuit of nature-based solutions in the NYM and Howardian Hills could reduce flood risk more broadly across the region, though the potential extent of this is unknown.

At lower hazard thresholds, adaptation is focused on improving the capacity of agricultural and natural landscapes to absorb, store and slow the movement of water. In the NYM, this includes measures to address soil compaction on inbye land and improve infiltration through enhanced soil management, while in the Howardian Hills, improving soil structure across arable landscapes can help reduce surface runoff during heavy rainfall events. Expanding hedgerows, shelterbelts and farm woodland can increase interception and slow overland flow, while supporting wider objectives for biodiversity recovery and landscape resilience. The restoration of peatlands and wet heath habitats across the North York Moors is particularly important at this stage, as is already being undertaken by the protected landscape authorities. Healthy peatlands function as natural water stores, helping to attenuate runoff and regulate downstream flows while also providing benefits for carbon storage,

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water quality and ecological resilience. Alongside physical interventions, early investment in farmer engagement, catchment partnerships, landscape-scale collaboration and funding mechanisms can help build the institutional capacity required for more ambitious adaptation later. At these lower levels of flood risk, such measures are typically cost-effective and deliver multiple benefits beyond flood management alone.

As flood risk increases, adaptation increasingly shifts from individual land management actions towards coordinated landscape and catchment-scale interventions. Natural flood management becomes more extensive, building on earlier investments in peatland recovery, woodland creation and soil improvement. The headwaters of the Esk, Derwent and Rye catchments are particularly important in this regard, as changes in land condition within upland and upper catchment areas can have significant implications for flood risk downstream. Restoring more natural hydrological processes through landscape rewetting, river restoration and reconnection of floodplains can help reduce the speed and volume of runoff entering river systems during extreme rainfall events. Expansion of woodland within appropriate locations across both landscapes can further enhance water retention and interception, particularly where integrated with wider habitat restoration objectives. At this stage, adaptation also increasingly relies on climate-informed spatial planning, blue-green infrastructure and strengthened controls on development in areas of increasing flood risk. Sustainable Drainage Systems become more widely deployed within settlements and developed areas, helping to manage runoff and reduce pressure on drainage networks during periods of intense rainfall. These measures represent a shift from enhancing resilience within existing systems towards actively reshaping landscapes to accommodate changing hydrological conditions.

Where increases in properties at higher flood risk approach or exceed higher metric thresholds, adaptation becomes increasingly strategic and transformative. Under these conditions, isolated interventions are unlikely to provide sufficient protection against increasingly severe flood events. Flood resilience depends instead on integrated catchment management operating across administrative and land ownership boundaries. Long-term catchment planning becomes a critical adaptation activity, linking flood risk management, nature recovery, water resource management and agricultural land use within a shared framework. River restoration and floodplain reconnection are expanded where opportunities exist, while large-scale peatland restoration and landscape rewetting programmes play an increasingly important role in regulating water flows across the wider catchment. Updated land-use policies become essential to avoid locking future development into areas of growing risk and to encourage land uses that contribute positively to catchment resilience. Delivering these measures is likely to require substantial investment, long planning horizons and stronger coordination between multiple organisations and sectors.

The pathway therefore demonstrates a clear progression of responses as flood hazards intensify. At lower thresholds, adaptation focuses on strengthening the natural capacity of soils, peatlands and agricultural landscapes to manage water. As flood exposure increases, interventions expand towards landscape-scale natural flood management, river restoration and climate-resilient spatial planning. Under the highest levels of risk, maintaining flood resilience increasingly depends on integrated catchment governance and large-scale environmental restoration. For the North York Moors National Park and Howardian Hills National Landscape, this progression reflects the crucial role that natural systems play in regulating water and reducing downstream flood impacts. Early action to restore peatlands, improve soil health and strengthen catchment partnerships can deliver immediate resilience benefits while reducing the scale and cost of future interventions, helping these protected landscapes adapt to a future characterised by more frequent and more severe flooding.

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Annex 2:

Risk detail			Risk Themes		
Risk ID# (RR)	**Hazard**	**Risk description**	**UK CCRA3 Chapter**	**CCC Adaptation Monitoring System**	**Protected Landscape Thematic Area**
1	General changing climatic conditions	Risks to tourism centres from greater demand and pressure associated with more favourable weather conditions (e.g. hotter and drier summers)	Business and Industry	Business	Recreation & tourism
2	Extreme weather - general	Challenges for showgrounds and venue operation and maintenance from extreme weather events (e.g. storms and high winds, drought)	Business and Industry	Business	Recreation & tourism
3	General changing climatic conditions	Disproportionate impact on Small and Medium Enterprises (SMEs) from extreme weather events (storms, heatwaves, water scarcity, wildfire etc.) - SMEs have lower adaptive capacity than larger corporations.	Business and Industry	Business	Community & economy
4	Extreme rainfall	Negative impacts to bathing water quality at the coast becoming more severe during heavy rainfall events leading to reduced tourism activity at the coast. This risk may be moderated by reduced summer rainfall events (though extreme and sudden summer rainfall events may become more likely and overwhelm drainage systems).	Business and Industry	Business	Recreation & tourism
5	Sea level rise	Risks to businesses from Humber Estuary inundation (considered a risk up the River Ouse until Selby; there is tidal influence on the River Ouse to Naburn and on the River Wharfe to Tadcaster) (tidal flood risk)	Business and Industry	Business	Community & economy
6	Flooding	Risks to business sites from flooding (river, surface water and groundwater)	Business and Industry	Business	Built environment
7	Coastal change	Risk of loss of business locations and infrastructure from coastal change and erosion, flooding and extreme weather events	Business and Industry	Business	Built environment
8	Drought / water scarcity	Risks to non-tourist businesses (manufacturing, industry, retail, etc.) from water scarcity (e.g., months, cooling and heating, washing products, dissolving chemicals, suppressing dust, and as a direct input to products)	Business and Industry	Business	Community & economy
9	Drought / water scarcity	Risks to hospitality and leisure from temporary or longer periods of water scarcity (e.g. hotels and tourism businesses noting that research indicates that swimming pools and water parks typically reuse most of their water) including water limitations put on businesses from water utilities	Business and Industry	Business	Recreation & tourism
10	Extreme weather - general	Negative impacts to water treatment infrastructure and/or drainage/sewage systems resulting in reduced water quality available for businesses and reduced business productivity as a result (interdependency with infrastructure).	Business and Industry	Business	Community & economy

11	Coastal change	Risks to business locations and infrastructure from coastal change and erosion, flooding and extreme weather events	Business and Industry	Business	Built environment
12	Flooding	Loss of **business incomes** from **flooding impacts** either discouraging tourists from the area or preventing customers from reaching businesses.	Business and Industry	Business	Community & economy
13	High temperatures	Additional business running costs due to extreme weather and chronic changes, e.g., increased cooling requirements in hotter months.	Business and Industry	Business	Community & economy
14	General changing climatic conditions	Risks to business from disruption to supply chains, distribution, transportation, energy, ICT networks, including cascading risks from impacts to infrastructure (note interdependency with infrastructure).	Business and Industry	Business	Community & economy
15	High temperatures	Risks to business from reduced employee productivity or employee health issues due to disruption associated with high temperatures (including infrastructure disruption and direct impacts affecting working environments; note interdependency with the health theme)	Business and Industry	Business	Community & economy
16	Extreme weather - general	Risks to business from reduced employee productivity including those related to employee health issues due to healthcare disruption associated with severe weather (including infrastructure disruption and direct impacts affecting working environments; note interdependency with the health theme)	Business and Industry	Business	Community & economy
17	General changing climatic conditions	Risks related to finance, investment and insurance for businesses including higher insurance premiums and reduced access to capital, including relocating to other less risky areas and reduced ability to start businesses in at risk areas. Hazards include flooding, coastal erosion and subsidence (latter relevant to York where businesses required to obtain subsidence insurance)	Business and Industry	Finance	Community & economy
18	Climate change overseas	International dimension: Risks to Y&NY region finance sector from climate change overseas	Business and Industry	Finance	Community & economy
19	Climate change overseas	International dimension: Risks to Y&NY region from climate change on international trade routes	Business and Industry	Food security	Community & economy
20	Climate change overseas	International dimension: Risks to Y&NY region from changes in international law and governance from climate change overseas	Business and Industry	N/A	N/A
21	Flooding	Risks to people, communities and buildings from surface water or groundwater flooding.	Health, Communities and the Built Environment	Community preparedness and response	Community & economy
22	Flooding	Risks to people, communities and buildings from river flooding, including health and safety risks. This could also impact the ability of residents to obtain insurance (i.e., interdependency / cascading risk). Note that modelling indicates that, as a result of the York Flood Alleviation Scheme (namely upgrades to the Foss Barrier), the city is protected from a 1 in 100 flood until 2039.	Health, Communities and the Built Environment	Community preparedness and response	Community & economy
23	Coastal change	Risks to people, communities and buildings from coastal change including erosion, land loss and sea level change (interdependency - link to climate risks to Adaptation Infrastructure).	Health, Communities and the Built Environment	Community preparedness and response	Community & economy
24	General changing climatic conditions	Risks to building fabric from changing atmospheric conditions including extreme temperatures, moisture, wind and driving rain (excluding flooding and coastal erosion).	Health, Communities and the Built Environment	Buildings	Built environment
25	Sea level rise	Risks to people, communities and buildings from Humber Estuary inundation, (tidal flood risk), noting this is localised to a relatively small area.	Health, Communities and the Built Environment	Community preparedness and response	Community & economy
26	Extreme weather - general	Risks to culturally valued structures and historic environment from extreme weather events, including both damages to the building that require repairs and/or loss of assets and an inability to use the building, disrupting any related processes.	Health, Communities and the Built Environment	Community preparedness and response	Historical environment
27	Extreme weather - general	Risks to integrity of **cultural** and **historic collections** including art works within museums, art galleries and storage facilities from changing environmental climate conditions within buildings, including humidity, more frequent / extreme fluctuations in temperature and flooding.	Health, Communities and the Built Environment	Towns and cities	Historical environment
28	General changing climatic conditions	Risk of loss of green amenity space in urban areas and rural settlements due to a changing climate, including flooding, extreme heat, urban wildfires, etc.) resulting in a loss of ecosystem services / natural capital such as mental / physical health benefits, amenity and other benefits such as property values (interdependency / cascading link to Infrastructure and Natural Environment, including urban trees).	Health, Communities and the Built Environment	Health	Built environment
29	Other	Risk to culturally valued structures and historic environment from measures designed to adapt to climate change risks, such as constructing flooding defences, restoring wetlands, planting forests etc. (which may damage historic structures or underground archaeology in	Health, Communities and the Built Environment	N/A	Built environment
30	Extreme weather - general	Risks to prison services (e.g. Askham Grange Prison and Young Offender Institution) from extreme weather events (e.g. high temperatures, storms) and a changing climate	Health, Communities and the Built Environment	Buildings	Community & economy
31	General changing climatic conditions	Risk of increased demand and pressures on emergency services due to attendance at and management of other weather-related events, including floods, heat stress across the region, wildfires, storms. Warm weather increases likelihood of public grouping; while this does not	Health, Communities and the Built Environment	Community preparedness and response	Community & economy
32	Extreme weather - general	Risks to education services due to more challenging conditions from extreme weather events	Health, Communities and the Built Environment	Community preparedness and response	Community & economy
33	Wildfire/Drought	Risk to availability of water sources for use by fire and rescue services due to changing rainfall patterns	Health, Communities and the Built Environment	Community preparedness and response	Community & economy
34	Cascading	Risk of increases in anti-social or criminal behaviour due to increasing scarcity of resources or loss of economic stability; an example could be increased competition for housing resources due to flooding damages resulting in increased deprivation and increased anti social and criminal behaviour. Scarcity could be exacerbated by international mobility due to climate change (see risk below). (Interdependency / cascadinglink to Business and Industry due to link to economic stability)	Health, Communities and the Built Environment	Community preparedness and response	Community & economy
35	Climate change overseas	International dimension: Risks to Y&NY region from disruptions and costs due to climate-related international and domestic human mobility or international violent conflict resulting from climate change. Domestic mobility may relate to areas of the UK that become less habitable due to climate change, e.g., loss of housing due to river flooding and coastal erosion.	Health, Communities and the Built Environment	N/A	N/A
36	Extreme weather - general	Risks to human and community health from disruption to transport infrastructure from extreme weather events (e.g., flood disrupting access during emergency healthcare events).	Health, Communities and the Built Environment	Transport	Community & economy
37	Climate change overseas	International dimension: Risks to Y&NY region from reduced availability of safe and high quality food due to climate change overseas (e.g. weather related shocks to global food production and trade) (link to Natural Environment and Food)	Health, Communities and the Built Environment	Food security	Community & economy
38	Climate change overseas	International dimension: Risks to Y&NY region from imported food safety risks (e.g. potential contamination with mycotoxins, pesticides, Salmonella, etc.)	Health, Communities and the Built Environment	Food security	Community & economy
39	General changing climatic conditions	Risks to food security and food safety from disruptions to domestic food supply due to climate change (e.g., drought, extreme heat). (Interdependency to Business Industry - latter due to loss of agricultural business revenues).	Health, Communities and the Built Environment	Food security	Community & economy
40	High temperatures	Risks to health and wellbeing from high temperatures including exacerbation of existing health conditions (interdependency / cascading link to Business & Industry - reduced employee productivity).	Health, Communities and the Built Environment	Health	Community & economy
41	Air quality	Risks to health and wellbeing from changes in indoor (e.g. housing characteristics and ventilation, and natural sources of pollution related to pollen and mould) and outdoor (e.g. traffic and industry) air quality. Note: housing air quality can also decline due to damages to	Health, Communities and the Built Environment	Health	Community & economy
42	General changing climatic conditions	Risk to mental health deterioration due to the physical effects of climate change or fear of expected future effects. (Interdependency to Business and Industry due to loss of productivity)	Health, Communities and the Built Environment	Health	Community & economy
43	General changing climatic conditions	Risks to public health from water quality, including negative impacts on water treatment from changing rainfall and temperature patterns and contaminated water bodies (interdependency to Infrastructure due to dependence on wastewater treatment).	Health, Communities and the Built Environment	Health	Community & economy
44	High temperatures	Risks to passengers from high temperatures on public transport	Health, Communities and the Built Environment	Health	Community & economy
45	Climate change overseas	International dimension: Risks to Y&NY region public health from incurring climate change-influenced illnesses while travelling overseas and requiring care once home (e.g., suffering from a disease visiting a country that pre climate change was not affected by that disease).	Health, Communities and the Built Environment	Health	Community & economy
46	General changing climatic conditions	Risks to health from vector-borne diseases whose prevalence increases as temperatures increase and the climate continues to change.	Health, Communities and the Built Environment	Health	Community & economy
47	Sea level rise	Risks to industry-related infrastructure (energy production) from Humber Estuary inundation (i.e., tidal flood risk)	Infrastructure	Energy	Built environment
48	Extreme weather - general	Risk of temporary disruption (loss of gas supply) associated with extreme weather events (e.g. storms, high winds, snowfall, wildfire, flooding, extreme heat)	Infrastructure	Energy	Built environment
49	Extreme weather - general	Risk of short/medium-term disruption (loss of gas supply) associated with significant damage to the gas infrastructure network (e.g. flooding, coastal change, landslides).	Infrastructure	Energy	Built environment

50	Cascading	Risks to gas infrastructure networks from cascading failures	Infrastructure	Energy	Built environment
51	Extreme weather - general	Risk of temporary disruption to power supplies (power outages <24 hrs) associated with extreme weather events to power infrastructure (e.g. storms, incl.. hail, high winds, snowfall, wildfire, lightning strikes, flooding, extreme heat).	Infrastructure	Energy	Built environment
52	Extreme weather - general	Risk of short/medium-term disruption (power outages >24 hrs) associated with significant damage to electricity infrastructure (e.g. flooding, coastal change, landslides)	Infrastructure	Energy	Built environment
53	Hotter summers	Risk of increased customer demand for electricity (e.g. air conditioning) during hot periods, coinciding with assets being derated as a result of increased heat.	Infrastructure	Energy	Built environment
54	Cascading	Risks to electricity infrastructure networks from cascading failures	Infrastructure	Energy	Built environment
55	Land movement	Risks to subterranean and surface infrastructure from subsidence	Infrastructure	Energy	Built environment
56	Sea level rise	Risks to coastal adaptation infrastructure from flooding (coastal), coastal change, storms, landslides, subsistence/embankment failure.	Infrastructure	Towns and cities	Built environment
57	Extreme weather - storms	Risks to offshore infrastructure from storms and high waves (e.g. equipment used by the oil and gas industry, wind, tidal and wave energy, and gas pipelines and power cables on or under the seabed)	Infrastructure	Energy	Built environment
58	Extreme weather - general	Risk of temporary disruption to ICT and communications associated with extreme weather events (e.g. storms, high winds, snowfall, wildfire, flooding, extreme heat, cooling servers) including connectivity infrastructure such as underground cabling.	Infrastructure	Telecoms and ICT	Built environment
59	Extreme weather - general	Risk of short/medium-term disruption to loss of ICT and communications associated with significant damage to communications infrastructure (e.g. flooding, coastal change, landslides) including connectivity infrastructure such as underground cabling.	Infrastructure	Telecoms and ICT	Built environment
60	Cascading	Risks to ICT and communications infrastructure networks from cascading climate- and extreme weather-related failures (including where services in YNYCA reliant on servers in other regions or nations).	Infrastructure	Telecoms and ICT	Built environment
61	Extreme weather - general	Risk of temporary disruption to road and rail networks and associared travel due to extreme weather events (e.g. storms, high winds, snowfall, wildfire, flooding, extreme heat). (Interdependency with Infrastructure such as power supplies).	Infrastructure	Transport	Community & economy
62	Extreme weather - general	Risk of short/medium-term disruption to **majors roads** associated with significant damage to the transport network (e.g. flooding, coastal change, landslides, embankment failure)	Infrastructure	Transport	Community & economy
63	Extreme weather - general	Risk of short/medium-term disruption to **minor/rural roads** associated with significant damage to the transport network (e.g. flooding, coastal change, landslides, embankment failure)	Infrastructure	Transport	Community & economy
64	Extreme weather - general	Risk of short/medium-term disruption to **rail** associated with significant damage to the transport network (e.g. flooding, coastal change, landslides, embankment failure).	Infrastructure	Transport	Community & economy
65	Cascading	Risks to transport networks from cascading failures (note interdependency / cascading risk- e.g., winds impacts to electricity, resulting in rail outages and associated negative effects to services / business).	Infrastructure	Transport	Community & economy
66	Extreme weather - general	Risk of temporary disruption (localised outages) to **public** water supply associated with operational disruption due to extreme weather events (e.g. storms, high winds, snowfall, cold events, wildfire, flooding, extreme heat)	Infrastructure	Water supply	Built environment
67	Extreme weather - general	Risk of short/medium-term disruption to **public** water supply associated with significant damage to water infrastructure (e.g. flooding, coastal change, landslides).	Infrastructure	Water supply	Built environment
68	Drought / water scarcity	Risk of reduced **public** water availability due to drought conditions (lower reservoir levels), creating pressure on supplies (e.g. need for temporary use ban, increased water pricing)	Infrastructure	Water supply	Built environment
69	Hotter summers	Risk of increased customer demand on **public** water supply during hot dry periods, creating pressure on supplies (e.g. need for temporary use ban, increased water pricing)	Infrastructure	Water supply	Built environment
70	Sea level rise	Risk to **public** water supply due to saltwater intrusion to groundwater sources	Infrastructure	Water supply	Built environment
71	Cascading	Risks to **public** water and wastewater infrastructure networks from cascading failures	Infrastructure	Water supply	Built environment
72	General changing climatic conditions	Risk of reduced **public** water availability due to raw water quality deterioration	Infrastructure	Water supply	Built environment
73	Extreme weather - general	Risk of disruption to **private** water supply (i.e., residential and other properties that do not obtain their water from a utility) associated with damage to water infrastructure (e.g. erosion, coastal change, landslides, contamination)	Infrastructure	Water supply	Built environment
74	Drought / water scarcity	Risk to **private** water supply (i.e., residential and other properties that do not obtain their water from a utility) due to low rainfall and drought conditions. Note, if there is a health risk associated with the loss of supply, LAs have a statutory responsibility to provide support. For	Infrastructure	Water supply	Built environment
75	General changing climatic conditions	Risk to **private** water supply (i.e., residential and other properties that do not obtain their water from a utility) due to poor water quality of rivers or groundwater sources	Infrastructure	Water supply	Built environment
76	Sea level rise	Risk to **private** water supply (i.e., residential and other properties that do not obtain their water from a utility) due to saltwater intrusion to groundwater sources	Infrastructure	Water supply	Built environment
77	Extreme weather - general	Risk of temporary disruption (to **wastewater** services) associated with extreme weather events (e.g. storms, high winds, snowfall, wildfire, flooding, extreme heat, extreme rainfall)	Infrastructure	Water supply	Built environment
78	Extreme weather - general	Risk of short/medium-term disruption (to **wastewater** services) associated with significant damage to wastewater infrastructure (e.g. flooding, coastal change, landslides)	Infrastructure	Water supply	Built environment
79	Extreme weather - general	Risks to closed and active landfill sites, treatment centres and waste transfer sites due to extreme weather events (e.g. flooding, extreme heat).	Infrastructure	N/A	N/A
80	Extreme rainfall	Risks of **wastewater**/sewer infrastructure flooding, overflow or releases into water courses due to heavy rainfall (interdependency / cascading link to Health and Natural Environment).	Infrastructure	Water supply	Built environment
81	Pests & disease	Risks to **terrestrial** species and habitats from pests, pathogens and invasive species, including viral and parasitic diseases, where climate change improves conditions for these to spread and cause damage.	Natural Environment and Assets	Nature	Natural environment
82	General changing climatic conditions	Risks to **terrestrial** species and habitats from changing climatic conditions and extreme events, including temperature change, water scarcity, wildfire, flooding, wind, and altered hydrology (including water scarcity, flooding and saline intrusion)	Natural Environment and Assets	Nature	Natural environment
83	Sea level rise	Risk of coastal flooding and Humber Estuary inundation from sea level rise impacting **terrestrial** habitats and biodiversity, including natural capital	Natural Environment and Assets	Nature	Natural environment
84	Wildfire	Risks of wildfires and destruction of **terrestrial** habitats including forests, heathland/moors, peatlands and grasslands, where the habitat is difficult to return to its former state.	Natural Environment and Assets	Nature	Natural environment
85	Drought / water scarcity	Risk of environmental drought and water scarcity to **terrestrial** habitats.	Natural Environment and Assets	Nature	Natural environment
86	Extreme rainfall	Risk of drainage and/or sewage networks flooding and contamination of land impacting **terrestrial** habitats and biodiversity, including natural capital	Natural Environment and Assets	Nature	Natural environment
87	Extreme rainfall	Risk of mine water outbreak and contamination of the natural environment and **terrestrial** habitats	Natural Environment and Assets	Nature	Natural environment
88	Flooding	Risk of climate-influenced river flooding impacting **terrestrial** habitats and biodiversity, including urban habitats and natural capital, noting that while flood plain habitats naturally flood and are not materially affected by normal flood levels, increasingly extreme or severe	Natural Environment and Assets	Nature	Natural environment
89	General changing climatic conditions	Risk of negative effects for the region's biodiversity, including changing species distributions and increased fragmentation of sensitive habitats where these cannot adapt to the rapid rate of climate change and related extreme weather.	Natural Environment and Assets	Nature	Natural environment
90	Soil health	Risk to soils (including soil health and associated ecosystem services) from changing climatic conditions, including fluctuations between seasonal aridity and wetness resulting in soil health declines and soil loss events like erosion.	Natural Environment and Assets	Nature	Natural environment
91	General changing climatic conditions	Risks for natural carbon stores (e.g. peatlands, saltmarsh, kelp forests), carbon sequestration and GHG emissions from changing climatic conditions, including temperature change and water scarcity	Natural Environment and Assets	Nature	Natural environment
92	General changing climatic conditions	Risks to landscape character from a changing climate.	Natural Environment and Assets	Nature	Landscape
93	Land movement	Risk of landslides and slope failures impacting landscape character and **terrestrial/freshwater** habitats and species (noting that risks of landslides/slope failures to Infrastructure/Built Environment is covered under different risks).	Natural Environment and Assets	Nature	Landscape
94	General changing climatic conditions	Risks to **freshwater** species and habitats (e.g. wetlands) from changing climatic conditions and extreme events, including higher water temperatures, flooding, water scarcity and phenological shifts.	Natural Environment and Assets	Nature	Natural environment

95	Pests & disease	Risks to **freshwater** species and habitats from pests, pathogens and invasive species	Natural Environment and Assets	Nature	Natural environment
96	Extreme rainfall	Risk of drainage and/or sewage networks flooding and contamination of to **freshwater** species and habitats (e.g. wetlands). Note, if river levels decline in dry periods the concentration of pollutant will increase if effluent is still being released.	Natural Environment and Assets	Nature	Natural environment
97	Coastal change	Risks to **coastal** species and habitats due to coastal flooding, erosion and climate factors	Natural Environment and Assets	Nature	Natural environment
98	General changing climatic conditions	Risks to **marine** species, habitats and fisheries from changing climatic conditions, including ocean acidification and higher water temperatures including marine heatwaves, noting in 2025 the UK experienced severe marine heatwaves, the effects of which are at present unknown (June 2025).	Natural Environment and Assets	Nature	Natural environment
99	Pests & disease	Risks to **marine** species and habitats from pests, pathogens and invasive species	Natural Environment and Assets	Nature	Natural environment
100	Extreme weather	Risks to **forestry** productivity from extreme events and changing climatic conditions (including temperature change, water scarcity, wildfire, flooding, coastal erosion, wind and saline intrusion).	Natural Environment and Assets	Working lands and seas	Farming forestry & land management
101	Pests & disease	Risks to **forestry** from pests, pathogens and invasive species	Natural Environment and Assets	Working lands and seas	Farming forestry & land management
102	High temperatures	Risk to **urban trees and urban woodland carbon storage projects** from extreme weather events including extreme heat and flooding. Interdependency to Health and Built Environment as urban trees provide cooling effects, mental health benefits and property value benefits.	Natural Environment and Assets	Towns and cities	Natural environment
103	High temperatures	Risks to regional **forestry** and forest planting targets (e.g., woodland creation, nature restoration targets, carbon sequestration targets, urban climate adaptation using trees) from extreme events and changing climatic conditions increasing tree mortality (including temperature change, water scarcity, wildfire, flooding, coastal erosion, wind and saline intrusion)	Natural Environment and Assets	Working lands and seas	Farming forestry & land management
104	Drought / water scarcity	Water shortages affecting **agricultural** practices (e.g. irrigation and livestock health)	Natural Environment and Assets	Working lands and seas	Farming forestry & land management
105	Drought and extreme rainfall, extreme	Risks to **agricultural** productivity from extreme events, unpredictable weather and changing climatic conditions such as changing seasonality (primarily water scarcity and extreme / unpredictable rainfall, but also including temperature change, wildfire, flooding, coastal	Natural Environment and Assets	Working lands and seas	Farming forestry & land management
106	Flooding	Risk of river flooding of **agricultural** land impacting productivity (e.g. crop damage or loss) and the potential for contamination	Natural Environment and Assets	Working lands and seas	Farming forestry & land management
107	Pests & disease	Risks to **agricultural** crops & livestock health and productivity from pests, pathogens and invasive species, including viral and parasitic diseases	Natural Environment and Assets	Working lands and seas	Farming forestry & land management
108	Sea level rise	Risks to aquifers and **agricultural** land from sea level rise, saltwater intrusion, and Humber Estuary inundation	Natural Environment and Assets	Working lands and seas	Farming forestry & land management
109	Soil health	Risks to **agricultural** productivity from soil erosion	Natural Environment and Assets	Working lands and seas	Farming forestry & land management
110	Wildfire	Risks of wildfires on or affecting **agricultural** land (e.g. arable crops)	Natural Environment and Assets	Working lands and seas	Farming forestry & land management
111	Flooding	Risk of increased surface water flooding associated with choice of land management practices exacerbating flood risk	Natural Environment and Assets	Nature	Farming forestry & land management
112	General changing climatic conditions	Risk of short term accessibility challenges for footpaths and rights of way (including urban footpaths and parks) associated with a changing climate (e.g. landslips, fallen trees, flooding, coastal erosion, maintenance work to remove climate-induced invasive species).	Natural Environment and Assets	Nature	Recreation & tourism
113	General changing climatic conditions	Risk of long-term accessibility challenges for footpaths and rights of way (including urban footpaths and parks) associated with a changing climate (e.g. landslips, erosion, inundation or loss of paths) (Interdependency to Infrastructure theme - walking infrastructure and	Natural Environment and Assets	Nature	Recreation & tourism
114	Pests & disease	Risks to public parks, parkland and garden biodiversity/ecosystem services from pests, pathogens and invasive species	Natural Environment and Assets	Working lands and seas	Natural environment

Regions affected							Climate Projections | North Yorkshire | Median (50th percentile)			
York and North Yorkshire Region	North Yorkshire Region	City of York Region	Yorkshire Dales National Park	North York Moors National Park	Nidderdale National Landscape	Howardian Hills National Landscape	Variable / Indicator / Proxy	1.5°C GWL (Paris Agreement)	2.0°C GWL (prepare)	4.0°C GWL (assess risks)
Material	Material	Material	Material	Material	Material	Material	Summer average temperature (°C change) / Summer precipitation rate (% change)	+1.3 | +2%	+1.9 | -6%	+3.9 / -25%
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	N/A	N/A	Material	N/A	N/A	Winter precipitation rate (% change)	+3	+5	+13
Material	Material	N/A	N/A	N/A	N/A	N/A	Sea level anomaly (cm) compared to 1981 - 2000 average	+18	+32	+68
Material	Material	Material	Material	Material	Material	Material	Winter precipitation rate (% change)	+3	+5	+13
Material	Material	Material	N/A	Material	N/A	N/A	Sea level anomaly (cm) compared to 1981 - 2000 average	+18	+32	+68
Material	Material	Material	Material	Material	Material	Material	Summer precipitation rate (% change)	+2	-6	-25
Material	Material	Material	Material	Material	Material	Material	Summer precipitation rate (% change)	+2	-6	-25
Material	Material	Material	Material	Material	Material	Material	Winter precipitation rate (% change)	+3	+5	+13

Material	Material	Immaterial	N/A	Material	N/A	N/A	Sea level anomaly (cm) compared to 1981 - 2000 average	+18	+32	+68
Material	Material	Material	Immaterial	Immaterial	Immaterial	Immaterial	Winter precipitation rate (% change)	+3	+5	+13
Material	Material	Material	Immaterial	Immaterial	Immaterial	Immaterial	Summer average temperature (°C change)	+1.3	+1.9	+3.9
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	Summer average temperature (°C change)	+1.3	+1.9	+3.9
Material	Material	Material	Material	Material	Material	Material	Summer average temperature (°C change)	+1.3	+1.9	+3.9
Material	Material	Material	Immaterial	Immaterial	Immaterial	Immaterial	N/A			
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	Winter precipitation rate (% change)	+3	+5	+13
Material	Material	Material	Material	Material	Material	Material	Winter precipitation rate (% change)	+3	+5	+13
Material	Material	N/A	N/A	Material	N/A	N/A	Sea level anomaly (cm) compared to 1981 - 2000 average	+18	+32	+68
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	N/A	N/A	N/A	N/A	N/A	Sea level anomaly (cm) compared to 1981 - 2000 average	+18	+32	+68
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Immaterial	Material	N/A	N/A	N/A	N/A				
Material	Material	Material	Immaterial	Immaterial	Immaterial	Immaterial	N/A			
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	N/A	N/A	N/A	N/A	Summer maximum temperature (°C change)	+2.5	+2.8	+6.5
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	Summer precipitation rate (% change)	+2	-6	-25
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	Summer precipitation rate (% change) | Winter precipitation rate (% change)	+2 | +3	-6 | +5	-25 | +13
Material	Material	Material	Material	Material	Material	Material	Summer maximum temperature (°C change)	+2.5	+2.8	+6.5
Material	Material	Material	Material	Material	Material	Material	Summer average temperature (°C change)	+1.3	+1.9	+3.9
Material	Material	Material	Material	Material	Material	Material	Hot summer days (daily maximum temperature >30°C)	1	1	7
Material	Material	Material	Material	Material	Material	Material	Winter precipitation rate (% change)	+3	+5	+13
Material	Material	Material	Material	Material	Material	Material	Hot summer days (daily maximum temperature >30°C)	1	1	7
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	Summer average temperature (°C change)	+1.3	+1.9	+3.9
Material	Material	N/A	N/A	N/A	N/A	N/A	Sea level anomaly (cm) compared to 1981 - 2000 average	+18	+32	+68
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	N/A			

Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	Cooling degree days	23	28	75
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	Winter precipitation rate (% change)	+3	+5	+13
Material	Material	N/A	N/A	Material	N/A	N/A	Sea level anomaly (cm) compared to 1981 - 2000 average	+18	+32	+68
Material	Material	N/A	N/A	Immaterial	N/A	N/A	Winter precipitation rate (% change)	+3	+5	+13
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	Winter precipitation rate (% change)	+3	+5	+13
Material	Material	Material	Material	Material	Material	Material	Winter precipitation rate (% change)	+3	+5	+13
Material	Material	Material	Material	Material	Material	Material	Winter precipitation rate (% change)	+3	+5	+13
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	Summer precipitation rate (% change)	+2	-6	-25
Material	Material	Material	Material	Material	Material	Material	Summer precipitation rate (% change) | Hot summer days (daily maximum temperature >30°C)	+2 | 1	-6 | 1	-25 | 7
Material	Material	Immaterial	Immaterial	Immaterial	Immaterial	Immaterial	Sea level anomaly (cm) compared to 1981 - 2000 average	+18	+32	+68
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	Winter precipitation rate (% change)	+3	+5	+13
Material	Material	Immaterial	Material	Material	Material	Material	N/A			
Material	Material	Immaterial	Material	Material	Material	Material	Summer precipitation rate (% change)	+2	-6	-25
Material	Material	Immaterial	Material	Material	Material	Material	N/A			
Material	Material	Immaterial	Material	Material	Material	Material	Sea level anomaly (cm) compared to 1981 - 2000 average	+18	+32	+68
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Immaterial	Immaterial	Immaterial	Immaterial	Hot summer days (daily maximum temperature >30°C)	1	1	7
Material	Material	Material	Material	Material	Material	Material	Winter precipitation rate (% change)	+3	+5	+13
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	N/A	N/A	Material	N/A	N/A	Sea level anomaly (cm) compared to 1981 - 2000 average | Winter precipitation rate (% change)	+18 | +3	+32 | +3	+68 | +13
Material	Material	Material	Material	Material	Material	Material	Summer average temperature (°C change) | Summer precipitation rate (% change)	+1.3 | +2	+1.9 | -6	+3.9 | -25
Material	Material	Material	Material	Material	Material	Material	Summer precipitation rate (% change) | Hot summer days (daily maximum temperature >30°C)	+2 | 1	-6 | 1	-25 | 7
Material	Material	Material	Material	Material	Material	Material	Winter precipitation rate (% change)	+3	+5	+13
Material	Material	Material	Material	Material	Material	Material	Winter precipitation rate (% change)	+3	+5	+13
Material	Material	Material	Material	Material	Material	Material	Winter precipitation rate (% change)	+3	+5	+13
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	Summer precipitation rate (% change) | Winter precipitation rate (% change)	+2 | +3	-6 | +5	-25 | +13
Material	Material	Material	Material	Material	Material	Material	Summer average temperature (°C change) | Summer precipitation rate (% change)	+1.3 | +2	+1.9 | -6	+3.9 | -25
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	Winter precipitation rate (% change)	+3	+5	+13
Material	Material	Material	Material	Material	Material	Material	N/A			

Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	Winter precipitation rate (% change)	+3	+5	+13
Material	Material	N/A	N/A	Material	N/A	N/A	Sea level anomaly (cm) compared to 1981 - 2000 average | Winter precipitation rate (% change)	+18 | +3	+32 | +3	+68 | +13
Material	Material	Material	Material	Material	Material	Material	Annual average temperature (°C change)	+1.1	+1.6	+3.2
Material	Material	N/A	N/A	Material	N/A	N/A	N/A			
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	Summer precipitation rate (% change) | Hot summer days (daily maximum temperature >30°C)	+2 | 1	-6 | 1	-25 | 7
Material	Material	Material	Material	Material	Material	Material	Summer precipitation rate (% change) | Hot summer days (daily maximum temperature >30°C)	+2 | 1	-6 | 1	-25 | 7
Material	Material	Material	Material	Material	Material	Material	Summer precipitation rate (% change) | Hot summer days (daily maximum temperature >30°C)	+2 | 1	-6 | 1	-25 | 7
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	Material	Material	Material	Material	Material	Winter precipitation rate (% change)	+3	+5	+13
Material	Material	Material	Material	Material	Material	Material	N/A			
Material	Material	N/A	N/A	Material	N/A	N/A	Sea level anomaly (cm) compared to 1981 - 2000 average | Winter precipitation rate (% change)	+18 | +4	+32 | +4	+68 | +14
Material	Material	Material	Material	Material	Material	Material	Summer precipitation rate (% change) | Winter precipitation rate (% change)	+2 | +3	-6 | +5	-25 | +13
Material	Material	Material	Material	Material	Material	Material	Summer average temperature (°C change) | Summer precipitation rate (% change)	+1.3 | +3	+1.9 | -7	+3.9 | -26
Material	Material	Material	Material	Material	Material	Material	Winter precipitation rate (% change)	+3	+5	+13
Material	Material	Material	Material	Material	Material	Immaterial	N/A			
Material	Material	Material	Material	Material	Material	Immaterial	N/A			
Material	Material	Material	Material	Material	Material	Material	N/A			

Present day 2030s (1.5°C GWL)						Mid century 2050s (2°C GWL)						End of century 2100 (2°C GWL)			
Likelihood	Magnitude	Likelihood score	Magnitude score	Risk score	Risk Rating (2030, 1.5C)	Likelihood	Magnitude	Likelihood score	Magnitude score	Risk score	Risk Rating (2050, 2C)	Likelihood	Magnitude	Likelihood score	Magnitude score
1 - Highly Unlikely	1 - Very Low	1	1	1	[1] Negligible	2 - Unlikely	1 - Very Low	2	1	2	[2] Minor	3 - Possible	1 - Very Low	3	1
1 - Highly Unlikely	1 - Very Low	1	1	1	[1] Negligible	2 - Unlikely	1 - Very Low	2	1	2	[2] Minor	2 - Unlikely	1 - Very Low	2	1
3 - Possible	2 - Low	3	2	6	[3] Moderate	4 - Likely	2 - Low	4	2	8	[3] Moderate	4 - Likely	2 - Low	4	2
3 - Possible	2 - Low	3	2	6	[3] Moderate	4 - Likely	2 - Low	4	2	8	[3] Moderate	4 - Likely	2 - Low	4	2
1 - Highly Unlikely	1 - Very Low	1	1	1	[1] Negligible	2 - Unlikely	2 - Low	2	2	4	[3] Moderate	3 - Possible	3 - Moderate	3	3
4 - Likely	3 - Moderate	4	3	12	[4] Major	4 - Likely	3 - Moderate	4	3	12	[4] Major	4 - Likely	3 - Moderate	4	3
1 - Highly Unlikely	2 - Low	1	2	2	[2] Minor	2 - Unlikely	2 - Low	2	2	4	[3] Moderate	3 - Possible	3 - Moderate	3	3
1 - Highly Unlikely	2 - Low	1	2	2	[2] Minor	3 - Possible	3 - Moderate	3	3	9	[3] Moderate	3 - Possible	3 - Moderate	3	3
1 - Highly Unlikely	2 - Low	1	2	2	[2] Minor	3 - Possible	2 - Low	3	2	6	[3] Moderate	3 - Possible	3 - Moderate	3	3
1 - Highly Unlikely	2 - Low	1	2	2	[2] Minor	2 - Unlikely	2 - Low	2	2	4	[3] Moderate	2 - Unlikely	2 - Low	2	2

2 - Unlikely	1 - Very Low	2	1	2	[2] Minor	2 - Unlikely	1 - Very Low	2	1	2	[2] Minor	3 - Possible	2 - Low	3	2
3 - Possible	3 - Moderate	3	3	9	[3] Moderate	3 - Possible	3 - Moderate	3	3	9	[3] Moderate	3 - Possible	3 - Moderate	3	3
3 - Possible	1 - Very Low	3	1	3	[2] Minor	3 - Possible	2 - Low	3	2	6	[3] Moderate	3 - Possible	2 - Low	3	2
3 - Possible	2 - Low	3	2	6	[3] Moderate	3 - Possible	3 - Moderate	3	3	9	[3] Moderate	3 - Possible	3 - Moderate	3	3
1 - Highly Unlikely	1 - Very Low	1	1	1	[1] Negligible	2 - Unlikely	1 - Very Low	2	1	2	[2] Minor	2 - Unlikely	1 - Very Low	2	1
2 - Unlikely	1 - Very Low	2	1	2	[2] Minor	2 - Unlikely	1 - Very Low	2	1	2	[2] Minor	2 - Unlikely	1 - Very Low	2	1
4 - Likely	3 - Moderate	4	3	12	[4] Major	4 - Likely	3 - Moderate	4	3	12	[4] Major	4 - Likely	3 - Moderate	4	3
1 - Highly Unlikely	1 - Very Low	1	1	1	[1] Negligible	2 - Unlikely	1 - Very Low	2	1	2	[2] Minor	2 - Unlikely	1 - Very Low	2	1
1 - Highly Unlikely	1 - Very Low	1	1	1	[1] Negligible	2 - Unlikely	1 - Very Low	2	1	2	[2] Minor	2 - Unlikely	1 - Very Low	2	1
1 - Highly Unlikely	1 - Very Low	1	1	1	[1] Negligible	1 - Highly Unlikely	1 - Very Low	1	1	1	[1] Negligible	1 - Highly Unlikely	1 - Very Low	1	1
4 - Likely	2 - Low	4	2	8	[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major	4 - Likely	3 - Moderate	4	3
4 - Likely	4 - High	4	4	16	[4] Major	4 - Likely	4 - High	4	4	16	[4] Major	4 - Likely	4 - High	4	4
3 - Possible	3 - Moderate	3	3	9	[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major	4 - Likely	3 - Moderate	4	3
3 - Possible	1 - Very Low	3	1	3	[2] Minor	3 - Possible	1 - Very Low	3	1	3	[2] Minor	3 - Possible	1 - Very Low	3	1
1 - Highly Unlikely	3 - Moderate	1	3	3	[2] Minor	2 - Unlikely	3 - Moderate	2	3	6	[3] Moderate	3 - Possible	4 - High	3	4
3 - Possible	3 - Moderate	3	3	9	[3] Moderate	3 - Possible	4 - High	3	4	12	[4] Major	3 - Possible	4 - High	3	4
3 - Possible	4 - High	3	4	12	[4] Major	4 - Likely	4 - High	4	4	16	[4] Major	4 - Likely	4 - High	4	4
3 - Possible	1 - Very Low	3	1	3	[2] Minor	4 - Likely	2 - Low	4	2	8	[3] Moderate	4 - Likely	2 - Low	4	2
3 - Possible	1 - Very Low	3	1	3	[2] Minor	3 - Possible	2 - Low	3	2	6	[3] Moderate	3 - Possible	2 - Low	3	2
2 - Unlikely	1 - Very Low	2	1	2	[2] Minor	3 - Possible	1 - Very Low	3	1	3	[2] Minor	3 - Possible	1 - Very Low	3	1
3 - Possible	1 - Very Low	3	1	3	[2] Minor	3 - Possible	1 - Very Low	3	1	3	[2] Minor	3 - Possible	1 - Very Low	3	1
2 - Unlikely	2 - Low	2	2	4	[3] Moderate	3 - Possible	2 - Low	3	2	6	[3] Moderate	3 - Possible	2 - Low	3	2
3 - Possible	2 - Low	3	2	6	[3] Moderate	3 - Possible	2 - Low	3	2	6	[3] Moderate	3 - Possible	2 - Low	3	2
1 - Highly Unlikely	1 - Very Low	1	1	1	[1] Negligible	2 - Unlikely	1 - Very Low	2	1	2	[2] Minor	2 - Unlikely	1 - Very Low	2	1
1 - Highly Unlikely	2 - Low	1	2	2	[2] Minor	3 - Possible	2 - Low	3	2	6	[3] Moderate	3 - Possible	2 - Low	3	2
4 - Likely	2 - Low	4	2	8	[3] Moderate	4 - Likely	2 - Low	4	2	8	[3] Moderate	5 - Very Likely	2 - Low	5	2
3 - Possible	2 - Low	3	2	6	[3] Moderate	4 - Likely	4 - High	4	4	16	[4] Major	4 - Likely	4 - High	4	4
1 - Highly Unlikely	1 - Very Low	1	1	1	[1] Negligible	2 - Unlikely	1 - Very Low	2	1	2	[2] Minor	2 - Unlikely	1 - Very Low	2	1
3 - Possible	2 - Low	3	2	6	[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major	4 - Likely	4 - High	4	4
4 - Likely	4 - High	4	4	16	[4] Major	4 - Likely	4 - High	4	4	16	[4] Major	4 - Likely	4 - High	4	4
3 - Possible	2 - Low	3	2	6	[3] Moderate	3 - Possible	2 - Low	3	2	6	[3] Moderate	3 - Possible	2 - Low	3	2
3 - Possible	1 - Very Low	3	1	3	[2] Minor	4 - Likely	2 - Low	4	2	8	[3] Moderate	4 - Likely	2 - Low	4	2
3 - Possible	1 - Very Low	3	1	3	[2] Minor	3 - Possible	1 - Very Low	3	1	3	[2] Minor	3 - Possible	1 - Very Low	3	1
3 - Possible	1 - Very Low	3	1	3	[2] Minor	3 - Possible	1 - Very Low	3	1	3	[2] Minor	3 - Possible	1 - Very Low	3	1
2 - Unlikely	2 - Low	2	2	4	[3] Moderate	3 - Possible	2 - Low	3	2	6	[3] Moderate	3 - Possible	2 - Low	3	2
3 - Possible	3 - Moderate	3	3	9	[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major	4 - Likely	3 - Moderate	4	3
1 - Highly Unlikely	3 - Moderate	1	3	3	[2] Minor	1 - Highly Unlikely	3 - Moderate	1	3	3	[2] Minor	2 - Unlikely	3 - Moderate	2	3
2 - Unlikely	1 - Very Low	2	1	2	[2] Minor	3 - Possible	1 - Very Low	3	1	3	[2] Minor	3 - Possible	1 - Very Low	3	1
1 - Highly Unlikely	3 - Moderate	1	3	3	[2] Minor	2 - Unlikely	3 - Moderate	2	3	6	[3] Moderate	2 - Unlikely	3 - Moderate	2	3

3 - Possible	3 - Moderate	3	3	9	[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major	4 - Likely	3 - Moderate	4	3
3 - Possible	2 - Low	3	2	6	[3] Moderate	4 - Likely	2 - Low	4	2	8	[3] Moderate	4 - Likely	2 - Low	4	2
2 - Unlikely	4 - High	2	4	8	[3] Moderate	3 - Possible	4 - High	3	4	12	[4] Major	3 - Possible	4 - High	3	4
1 - Highly Unlikely	1 - Very Low	1	1	1	[1] Negligible	1 - Highly Unlikely	1 - Very Low	1	1	1	[1] Negligible	1 - Highly Unlikely	1 - Very Low	1	1
2 - Unlikely	3 - Moderate	2	3	6	[3] Moderate	3 - Possible	3 - Moderate	3	3	9	[3] Moderate	4 - Likely	3 - Moderate	4	3
1 - Highly Unlikely	2 - Low	1	2	2	[2] Minor	2 - Unlikely	2 - Low	2	2	4	[3] Moderate	2 - Unlikely	2 - Low	2	2
3 - Possible	1 - Very Low	3	1	3	[2] Minor	3 - Possible	2 - Low	3	2	6	[3] Moderate	3 - Possible	3 - Moderate	3	3
1 - Highly Unlikely	2 - Low	1	2	2	[2] Minor	2 - Unlikely	2 - Low	2	2	4	[3] Moderate	2 - Unlikely	2 - Low	2	2
1 - Highly Unlikely	2 - Low	1	2	2	[2] Minor	1 - Highly Unlikely	2 - Low	1	2	2	[2] Minor	2 - Unlikely	2 - Low	2	2
1 - Highly Unlikely	4 - High	1	4	4	[3] Moderate	1 - Highly Unlikely	4 - High	1	4	4	[3] Moderate	1 - Highly Unlikely	4 - High	1	4
2 - Unlikely	4 - High	2	4	8	[3] Moderate	3 - Possible	4 - High	3	4	12	[4] Major	4 - Likely	4 - High	4	4
4 - Likely	1 - Very Low	4	1	4	[3] Moderate	4 - Likely	1 - Very Low	4	1	4	[3] Moderate	4 - Likely	1 - Very Low	4	1
2 - Unlikely	4 - High	2	4	8	[3] Moderate	2 - Unlikely	4 - High	2	4	8	[3] Moderate	3 - Possible	4 - High	3	4
3 - Possible	1 - Very Low	3	1	3	[2] Minor	4 - Likely	1 - Very Low	4	1	4	[3] Moderate	4 - Likely	1 - Very Low	4	1
2 - Unlikely	4 - High	2	4	8	[3] Moderate	2 - Unlikely	4 - High	2	4	8	[3] Moderate	3 - Possible	4 - High	3	4
3 - Possible	4 - High	3	4	12	[4] Major	3 - Possible	4 - High	3	4	12	[4] Major	4 - Likely	4 - High	4	4
2 - Unlikely	1 - Very Low	2	1	2	[2] Minor	2 - Unlikely	1 - Very Low	2	1	2	[2] Minor	3 - Possible	1 - Very Low	3	1
3 - Possible	3 - Moderate	3	3	9	[3] Moderate	3 - Possible	4 - High	3	4	12	[4] Major	3 - Possible	4 - High	3	4
3 - Possible	4 - High	3	4	12	[4] Major	4 - Likely	4 - High	4	4	16	[4] Major	4 - Likely	4 - High	4	4
3 - Possible	3 - Moderate	3	3	9	[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major	4 - Likely	3 - Moderate	4	3
1 - Highly Unlikely	1 - Very Low	1	1	1	[1] Negligible	1 - Highly Unlikely	1 - Very Low	1	1	1	[1] Negligible	2 - Unlikely	1 - Very Low	2	1
2 - Unlikely	3 - Moderate	2	3	6	[3] Moderate	3 - Possible	3 - Moderate	3	3	9	[3] Moderate	3 - Possible	3 - Moderate	3	3
2 - Unlikely	2 - Low	2	2	4	[3] Moderate	3 - Possible	2 - Low	3	2	6	[3] Moderate	3 - Possible	2 - Low	3	2
2 - Unlikely	1 - Very Low	2	1	2	[2] Minor	2 - Unlikely	1 - Very Low	2	1	2	[2] Minor	2 - Unlikely	1 - Very Low	2	1
3 - Possible	1 - Very Low	3	1	3	[2] Minor	4 - Likely	1 - Very Low	4	1	4	[3] Moderate	4 - Likely	1 - Very Low	4	1
2 - Unlikely	1 - Very Low	2	1	2	[2] Minor	3 - Possible	1 - Very Low	3	1	3	[2] Minor	3 - Possible	1 - Very Low	3	1
1 - Highly Unlikely	1 - Very Low	1	1	1	[1] Negligible	1 - Highly Unlikely	1 - Very Low	1	1	1	[1] Negligible	2 - Unlikely	1 - Very Low	2	1
2 - Unlikely	2 - Low	2	2	4	[3] Moderate	2 - Unlikely	2 - Low	2	2	4	[3] Moderate	2 - Unlikely	2 - Low	2	2
1 - Highly Unlikely	1 - Very Low	1	1	1	[1] Negligible	2 - Unlikely	1 - Very Low	2	1	2	[2] Minor	2 - Unlikely	1 - Very Low	2	1
3 - Possible	1 - Very Low	3	1	3	[2] Minor	3 - Possible	1 - Very Low	3	1	3	[2] Minor	3 - Possible	1 - Very Low	3	1
4 - Likely	3 - Moderate	4	3	12	[4] Major	4 - Likely	3 - Moderate	4	3	12	[4] Major	4 - Likely	3 - Moderate	4	3
4 - Likely	3 - Moderate	4	3	12	[4] Major	4 - Likely	4 - High	4	4	16	[4] Major	4 - Likely	4 - High	4	4
3 - Possible	3 - Moderate	3	3	9	[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major	4 - Likely	3 - Moderate	4	3
1 - Highly Unlikely	2 - Low	1	2	2	[2] Minor	2 - Unlikely	2 - Low	2	2	4	[3] Moderate	3 - Possible	2 - Low	3	2
4 - Likely	4 - High	4	4	16	[4] Major	4 - Likely	4 - High	4	4	16	[4] Major	4 - Likely	4 - High	4	4
4 - Likely	2 - Low	4	2	8	[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major	4 - Likely	3 - Moderate	4	3
3 - Possible	1 - Very Low	3	1	3	[2] Minor	3 - Possible	1 - Very Low	3	1	3	[2] Minor	3 - Possible	1 - Very Low	3	1
2 - Unlikely	3 - Moderate	2	3	6	[3] Moderate	2 - Unlikely	3 - Moderate	2	3	6	[3] Moderate	2 - Unlikely	3 - Moderate	2	3
3 - Possible	1 - Very Low	3	1	3	[2] Minor	3 - Possible	1 - Very Low	3	1	3	[2] Minor	3 - Possible	1 - Very Low	3	1
3 - Possible	2 - Low	3	2	6	[3] Moderate	3 - Possible	2 - Low	3	2	6	[3] Moderate	3 - Possible	2 - Low	3	2
3 - Possible	4 - High	3	4	12	[4] Major	4 - Likely	4 - High	4	4	16	[4] Major	4 - Likely	4 - High	4	4
3 - Possible	2 - Low	3	2	6	[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major	4 - Likely	3 - Moderate	4	3
3 - Possible	3 - Moderate	3	3	9	[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major	4 - Likely	3 - Moderate	4	3
3 - Possible	1 - Very Low	3	1	3	[2] Minor	3 - Possible	2 - Low	3	2	6	[3] Moderate	3 - Possible	2 - Low	3	2
2 - Unlikely	2 - Low	2	2	4	[3] Moderate	3 - Possible	3 - Moderate	3	3	9	[3] Moderate	3 - Possible	3 - Moderate	3	3

3 - Possible	3 - Moderate	3	3	9	[3] Moderate	3 - Possible	3 - Moderate	3	3	9	[3] Moderate	3 - Possible	3 - Moderate	3	3
4 - Likely	2 - Low	4	2	8	[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major	4 - Likely	3 - Moderate	4	3
3 - Possible	3 - Moderate	3	3	9	[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major	5 - Very Likely	3 - Moderate	5	3
4 - Likely	2 - Low	4	2	8	[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major	4 - Likely	3 - Moderate	4	3
2 - Unlikely	2 - Low	2	2	4	[3] Moderate	3 - Possible	3 - Moderate	3	3	9	[3] Moderate	3 - Possible	3 - Moderate	3	3
3 - Possible	2 - Low	3	2	6	[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major	4 - Likely	3 - Moderate	4	3
4 - Likely	2 - Low	4	2	8	[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major	4 - Likely	3 - Moderate	4	3
3 - Possible	2 - Low	3	2	6	[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major	4 - Likely	3 - Moderate	4	3
3 - Possible	1 - Very Low	3	1	3	[2] Minor	4 - Likely	3 - Moderate	4	3	12	[4] Major	4 - Likely	3 - Moderate	4	3
2 - Unlikely	1 - Very Low	2	1	2	[2] Minor	3 - Possible	1 - Very Low	3	1	3	[2] Minor	3 - Possible	1 - Very Low	3	1
4 - Likely	3 - Moderate	4	3	12	[4] Major	4 - Likely	3 - Moderate	4	3	12	[4] Major	4 - Likely	4 - High	4	4
2 - Unlikely	1 - Very Low	2	1	2	[2] Minor	2 - Unlikely	1 - Very Low	2	1	2	[2] Minor	2 - Unlikely	1 - Very Low	2	1
3 - Possible	3 - Moderate	3	3	9	[3] Moderate	4 - Likely	4 - High	4	4	16	[4] Major	4 - Likely	4 - High	4	4
1 - Highly Unlikely	1 - Very Low	1	1	1	[1] Negligible	1 - Highly Unlikely	1 - Very Low	1	1	1	[1] Negligible	1 - Highly Unlikely	1 - Very Low	1	1
3 - Possible	2 - Low	3	2	6	[3] Moderate	3 - Possible	2 - Low	3	2	6	[3] Moderate	3 - Possible	2 - Low	3	2
1 - Highly Unlikely	1 - Very Low	1	1	1	[1] Negligible	2 - Unlikely	1 - Very Low	2	1	2	[2] Minor	2 - Unlikely	1 - Very Low	2	1
3 - Possible	1 - Very Low	3	1	3	[2] Minor	3 - Possible	1 - Very Low	3	1	3	[2] Minor	3 - Possible	1 - Very Low	3	1
4 - Likely	1 - Very Low	4	1	4	[3] Moderate	4 - Likely	1 - Very Low	4	1	4	[3] Moderate	4 - Likely	1 - Very Low	4	1
1 - Highly Unlikely	2 - Low	1	2	2	[2] Minor	2 - Unlikely	2 - Low	2	2	4	[3] Moderate	2 - Unlikely	2 - Low	2	2
3 - Possible	2 - Low	3	2	6	[3] Moderate	3 - Possible	4 - High	3	4	12	[4] Major	3 - Possible	4 - High	3	4

		End of century 2100 (4°C GWL)							Urgency scoring	
Risk score	Risk Rating (2100, 2C)	Likelihood	Magnitude	Likelihood score	Magnitude score	Risk score	Risk Rating (2100, 4C)	Rationale to scores (Based on inherent risk before measures to mitigate, adapt to, or manage the risk are introduced)	Urgency score	Timeframe for action
3	[2] Minor	3 - Possible	1 - Very Low	3	1	3	[2] Minor	More favourable conditions (e.g. warmer temperatures)presents the opportunity for more tourists to the region, which would increase demand on tourism infrastructure.		
2	[2] Minor	3 - Possible	1 - Very Low	3	1	3	[2] Minor	Extreme weather will become more frequent in the future, potentially creating challenges for some events and showgrounds where extreme events conincide, or where ground becomes unsuitable (e.g. waterlogged in the winter).		
8	[3] Moderate	5 - Very Likely	3 - Moderate	5	3	15	[4] Major	More frequent extreme weather will put pressure on businesses, with some struggling to cope or rebound when impacted, with SMEs more likely affected and at risk of failure.		
8	[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major	In the present day and , these impacts are largely driven by sewage systems and mismanagement rather than climate change. Climate change contributes to this risk but is not the sole determinant.		
9	[3] Moderate	4 - Likely	4 - High	4	4	16	[4] Major	Sea level change will increase the risk of tidal flooding / changing water tables in the southern area of North Yorkshire. Vulnerablility assessment estimates that ~3,068 ha of 'built up areas' are at risk of flooding (low, medium, high) from rivers and the sea at present, increasing to 3,258 ha under the RCP8.5 scenario for 2050s. This		
12	[4] Major	5 - Very Likely	4 - High	5	4	20	[5] Severe	Businesses at risk fo flooding will likely experience more intense or more frequent flood events in the future, causing damage and operational disruption. MR flags this as key for the Malton area where there is a trio of risks - river, surface, groundwater risks; this has been exacerbated by building flood defences that prevent water gettting back into the river (built in 2000s).		
9	[3] Moderate	3 - Possible	4 - High	3	4	12	[4] Major	Business and infrastructure near the coast will be susceptible to sea level change and coastal flood events, with the potential for the loss of some businesses. Vulnerability assessment estimates that ~3,068 ha of 'built up areas' are at risk of flooding (low, medium, high) from rivers and the sea at present, increasing to 3,258 ha under the RCP8.5 scenario for 2050s. This includes an increase in the level of risk, with those at medium or high risk of flooding increasing from 1,580 ha in present day to 2,476 ha in the future, a 57% increase. Vulnerability assessment estimates that erosion rates on the coast would be 13.48 ha by 2055 and 21.48 ha by 2105 under current climate conditions. Under the RCP8.5 Moderate SLR 70th percentile, this increases to 16.85 ha in 2055 and 36.92 ha in 2105.		
9	[3] Moderate	3 - Possible	3 - Moderate	3	3	9	[3] Moderate	Demand on water resources will increase, with potential impacts on water-intensive industries during periods of drought.		
9	[3] Moderate	3 - Possible	3 - Moderate	3	3	9	[3] Moderate	Water scarcity in the hot summer months could impact water parks in the region like Alpamare UK and North Yorkshire Water Park, as well as spa's and swimming pools when water use restrictions are being put in place. Facilities like these often reuse and recitrculate up to 97% of their water but restrictions have been implemented before in other European locations like Spain.		
4	[3] Moderate	3 - Possible	3 - Moderate	3	3	9	[3] Moderate	Sewage overflows during intense rainfall?		

6	[3] Moderate	4 - Likely	2 - Low	4	2	8	[3] Moderate	Business and infrastructure near the coast will be susceptible to sea level change and coastal flood events, causing damage and operational losses. Vulnerability assessment estimates that ~3,068 ha of 'built up areas' are at risk of flooding (low, medium, high) from		
9	[3] Moderate	4 - Likely	4 - High	4	4	16	[4] Major			
6	[3] Moderate	4 - Likely	2 - Low	4	2	8	[3] Moderate			
9	[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major	Supply chain disruption will likely become more impactful, although the exact nature of challenges will be variable by business and product.		
2	[2] Minor	3 - Possible	2 - Low	3	2	6	[3] Moderate	Increasing frequency of heatwave events could impact productivity		
2	[2] Minor	3 - Possible	2 - Low	3	2	6	[3] Moderate	Increasing frequency of extreme weather events could impact productivity; impact is reduced as impacts are likely to be temporary.		
12	[4] Major	4 - Likely	4 - High	4	4	16	[4] Major	Increasing risk to financial stability due to the scale of physical damage affecting assets, products, and services in the UK and abroad. In a 4°C warming scenario, CCRA3 highlighted that climate change impacts could be largely uninsurable due to the sheer scale and extent of damages. Note: scale of potential economic impact is difficult to calculate (would require knowledge of how many businesses are at risk from extreme weather and how much their premiums or capital costs have increased by).		
2	[2] Minor	3 - Possible	1 - Very Low	3	1	3	[2] Minor	The region will be impacted the same as other regions in the UK, driven by the strength of the finance sector. Direct impacts considered low.		
2	[2] Minor	3 - Possible	1 - Very Low	3	1	3	[2] Minor	The region will be impacted the same as other regions in the UK, driven by trade routes. Direct impacts considered low.		
1	[1] Negligible	1 - Highly Unlikely	1 - Very Low	1	1	1	[1] Negligible	The region will be impacted the same as other regions in the UK, driven by UK policy.		
12	[4] Major	5 - Very Likely	3 - Moderate	5	3	15	[4] Major	The risk of surface water flooding is expected to increase due to changes in rainfall intensity, and increased frequency of heavy rainfall events. The risk of surface water flooding is expected to increase due to changes in rainfall intensity, and increased		
16	[4] Major	5 - Very Likely	5 - Very High	5	5	25	[5] Severe	Many buildings are already at risk of flooding from rivers, so changes in rainfall totals and intensity will exacerbate this risk, with sea level change also increasing risk for some areas. Vulnerability assessment estimates that ~3,068 ha of 'built up areas' are at risk of flooding (low, medium, high) from rivers and the sea at present, increasing to 3,258 ha under the RCP8.5 scenario in the 2050s. This		
12	[4] Major	5 - Very Likely	4 - High	5	4	20	[5] Severe	Expected that sea level change will excerbate erosion risk. Vulnerability assessment estimates that erosion rates on the coast would be 13.48 ha by 2055 and 21.48 ha by 2105 under current climate conditions. Under the RCP8.5 Moderate SLR 70th percentile, this increases to 16.85 ha in 2055 and 36.92 ha in 2105.		
3	[2] Minor	3 - Possible	2 - Low	3	2	6	[3] Moderate	The risk to buidling fabric will continue to be applicable, especially as property condition deteriorates in the future, making them more vulnerable to extreme weather conditions. Subsidence caused by		
12	[4] Major	4 - Likely	4 - High	4	4	16	[4] Major	Changing sea levels will increase risk of inundation up the Humber, affecting properties and communities further upstream. Vulnerability assessment estimates that ~3,068 ha of 'built up areas'		
12	[4] Major	4 - Likely	4 - High	4	4	16	[4] Major	Incidents recorded in recent years (UK CCRA3) that show how climate related pressures can impact on heritage assets include waterlogging of archaeological sites, damp problems and water ingress issues at historic properties, changes in groundwater levels affecting historic gardens, new pest species threatening heritage		
16	[4] Major	5 - Very Likely	5 - Very High	5	5	25	[5] Severe	Cultural collections are in buildings that present difficulties to score, can easily be degraded by changing humidity and flooding and are "priceless" in value due to aggregate cultural and financial value.		
8	[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major	The risk of loss of greenspace is more likely to be driven by other factors, although there is a possibility that changing rainfall patterns and temperatures changes the suitability of species used in green spaces in the future. In York, recent floods have meant green spaces are unavailable for use sometimes for months at a time.		
6	[3] Moderate	3 - Possible	3 - Moderate	3	3	9	[3] Moderate			
3	[2] Minor	4 - Likely	1 - Very Low	4	1	4	[3] Moderate	There are relatively few prisons in the area, and higher temperatures are expected to be less severe than other parts of the country.		
3	[2] Minor	3 - Possible	2 - Low	3	2	6	[3] Moderate	An increase in the frequency and severity of extreme weather events will put increased pressure on emergency services. Ongoing research has linked increase warmer temperatures to violent crime		
6	[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major	The effects of climate hazards on education services are a health concern given the risks to people in those settings from hazards such as flooding or heat. Nationally, the risk is considered medium		
6	[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major	Accessibility to water for putting out wildfires can be a challenge in some areas, which will be exacerbated by changing rainfall patterns and have a greater consequence in a high GWL scenario due to the combination of increased wildfires and water scarcity.		
2	[2] Minor	4 - Likely	3 - Moderate	4	3	12	[4] Major	Scarcity of resources can create conflict and anti-social behaviour. As the climate changes and some resources become more limited, there is the potential that antisocial behaviour increases.		
6	[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major	The displacement of humans overseas due to climate change (e.g. loss of land from sea level rise, conflict for resources, extreme temperatures) will increase. This could result in people relocating to the UK. The YANY region also historically has lower experience of multi-cultural integration than other more diverse areas of the UK,		
10	[4] Major	5 - Very Likely	3 - Moderate	5	3	15	[4] Major	Extreme weather will become more frequent in the future, potentially creating challenges for some isolated communities reliant on public transport. Disruption to rail could prevent people coming into, or passing through the region. Large parts of North Yorkshire are already highly remote.		
16	[4] Major	5 - Very Likely	4 - High	5	4	20	[5] Severe	Climate change is likely to exacerbate disruptive events that impact on global agricultural production and food supply chains, including through droughts, storms and pests and diseases, with increased risks of disruptions associated with multiple production areas.		
2	[2] Minor	3 - Possible	1 - Very Low	3	1	3	[2] Minor	The region will be impacted the same as other regions in the UK, driven by food safety standards globally. Direct impacts considered low.		
16	[4] Major	5 - Very Likely	4 - High	5	4	20	[5] Severe	Increases in extreme weather patterns, variations in rainfall and changing annual temperatures will impact the occurrence and persistence of bacteria, viruses, parasites, harmful algae, fungi and		
16	[4] Major	5 - Very Likely	5 - Very High	5	5	25	[5] Severe	Risks to health and wellbeing from high temperatures, such as the 2003 and 2020 heatwaves, have already been observed. As the climate changes, it is expected that such events will become more		
6	[3] Moderate	3 - Possible	2 - Low	3	2	6	[3] Moderate	Outdoor air pollution is associated with tens of thousands of deaths per year in the UK, which pose a significant burden to the NHS. The main health-related hazard from outdoor air pollution is particulates		
8	[3] Moderate	5 - Very Likely	3 - Moderate	5	3	15	[4] Major	Climate anxiety' levels are currently increasing especially among young people. As the effects of climate change become more severe, this is likely to increase. Events such as floods result in		
3	[2] Minor	3 - Possible	2 - Low	3	2	6	[3] Moderate	Climate change may increase the risk of contamination of drinking water through increased runoff and flooding events that overwhelm current water treatment approaches. Risks to health from contact with contaminated bathing water (sea, lakes and rivers) and harmful algal blooms are also likely to increase with climate change.		
3	[2] Minor	4 - Likely	2 - Low	4	2	8	[3] Moderate	There is a risk to public health on public transport (e.g. Buses and Trains) from high temperatures, where onboard cooling is not sufficient. The risk will be greater in later century as the climate warms		
6	[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major	There have been changes in observed distributions and seasonal activity of some vectors across Europe including ticks (which transmit Lyme Disease), Culex and Aedes species of mosquitos.		
12	[4] Major	4 - Likely	4 - High	4	4	16	[4] Major	Some diseases transmitted by insects and ticks (vectors) are likely to change in prevalence in the future due to warmer temperatures contributing to a changing the distribution of the vector in the UK.		
6	[3] Moderate	3 - Possible	3 - Moderate	3	3	9	[3] Moderate	Energy generation, such as Drax Power Station, is at risk for tidal flooding. Drax is the largest renewable energy generator in the UK and supplies electricity to millions of homes. Drax is a significant		
3	[2] Minor	4 - Likely	1 - Very Low	4	1	4	[3] Moderate	Temporary disruption to gas network possible where staff cannot undertake duties due to the weather, or minor damage to the network causes supply challenges.		
6	[3] Moderate	3 - Possible	3 - Moderate	3	3	9	[3] Moderate	Delays to the gas network are possible where damage is sustained to key infrastructure. Vulnerability assessment estimates that ~3,068 ha of 'built up areas' are at risk of flooding (low, medium, high) from rivers and the sea at present, increasing to 3,258 ha		

12	[4] Major	5 - Very Likely	3 - Moderate	5	3	15	[4] Major	Vulnerabilities on one infrastructure network can cause problems on others, and energy infrastructure represents a significant part of		
8	[3] Moderate	5 - Very Likely	2 - Low	5	2	10	[4] Major	storms or high winds. Climate change also increases the chances of heavy thunderstorms and lighting strikes.		
12	[4] Major	4 - Likely	4 - High	4	4	16	[4] Major	Power outages are common, especially in snow events or due to storms or high winds. Damage can leave some areas out of power		
1	[1] Negligible	3 - Possible	2 - Low	3	2	6	[3] Moderate	summer, trebling by end of century under four degrees of warming.		
12	[4] Major	5 - Very Likely	3 - Moderate	5	3	15	[4] Major	Vulnerabilities on one infrastructure network can cause problems on others, and energy infrastructure represents a significant part of		
4	[3] Moderate	3 - Possible	2 - Low	3	2	6	[3] Moderate	Damage to infrastructure due to subsidence often occurs as a direct result of shrinking and swelling of clay soils due to changes in soil water content. This form of subsidence is regarded as the most		
9	[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major	Importance of updating the current coastal defence infrastructure to be able to withstand the changing climate, cliff instability etc. Many of the current defence is outdated and is not able to withstand the change. Adaptation assets updates are up to councils (majority) and EA. Here the political change can impact how the approach to		
4	[3] Moderate	3 - Possible	2 - Low	3	2	6	[3] Moderate	Increasing impact as more infrastructure is built out to sea and exacerbated by sea level change and changing intensity of storms.		
4	[3] Moderate	3 - Possible	2 - Low	3	2	6	[3] Moderate	Outage incidents to ICT and telecoms networks and services from weather-related incidents are considered minimal relative to other causes and controls are in place to ensure redundancy and minimise in the national ICT infrastructure system.		
4	[3] Moderate	2 - Unlikely	4 - High	2	4	8	[3] Moderate	Outage incidents to ICT and telecoms networks and services from weather-related incidents are considered minimal relative to other causes. Vulnerability assessment estimates that ~3,068 ha of 'built up areas' are at risk of flooding (low, medium, high) from rivers and the sea at present, increasing to 3,258 ha under the RCP8.5		
16	[4] Major	5 - Very Likely	4 - High	5	4	20	[5] Severe	Telecommunications are an integral part of this interconnectedness, with a particularly strong connection with the energy sector given that all ICT and telecoms systems are reliant on		
4	[3] Moderate	5 - Very Likely	2 - Low	5	2	10	[4] Major	Temporary disruption across the transport network will become increasingly more frequent and have a greater impact on the movement of people and goods and services.		
12	[4] Major	4 - Likely	3 - Moderate	4	3	12	[4] Major	Increasing risk of damage to major roads, effecting key routes. Vulnerability assessment estimates that ~1,520 km of roads and rail are at risk of flooding (low, medium, high) from rivers and the sea at		
4	[3] Moderate	5 - Very Likely	1 - Very Low	5	1	5	[3] Moderate	Increasing risk of damage to minor risks, effecting some local communities. Particular risk to areas that are only serviced by a single road. Vulnerability assessment estimates that ~1,520 km of		
12	[4] Major	4 - Likely	4 - High	4	4	16	[4] Major	Increasing risk of damage to rail, effecting key routes. Vulnerability assessment estimates that ~1,520 km of roads and rail are at risk of flooding (low, medium, high) from rivers and the sea at present,		
16	[4] Major	5 - Very Likely	4 - High	5	4	20	[5] Severe	Key infrastructure will be reliant on other networks, particularly electricity and communications. Matthew Robinson @ NYC believes that anecdotally, high wind events are increasing. A common problem flagged by NYC - there may be one access road or, from someone's personal experience, 4 or 5 routes but all high risk for flooding. Steps can be taken to prepare before having the extreme		
3	[2] Minor	3 - Possible	1 - Very Low	3	1	3	[2] Minor	Risk associated with extreme weather will increase risk of damage to assets, although a decrease in cold events under 4 degree warming scenario may lessen impacts from cold events.		
12	[4] Major	3 - Possible	3 - Moderate	3	3	9	[3] Moderate	Risk associated with extreme weather will increase risk of damage to assets, although a decrease in cold events under 4 degree warming scenario may lessen impacts from cold events.		
16	[4] Major	5 - Very Likely	4 - High	5	4	20	[5] Severe	The region is already dependent on sourcing water from other regions, and this will be further exacerbated as the climate changes and drought conditions become more common.		
12	[4] Major	5 - Very Likely	4 - High	5	4	20	[5] Severe	Increased demand will require more Temporary Use Bans, effecting water use for customers. Figures for the current dry period (spring 2025) show that it is the driest since 1852 (0.5% of average rainfall)		
2	[2] Minor	3 - Possible	1 - Very Low	3	1	3	[2] Minor	Yorkshire Water sources 20-25% of water from groundwater sources. Combining diversification of supply, with the existing research suggesting that abstraction management can prevent		
9	[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major	Cascading failures, such as loss of energy or comms networks, could effect the provision of water supply.		
6	[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major	Increased agricultural run-off, soil erosion and upland degradation (i.e. peatland) will result in raw water quality deterioration, linked to increased winter rainfall. Large amounts of surface water is stored in		
2	[2] Minor	2 - Unlikely	1 - Very Low	2	1	2	[2] Minor	Damage to local water infrastructure could leave some properties without a water supply. Vulnerability assessment estimates that ~3,068 ha of 'built up areas' are at risk of flooding (low, medium,		
4	[3] Moderate	5 - Very Likely	2 - Low	5	2	10	[4] Major	Increasing hot and dry spells will impact on water storage and effect some properties reliant on private abstraction. Private water supplies are most vulnerable to current and future climate hazards		
3	[2] Minor	3 - Possible	1 - Very Low	3	1	3	[2] Minor	Water quality and contamination is a challenge for some water sources, which will be effected by increased run-off and other climatic factors. Private water supplies are most vulnerable to		
2	[2] Minor	3 - Possible	1 - Very Low	3	1	3	[2] Minor	Some properties that source from groundwater reservoirs, particularly in the southern part of North Yorkshire, risk having supplies impacted by changing sea levels and water tables,		
4	[3] Moderate	3 - Possible	2 - Low	3	2	6	[3] Moderate	Extreme weather, including flood events, can disrupt operations and have adverse consequences on wastewater treatment.		
2	[2] Minor	3 - Possible	2 - Low	3	2	6	[3] Moderate	Damage to wastewater infrastructure may result in some customers having challenges with the disposal of wastewater. Vulnerability assessment estimates that ~3,068 ha of 'built up areas' are at risk of		
3	[2] Minor	3 - Possible	2 - Low	3	2	6	[3] Moderate	Landfill surface fires and deep-seated fires are a recurring issue in the UK. These fires are often linked to the improper disposal of lithium-ion batteries and other combustible materials together with		
12	[4] Major	5 - Very Likely	3 - Moderate	5	3	15	[4] Major	Already frequently happening and impacts will worsen with climate change unless infrastructure is updated.		
16	[4] Major	5 - Very Likely	4 - High	5	4	20	[5] Severe	New and emerging pests, diseases and INNS are important risks due to their negative effect on biodiversity, with potential economic impacts also. However, climate is a second order factor, providing		
12	[4] Major	5 - Very Likely	3 - Moderate	5	3	15	[4] Major	impacts on individual species and their distribution, as well as the composition and abundance of populations, with potential loss of some species in the YNY region. Expected climate changes including increasing temperatures, changes in rainfall and wildfire,		
6	[3] Moderate	4 - Likely	2 - Low	4	2	8	[3] Moderate	Inundation will effect some natural assets. Vulnerability assessment estimates that ~100,256 ha of 'habitats and priority habitats' are at risk of flooding (low, medium, high) from rivers and		
16	[4] Major	5 - Very Likely	5 - Very High	5	5	25	[5] Severe	CCRA3 notes that with the growing risk from wildfires due to climate change, there is a risk of serious damage and loss of wildlife and vegetation, and recovery can take decades. Several types of habitat		
12	[4] Major	5 - Very Likely	4 - High	5	4	20	[5] Severe	The risk of drought and water scarcity will become more likely as the climate changes, with the potential for droughts to increase in duration and severity.		
3	[2] Minor	4 - Likely	1 - Very Low	4	1	4	[3] Moderate	Risk of drainage/sewage networks flooding is likely to increase due to increased winter precipitation, however, impacts likely to be localised.		
6	[3] Moderate	3 - Possible	3 - Moderate	3	3	9	[3] Moderate	The Swale, Ure, Nidd and Upper Ouse the Wharfe and Lower Ouse catchment has a long legacy of mainly metal mining. Pollution from abandoned mines comes from two main sources, the underground		
3	[2] Minor	3 - Possible	1 - Very Low	3	1	3	[2] Minor	Rivers and their adjacent habitats naturally flood - damage to these ecosystems from natural flood levels is therefore likely to be immaterial. There is a risk that increased frequency or intensity of		
6	[3] Moderate	4 - Likely	2 - Low	4	2	8	[3] Moderate	Potential for negative effects on some parts of the region, with losses of fragmentation of sensitive habitats that can't naturally adapt to the speed of change.		
16	[4] Major	5 - Very Likely	5 - Very High	5	5	25	[5] Severe	CCRA3 found there is increasing evidence of the negative impacts of climate change on soil resources, often in combination with other factors, notably land use change. Heavier rainfall events, and		
12	[4] Major	5 - Very Likely	4 - High	5	4	20	[5] Severe	CCRA3 notes that peatland degradation and carbon losses will be exacerbated by runoff during intense rainfall events, in addition to increased oxidation from warmer and sometimes drier conditions.		
12	[4] Major	5 - Very Likely	3 - Moderate	5	3	15	[4] Major	The risk associated with changes to landscape character due to climate change is more difficult to measure vs other climate-related risks like loss of ecosystem services, etc. For example, what metric		
6	[3] Moderate	4 - Likely	2 - Low	4	2	8	[3] Moderate	Landslides happen from time to time, but generally have localised impacts. Vulnerability assessment estimates that erosion rates on the coast would be 13.48 ha by 2055 and 21.48 ha by 2105 under current climate conditions. Under the RCP8.5 Moderate SLR 70th percentile, this increases to 16.85 ha in 2055 and 36.92 ha in 2105. Limited data on risk of landslides in land such as quarries and mass movement events.		
9	[3] Moderate	4 - Likely	4 - High	4	4	16	[4] Major	Freshwater habitats and species are particularly vulnerable to reduced water availability and higher water temperatures due to climate change. North Yorkshire is home to some of the most northerly chalk streams in the UK, with notable examples including West Beck and Driffield Beck. Drought can cause reductions in invertebrate abundance and species turnover in plant communities, and higher temperatures can also directly or indirectly increase the possibility of water quality problems.		

9	[3] Moderate	3 - Possible	4 - High	3	4	12	[4] Major	New and emerging pests, diseases and Invasive non-native species (INNS) are important risks due to their negative effect on biodiversity, with potential economic impacts also. While climate change is just one factor affecting the arrival and possibly establishment of INNS, it is possible that some currently non-invasive, non-native species in the UK could become invasive with climate change. Over 130 INNS are currently present in freshwater in the UK, including topmouth gudgeon, water primrose, variable-leaved watermilfoil, ruddy duck, American bullfrog and floating pennywort.		
12	[4] Major	4 - Likely	4 - High	4	4	16	[4] Major	Sewage systems and storm overflows therein are known contributors to freshwater quality issues. Rain levels in winter are expected to increase while more extreme precipitation events are expected in general, which could overwhelm sewage systems and cause pollution. North Yorkshire is home to some of the most northerly chalk streams in the UK, with notable examples including West Beck and Driffield Beck.		
15	[4] Major	5 - Very Likely	4 - High	5	4	20	[5] Severe	Coastal habitats occur at the boundary of terrestrial and marine environments and include saltmarsh, machair, shingle, sand dunes and sea cliffs. Vulnerability assessment estimates that ~100,256 ha of 'habitats and priority habitats' are at risk of flooding (low, medium, high) from rivers and the sea at present, increasing to ~107,841 ha under the RCP8.5 scenario for 2050s. This includes an increase in the level of risk, with those at medium or high risk of flooding increasing from 76,822 ha in present day to 91,475 ha in the future, a 16% increase. Vulnerability assessment estimates that erosion rates on the coast would be 1,035 ha by 2055 and 1,157 ha by 2105 under current climate conditions. Under the RCP8.5 Moderate SLR 70th percentile, this increases to 1,089 ha in 2055 and 1,372 ha in 2105.		
12	[4] Major	5 - Very Likely	4 - High	5	4	20	[5] Severe	Marine ecosystems will be impacted by climate change through both direct and indirect effects on the distribution and abundance of species groups. This includes the effects of warming seas and ocean acidification on the entire marine food chain, from plankton to invertebrates, fish, seabirds, marine mammals and their habitats. There is the risk of large-scale extinctions from threshold effects like marine heatwaves or deoxygenation. Note, recent years have seen significant marine heatwaves in the UK region that may have significant impacts on marine ecosystems.		
9	[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major	The scientific consensus is that risks from pests, pathogens and INNS will increase in proportion to the degree of future additional marine warming but there is considerable uncertainty on how this will occur, due in a large part to the scale and complexity of the marine environment. In addition, many other stressors, including ocean acidification and changes in salinity levels due to stratification and modification of currents, are likely to continue, increasing the vulnerability of marine organisms to INNS or pathogens.		
12	[4] Major	4 - Likely	4 - High	4	4	16	[4] Major	Weather and climate variations will affect both land utilisation and forestry productivity from changing patterns of heat and cold, wetness and drought. Suitability for tree species is expected to change, affected by soil moisture deficits.		
12	[4] Major	4 - Likely	4 - High	4	4	16	[4] Major	Pests, pathogens and invasive non-native species (INNS) present serious risks to forest productivity, with consequences for livelihoods and businesses, and for the multiple ecosystem services that forests provide. Current management of forests limits the impacts at present, but the scale of climate change could see new threats emerging.		
12	[4] Major	5 - Very Likely	4 - High	5	4	20	[5] Severe	Flooding and extreme heat events are likely to damage urban tree populations, which provide important ecosystem and natural capital services within urban environments. It is likely that under a 4 degrees scenario, without adaptation, that extreme weather events could reduce urban tree populations and associated ecosystem services by 10 - 15% or more.		
12	[4] Major	4 - Likely	4 - High	4	4	16	[4] Major	Combined extreme heat and drought events in recent years have resulted in mass mortality events for young trees.		
3	[2] Minor	3 - Possible	2 - Low	3	2	6	[3] Moderate	Irrigation may be used on some systems, which will become more challenging if water scarcity increases and abstraction viability changes.		
16	[4] Major	5 - Very Likely	5 - Very High	5	5	25	[5] Severe	Weather hazards, including heat, cold, wetness and drought, affect the viability of agricultural land through its yields of crops and livestock, and hence productivity overall. Agricultural activities on		
2	[2] Minor	3 - Possible	2 - Low	3	2	6	[3] Moderate	Agriculture land effected by river flooding poses risk of damage or loss of crops, but generally localised impacts.		
16	[4] Major	4 - Likely	5 - Very High	4	5	20	[5] Severe	Pests, pathogens and invasive non-native species (INNS) present serious risks to agricultural productivity, with consequences for livelihoods and businesses. Large-scale outbreaks or invasions may		
1	[1] Negligible	2 - Unlikely	1 - Very Low	2	1	2	[2] Minor	If sea levels rise relative to fresh groundwater levels, saltwater can enter the aquifer and increase salinity in agricultural land. The risk is currently low at present and most likely to remain low in future		
6	[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major	Agricultural productivity will be effected by soil erosion, which will increase due to changing climate conditions and exacerbated by land management practices.		
2	[2] Minor	3 - Possible	1 - Very Low	3	1	3	[2] Minor	Productivity losses from fire could have high localised impacts.		
3	[2] Minor	3 - Possible	2 - Low	3	2	6	[3] Moderate	Land management practices can increase the risk of surface water run-off and exacerbate surface water flood risk. Assuming no change in the land management practice themselves, increased		
4	[3] Moderate	4 - Likely	1 - Very Low	4	1	4	[3] Moderate	Potential of isolated issues with footpaths, having localised and small impacts. Vulnerability assessment estimates that ~100,256 ha of 'habitats and priority habitats' are at risk of flooding (low, medium, high) from rivers and the sea at present, increasing to ~107,841 ha under the RCP8.5 scenario for 2050s. This includes an increase in the level of risk, with those at medium or high risk of		
4	[3] Moderate	3 - Possible	2 - Low	3	2	6	[3] Moderate	Erosion and increased extreme weather will effect some footpaths and rights of way in the region, unless maintained and adapted. Vulnerability assessment estimates that ~100,256 ha of 'habitats		
12	[4] Major	4 - Likely	4 - High	4	4	16	[4] Major	New and emerging pests, diseases and INNS are important risks due to their negative effect on biodiversity, with potential economic impacts also. However, climate is a second order factor, providing		

Risk detail					Source	
Context (locally specific detail)	Reference	Key Impacts	Example Impacts / Case Studies	Existing adaptation action in place / planned	Risk source	Risk source code
					Yorkshire & Humber Regional Adaptation Study 2009	N/A
					Yorkshire & Humber Regional Adaptation Study 2009	N/A
					Yorkshire & Humber Regional Adaptation Study 2009	N/A
					Risk validation workshop - Business & Industry	
Around 14,000 businesses at risk	Humber 2100+ https://consult.environment-agency.gov.uk/humber/strategyreview/				ADAS (steering group 1)	N/A
[Number of businesses at risk]					CCC CCRA3	B1
					NHS Gov Estates	BU2
[Number of businesses reliant on water for operations]					CCC CCRA3	B3
					Risk validation workshop - Business & Industry	
					Risk validation workshop - Business & Industry	

					CCC CCRA3	B2
					Risk validation workshop - Business & Industry	
					Risk validation workshop - Business & Industry	
					CCC CCRA3	B6
[Percent of offices with air conditioning]					CCC CCRA3	B5
					NHS Gov Estates	BU5
					CCC CCRA3	B4
					CCC CCRA3	ID8
					CCC CCRA3	ID7
					CCC CCRA3	ID5
[Number of homes in Flood zones]					CCC CCRA3	H3
Being on the confluence of the Rivers Ouse and Foss, York is well known	York CDP 2023				York CDP 2023	N/A
					ADAS	N/A
July 2022 saw temperatures of nearly 40°C in York and has raised quest	York CDP 2023				CCC CCRA3	H5
Over 200,000 properties in and around the Humber Estuary at risk of tid	Humber 2100+ https://consult.environment-agency.gov.uk/humber/strategyreview/				ADAS (steering group 1)	N/A
[Number of structures]					CCC CCRA3	H11
					York Sustainability Group	
Tree/shrub cover reduce extreme temperatures in built up areas, withou	York CDP 2023				York CDP 2023	N/A
					Risk validation workshop - Health, Communities and Built Environment	
[Number of prisons]					CCC CCRA3	H13
					Yorkshire & Humber Regional Adaptation Study 2009	N/A
[Number of education settings or number of people in education]					CCC CCRA3	H13
					Risk validation workshop - Health, Communities and Built Environment	
					Risk validation workshop - Health, Communities and Built Environment	
					CCC CCRA3	ID3
					Yorkshire & Humber Regional Adaptation Study 2009	N/A
Globally, extreme weather events such as temperature extremes, heavy	Global food supply chain faces 'significantly increasingly climate risks' - PA Future				CCC CCRA3	ID1
					CCC CCRA3	IT2
					CCC CCRA3	H9
[Population]					CCC CCRA3	H1
[Current typical air quality range]					CCC CCRA3	H7
					Risk validation workshop - Health, Communities and Built Environment	
					CCC CCRA3	H10a
					NHS Gov Estates	PB2
					CCC CCRA3	ID9
[Key diseases and prevalence numbers]					CCC CCRA3	H8
Drax power station at risk of tidal flooding	Humber 2100+ https://consult.environment-agency.gov.uk/humber/strategyreview/				ADAS (steering group 1)	N/A
					CCC CCRA3	
					CCC CCRA3	

					CCC CCRA3	
					CCC CCRA3	I3
					CCC CCRA3	
					CCC CCRA3	
					CCC CCRA3	
					CCC CCRA3	I7
					Risk validation workshop - Infrastructure	
					CCC CCRA3	I11
					CCC CCRA3	I2/I4
					CCC CCRA3	
					CCC CCRA3	
					CCC CCRA3	
					CCC CCRA3	
					CCC CCRA3	
					CCC CCRA3	
					CCC CCRA3	
			A large event, due to a power failure at our water treatment works in Doncaster, led to over 17,500 properties going without water for		CCC CCRA3	I2/I4
					CCC CCRA3	
During the summer of 2022 we faced the first drought in Yorkshire for m	Yorkshire Water, Climate Adaptation Report, published January 2025.				Yorkshire Water ARP4	
					Yorkshire Water ARP4	
YW sources ~25% of our raw water from groundwater sources, down to 20% in an average dry year. Combining this diversification of supply, with the existing research suggesting that abstraction management can prevent saline intrusion, the conclusion is that the risk of it occurr					Yorkshire Water ARP5	
					CCC CCRA3	
					Yorkshire Water ARP4	
					Risk validation workshop - Infrastructure	
					Yorkshire Water ARP4	
					Yorkshire Water ARP4	
YW sources ~25% of our raw water from groundwater sources, down to 20% in an average dry year. Combining this diversification of supply, with the existing research suggesting that abstraction management can prevent saline intrusion, the conclusion is that the risk of it occurr					Yorkshire Water ARP5	
					Yorkshire Water ARP4	
					Yorkshire Water ARP4	
					Risk validation workshop - Infrastructure	
Yorkshire Water to pay £40m for sewage overflow failures	https://news.sky.com/story/yorkshire-water-to-pay-40m-for-sewage-overflow-failures-13332521				Risk validation workshop - Infrastructure	
					CCC CCRA3	N2
					CCC CCRA3	N1
Internationally important habitats at risk	Humber 2100+ https://consult.environment-agency.gov.uk/humber/strategyreview/				Yorkshire & Humber Regional Adaptation Study 2009 (adapted)	N/A
[Number of large wildfires in the region]				North Yorkshire Wildfire Group (NYWG) - funding from Yorkshire Water for offroad ve	National Risk Register 2025 / YNY Community Risk Register (Kirsty Lowe)	R66
					Yorkshire & Humber Regional Adaptation Study 2009	N/A
					Yorkshire & Humber Regional Adaptation Study 2009 (adapted)	N/A
					Yorkshire & Humber Regional Adaptation Study 2009	N/A
There are 6 main river catchments in the Yorkshire Dales National Park - the Swale, the Ure, the Wharfe, the Aire, the Ribble and the Lune. The North York Moors are drained by 3 main river catchments, the Esk,	https://www.yorkshiredales.org.uk/about/wildlife/habitats/freshwater/rivers-and-streams/ https://www.northyorkmoors.org.uk/wildlife-and-				National Risk Register 2025 / YNY Community Risk Register (Kirsty Lowe)	R75b
With the reduction of these species it also provides problems for the hu	York CDP 2023				Yorkshire & Humber Regional Adaptation Study 2009 AND York CDP 2023	N/A
Seasonal aridity in York is also catastrophic for soil health. York is on the	York CDP 2023				CCC CCRA3	N4
					CCC CCRA3	N5
					CCC CCRA3	N18
					Yorkshire & Humber Regional Adaptation Study 2009	N/A
					CCC CCRA3	N11

					CCC CCRA3	N12
					Risk validation workshop - Natural Environment and Farming	
					National Risk Register 2025 / YNY Community Risk Register (Kirsty Lowe)	R75a
			https://www.theguardian.com/environment/2025/jun/09/sea-acidity-ecosystems-ocean-acidification-planetary-health-scientists		CCC CCRA3	N14
					CCC CCRA3	N16
					CCC CCRA3	N6
					CCC CCRA3	N8
					Risk validation workshop - Natural Environment and Farming	
					Risk validation workshop - Natural Environment and Farming	
					Yorkshire & Humber Regional Adaptation Study 2009	N/A
					CCC CCRA3	N6
					Yorkshire & Humber Regional Adaptation Study 2009 (adapted)	N/A
Increase in crop diseases e.g. clubroot in oilseed rape, more prevalent i	Country Land & Business Association (CLA) ~Emily Richardson				CCC CCRA3	N7
					CCC CCRA3	N10
					Yorkshire & Humber Regional Adaptation Study 2009	N/A
Wildfires are becoming an annual issue especially on the moors (drier l	Country Land & Business Association (CLA) ~Emily Richardson				ADAS	N/A
Slow, inefficient movement of water under bridges affecting agricultural	Country Land & Business Association (CLA) ~Emily Richardson				NHS Gov Estates	NE8
					Risk validation workshop - Natural Environment and Farming	
					Risk validation workshop - Natural Environment and Farming	
					Yorkshire & Humber Regional Adaptation Study 2009	N/A

Opportunity detail	
Opportunity ID#	Opportunity description
1	Opportunities for **tourism** from hotter, drier summers and milder winters
2	Opportunity for increases in eco-tourism related to new species moving to the region as a result of c
3	Opportunities for **business** from changes in demand for goods and services due to shifting weather
4	Opportunities for the **business** sector if climate change effects are more severe in other regions of t
5	Opportunities for **advanced manufacturing and Research and Development**
6	International dimensions: Benefits from changing winter **business energy demand** (e.g. reduction i
7	Benefits for **health and wellbeing** from milder winters, noting that NHS climate modelling indicates that future reductions in cold-related fatality events due to milder winters will be outweighed by increases in heat stress-related deaths.
8	Opportunities for water treatment and so **water quality** from changing rainfall patterns and temperatures (e.g. nature-based solutions)
9	International dimensions: Benefits from changing winter **household energy demand** (e.g. reductior
10	Opportunities for YNY region **food availability and exports** from climate impacts overseas
11	Opportunities to YNY region from **climate-related international human mobility**
12	Benefits to **terrestrial habitats** from new species colonisation
13	Opportunities to enhance **natural carbon stores, carbon sequestration and GHG emissions** due t
14	Benefits to **natural carbon stores and carbon sequestration** from changing climatic conditions, in
15	Opportunities for **agricultural productivity** from changing climatic conditions (including temperatu
16	Opportunities for **fisheries and aquaculture productivity** from changing climatic conditions (inclu
17	Opportunities for **forestry productivity** from changing climatic conditions (including temperature c
18	Benefits to marine and **coastal species and habitats** due to changing sea levels
19	Benefits from climate change to **landscape character** relating to features integral to Y&NY
20	Opportunities to **diversify the agricultural economy**
21	Opportunities for **greater tree cover** and woodland expansion

Risk Themes		Regions affected								Climate Projections | North Yorkshire |
UK CCRA3 Chapter	CCC Adaptation Monitoring System	Protected Landscape Thematic Area	York and North Yorkshire	North Yorkshire Region	City of York Region	Yorkshire Dales National	North York Moors Nationa	Nidderdale National Lan	Howardian Hills Nationa	Variable / Indicator / Proxy
Business and Indus	Business	Recreation & touris	ateri	ateri	ateri	ateri	ateri	ateri	ateri	Summer average te
Business and Indus	Business	Recreation & touris	mate	ateri	mate	ateri	ateri	mate	mate	N/A
Business and Indus	Business	Recreation & touris	ateri	ateri	ateri	ateri	ateri	ateri	ateri	N/A
Business and Indus	Business	N/A	ateri	ateri	ateri	mate	mate	mate	mate	N/A
Business and Indus	Business	Community & econ	ateri	ateri	ateri	mate	N/A	mate	mate	N/A
Business and Indus	Business	Built environment	ateri	ateri	ateri	ateri	ateri	ateri	ateri	Heating degree day
Health, Communiti	Health	Built environment	ateri	ateri	ateri	ateri	ateri	ateri	ateri	Winter minimum te
Health, Communiti	Water supply	Community & econ	ateri	ateri	ateri	ateri	ateri	mate	mate	N/A
International Dimer	Buildings	Built environment	ateri	ateri	ateri	ateri	ateri	ateri	ateri	Heating degree day
International Dimer	Food security	Farming forestry & l	ateri	ateri	mate	ateri	mate	mate	mate	N/A
International Dimer	Community prepare	Community & econ	mate	ateri	ateri	mate	mate	mate	mate	N/A
Natural Environmer	Nature	Natural environmer	ateri	ateri	ateri	ateri	mate	ateri	ateri	Annual average tem
Natural Environmer	Nature	Natural environmer	ateri	ateri	ateri	ateri	ateri	ateri	ateri	Winter precipitatio
Natural Environmer	Nature	Natural environmer	ateri	ateri	ateri	ateri	ateri	ateri	ateri	N/A
Natural Environmer	Working lands and s	Farming forestry & l	ateri	ateri	ateri	ateri	ateri	ateri	ateri	Growing degree day
Natural Environmer	Working lands and s	Farming forestry & l	ateri	ateri	N/A	N/A	ateri	N/A	N/A	N/A
Natural Environmer	Working lands and s	Farming forestry & l	ateri	ateri	N/A	ateri	ateri	ateri	ateri	N/A
Natural Environmer	Nature	Natural environmer	ateri	ateri	N/A	N/A	mate	N/A	N/A	Sea level anomaly
Natural Environmer	Nature	Landscape	mate	ateri	N/A	ateri	mate	mate	mate	N/A
Natural Environmer	Working lands and s	Farming forestry & l	ateri	ateri	mate	ateri	ateri	ateri	ateri	N/A
Natural Environmer	Nature	Landscape	ateri	ateri	ateri	ateri	ateri	ateri	ateri	N/A

			Pr es en				
1.5°C GWL (Paris Agreement)	2.0°C GWL (prepare)	4.0°C GWL (assess risks)	Likelihood	Magnitude	Likelihood score	Magnitude score	Risk score
+1.3	+1.9	+3.9	2 -	1 -	2	1	2
			3 -	1 -	3	1	3
			2 -	1 -	2	1	2
			1 -	2 -	1	2	2
			2 -	1 -	2	1	2
2371	2230	1824	2 -	1 -	2	1	2
+2.7	+3.2	+5.7	2 -	1 -	2	1	2
			3 -	1 -	3	1	3
2371	2230	1824	2 -	1 -	2	1	2
			1 -	1 -	1	1	1
			1 -	1 -	1	1	1
+1.1	+1.6	+3.2	1 -	2 -	1	2	2
+3	+5	+13	2 -	1 -	2	1	2
			1 -	1 -	1	1	1
1741	1883	2367	2 -	2 -	2	2	4
			1 -	1 -	1	1	1
			2 -	2 -	2	2	4
+18	+32	+68	2 -	1 -	2	1	2
			3 -	1 -	3	1	3
			3 -	2 -	3	2	6
			2 -	2 -	2	2	4

	Mid century 2050s (2°C GWL)	End of century 2100 (2°C GWL)	End of century 2100 (4°C GWL)		
Risk Rating (2030, 1.5C)	**Risk Rating (2050, 2C)**	**Risk Rating (2100, 2C)**	**Risk Rating (2100, 4C)**	**Rationale to scores** (Based on benefit or opportunity if measures to adapt or capitalise on the opportunity are introduced)	**Context (locally specific detail)**
[2] Minor	[3] Moderate	[3] Moderate	[4] Major	More favourable climate conditions in the region, cor	Hotter temperatures extend the high season for tourism. (
[2] Minor	[3] Moderate	[3] Moderate	[3] Moderate	The level of economic uplift from climate induced eco-tourism is unknown, but new species will likely enter the	
[2] Minor	[2] Minor	[2] Minor	[2] Minor	As the climate changes, there will likely be changes i	Data from 2010 to today: - Increase in pedestrians walkin
[2] Minor	[3] Moderate	[3] Moderate	[3] Moderate		
[2] Minor	[2] Minor	[2] Minor	[2] Minor	Potential opportunity for R&D, although the scale of t	Some major manufacturing supply chain opportunities ex
[2] Minor	[3] Moderate	[3] Moderate	[4] Major	Milder winters will become more common as the climate warms, although the direct benefits on health and wellbeing likely small. Jessica Marshall at NYC flagged that NHS modelling indicates the number of cold-related deaths is not expected to decrease significantly, while heat-related deaths are expected to increase significantly.	North Yorkshire- high proportion of 65+, south of the coun
[2] Minor	[2] Minor	[2] Minor	[3] Moderate	Opportunity for nature-based solutions will continue to be an option, with different types of solution likely as the climate changes, which could support the enhancement of water quality.	Yorkshire Water have over 100 reservoirs
[2] Minor	[2] Minor	[2] Minor	[2] Minor	Warmer winters already linked to reduced natural gas heating across the UK.	
[2] Minor	[2] Minor	[3] Moderate	[4] Major	Milder winters will reduce heating demand. Heating c	2023: Yorkshire and the Humber was the region with the h
[1] Negligible	[1] Negligible	[2] Minor	[3] Moderate	As climate change impacts key food producing region	YNY produces 20% of the UK's agrifood from farming and
[1] Negligible	[1] Negligible	[2] Minor	[2] Minor	As climate change impacts communities globally, th	In 2011 census 12% of the North Yorkshire population ide
[2] Minor	[3] Moderate	[3] Moderate	[3] Moderate	As the climate warms, there will be a natural migratio	Species moving to more northern regions as temperature
[2] Minor	[2] Minor	[2] Minor	[2] Minor	Changes in the climate, such as changing rainfall pat	Less depleted soils can sequester more carbon. Clay soil
[1] Negligible	[2] Minor	[2] Minor	[2] Minor	Changes in the climate, such as changing rainfall pat	Less depleted soils can sequester more carbon. Clay soil
[3] Moderate	[3] Moderate	[3] Moderate	[4] Major	As the climate warms, there will be a continued exter	YNY produces 20% of the UK's agrifood from farming and
[1] Negligible	[2] Minor	[2] Minor	[2] Minor	Warming oceans and waters may provided opportuni	Annual catch value over £16 million across whole Yorksh
[3] Moderate	[3] Moderate	[3] Moderate	[3] Moderate	Warmer temperatures may enhance tree growth and	Forestry England Forest Plans cover ~21,000 hectares ac
[2] Minor	[2] Minor	[2] Minor	[2] Minor	Warming oceans and coastal waters may enable som	Habitats of the NY coast: coastal grassland & woodland v
[2] Minor	[2] Minor	[2] Minor	[2] Minor	A range of climate impacts and adaptation actions m	YNY - predominantly rural, upland areas of open heathlan
[3] Moderate	[3] Moderate	[3] Moderate	[4] Major	A warming climate will present increasing opportunit	YNY produces 20% of the UK's agrifood from farming and
[3] Moderate	[3] Moderate	[3] Moderate	[3] Moderate	A changing climate may support an opportunity for in	York - In 2022 York's tree canopy cover was 10.8%.North Y

Opportunity detail				Source	
Reference	**Key Benefits**	**Example Impacts**	**Existing adaptation action /**	**Opportunity source**	**Opportunity source code**
https://www.visitb	More visitors per year, more income to the local businesses and authorities.			N/A	N/A
area as a result of climate change which may increase eco-tourism benefits.					
https://data.yorkop	More income to the local businesses and authorities.Opportunity and space for more start-ups			CCRA3	B7
https://yorknorthyorks-ca.gov.uk/wp-content/uploads/2024/01/York-and-North-Yorkshire-Priority-Sector-Research-Re				Yorkshire & Hu	N/A
https://hub.datano	Milder winters could lead to less hospitalisations within vulnerable population gorups, less excess v			CCRA3	H2
https://www.yorkshirewater.com/education/water-safety/				Yorkshire & Hu	N/A
https://www.utility	Less money per household spend on heating, less GHG emissions linked to energy used for heating.			CCRA3	H6
https://yorknorthyorks-ca.gov.uk/agri-tech-and-industrial-biotechnology/				CCRA3	ID2
https://humberand				CCRA3	ID3
https://www.ywt.or	Financial and biodiversity gains from the use of more durable, quickly g		https://www.ywt.org.uk/blog	CCRA3	N3
s around north Yorkshire- key carbon sink.				CCRA3	N5
https://www.sciencedirect.com/science/article/pii/S0167198723003		https://www.yorkshirewater.com/news-media/		CCRA3	N5
https://yorknorthyorks-ca.gov.uk/agri-tech-and-industrial-biotechnology/				CCRA3	N6
https://fishingnews.co.uk/features/shellfish-catches-lead-the-way-for-yorkshire-harbours/			https://www.visitwhitby.com	N/A	N/A
https://www.forest	Improved conditions for growth			CCRA3	N9
https://www.northyorkmoors.org.uk/planning/landscape-character-assessment/LCT-10-profile-FINAL-December-202				CCRA3	N17
https://www.northyorks.gov.uk/environment-and-neighbourhoods/conservation/describing-and-understanding-our-lan				CCRA3	N18
https://yorknorthyorks-ca.gov.uk/agri-tech-and-industrial-biotechnology/				Yorkshire & Hu	N/A
https://www.york.gov.uk/YorkGreenStreets	https://www.northyorkmoors.org.uk/wildlife-an		York Green Streets: The coun	Yorkshire & Hu	N/A

Risk description			
Project risk ID (AR)	**Hazard**	**Receptor affected**	**Authority operation affected**
001	Cascading	Assets	Multiple operations/services
002	Cascading	Assets	Multiple operations/services
003	Low rainfall - drought / water scarcity	Assets	Multiple operations/services
004	High rainfall - river flooding	Assets	Multiple operations/services
005	High rainfall - surface water flooding	Assets	Multiple operations/services
006	High rainfall - groundwater flooding	Assets	Multiple operations/services
007	Estuary inundation	Assets	Multiple operations/services
008	Snowfall	Assets	Multiple operations/services
009	Wildfire	Assets	Multiple operations/services
010	Coastal erosion	Assets	Multiple operations/services
011	Coastal inundation and loss of land	Assets	Multiple operations/services
012	Hot days (30C+)	Assets	Multiple operations/services
013	Coldwaves (3+ days below 0C)	Assets	Multiple operations/services
014	Freeze-thaw conditions	Assets	Multiple operations/services
015	Storms and high winds	Assets	Multiple operations/services
016	Storm surge and coastal flooding	Assets	Multiple operations/services
017	Mass movement - landslides/rockfalls	Assets	Multiple operations/services
018	Mass movement - subsidence	Assets	Multiple operations/services
019	Cascading	Operations/S	Council Services
020	Storms and high winds	Operations/S	Council Services
021	Snowfall	Operations/S	Council Services
022	Wildfire	Operations/S	Council Services
023	Drought / water scarcity	Operations/S	Council Services
024	High rainfall / flooding	Operations/S	Council Services
025	Storm surge and coastal flooding	Operations/S	Council Services
026	Cascading	Operations/S	Council Services
027	Fog	Operations/S	Council Services
029	Storms and high winds	Operations/S	Council Services
030	Snowfall	Operations/S	Council Services
031	Hot days (30C+)	Operations/S	Council Services
032	Warm summer days (25C+)	Operations/S	Council Services
033	Multiple hazards	Operations/S	Council Services
034	Multiple hazards	Operations/S	Council Services
035	Multiple hazards	Operations/S	Council Services
036	Storms and high winds	Operations/S	Council Services
037	Multiple hazards	Operations/S	Council Services
038	Multiple hazards	Operations/S	Council Services
039	Multiple hazards	Operations/S	Council Services
040	Multiple hazards	Operations/S	Council Services
041	Multiple hazards	Operations/S	Council Services
042	Flooding	Operations/S	Council Services

043	Multiple hazards	Operations/S	Council Services
044	Wildfire	Operations/S	Council Services
045	Warm summer days (25C+)	Operations/S	Council Services
046	Multiple hazards	Operations/S	Multiple operations/services
047	Hotter, drier summers	Operations/S	Multiple operations/services
048	Heatwaves (3 days above 25C)	People	Multiple operations/services
049	Hot days (30C+)	People	Multiple operations/services
050	Extreme heat days (35C+)	People	Multiple operations/services
051	Tropical nights (20C+)	People	Multiple operations/services
052	Cold days	People	Multiple operations/services
053	Coldwaves (3+ days below 0C)	People	Multiple operations/services
054	Storms and high winds	People	Multiple operations/services
055	Storms and high winds	People	Multiple operations/services
056	Snowfall / cold days	People	Multiple operations/services
057	High rainfall - river flooding	People	Multiple operations/services
058	Wetter winters	People	Multiple operations/services
059	High rainfall - surface water flooding	People	Multiple operations/services
060	High rainfall - groundwater flooding	People	Multiple operations/services
061	Mass movement - landslides/rockfalls	People	Multiple operations/services
062	Mass movement - landslides/rockfalls	People	Multiple operations/services
063	Wildfire	People	Multiple operations/services
064	Storm surge and coastal flooding	People	Multiple operations/services
065	Cascading	People	Multiple operations/services
066	Changing seasonality	People	Multiple operations/services
067	Cascading	Protected Lar	Protected Landscapes
068	Storms and high winds	Protected Lar	Protected Landscapes
069	Snowfall	Protected Lar	Protected Landscapes
070	Wildfire	Protected Lar	Protected Landscapes
071	High rainfall - river flooding	Protected Lar	Protected Landscapes
072	Storm surge and coastal flooding	Protected Lar	Protected Landscapes
073	Hot days (30C+)	Protected Lar	Protected Landscapes
074	Sea level change	Protected Lar	Protected Landscapes
075	Multiple hazards	Protected Lar	Protected Landscapes

Authority operation descripti
N/A
N/A
N/A
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All Council services
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All Council services, including
All Council services; Amenity
Amenity management includi
Amenity management includi
Amenity management includi
Central desk-based services i
Council services
Council services
Council services
Council services
Council services
Education, public health, soci
Education, Social Care
Emergency services
Healthcare services
Planning within Local Authorit

Transport services
Waste services including was
Waste services including was
All organisations
All organisations
N/A
N/A
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Day-to-day maintenance with

Risk description
Damage to buildings, infrastructure or assets from compound hazards (e.g. river flooding and surface water floodi
Damage to buildings, infrastructure or assets from cascading impacts (e.g. changing water tables)
Damage to buildings, infrastructure or assets from drought conditions
Damage to buildings, infrastructure or assets from flooding (fluvial)
Damage to buildings, infrastructure or assets from flooding (surface water)
Damage to buildings, infrastructure or assets from flooding (groundwater)
Damage to buildings, infrastructure or assets from inundation from the Humber / changing water tables
Damage to buildings, infrastructure or assets from heavy snowfall (not risk of snowfall in general)
Damage to buildings, infrastructure or assets from wildfire damage
Damage to buildings, infrastructure or assets from coastal erosion
Loss of buildings, infrastructure or assets from sea level change
Damage to buildings, infrastructure or assets from high temperatures, including melting of materials such as road
Damage to buildings, infrastructure or assets from extreme cold (e.g. pipes freeze)
Damage to buildings, infrastructure or assets from freeze-thaw
Damage to buildings, infrastructure or assets from storms and high winds
Damage to buildings, infrastructure or assets from flooding (coastal)
Damage to buildings, infrastructure or assets from landslides or mass movement of soil
Damage to buildings, infrastructure or assets from subsidence
Risk of disruption to Council services from acute cascading risks
Risk of disruption to Council services from staff (office and operational) unable to commute or travel into the work
Risk of disruption to Council services from staff (office and operational) unable to commute or travel due to heavy
Risk of disruption to Council services from wildfire
Risk of disruption to Council services from drought / water scarcity
Risk of disruption to Council services from major flood events (river, surface water, groundwater)
Risk to Council services from storm surge and coastal flooding
Risk of disruption to Council services from chronic cascading risks
Risk of disruption to Council services from staff unable to commute, travel or work safely due to fog
Risk of unsafe working conditions to undertake to conduct normal works due to storms
Risk of unsafe working conditions to undertake to conduct normal works (e.g. waste services)
Risk of disruption to Council services from staff unable to work safely outside in high temperatures
Risk of service disruption due to changes in office-based staff wellbeing and productivity from uncomfortable con
Risk to demands on Council resources from climate-induced mass migration (domestic/international)
Risk to food supply chains (e.g. providing catering into schools, carehomes)
Risk to council services / operations from disruptions to non-food global supply chains
Risk to public health from (Council owned) trees falling over resulting in liability
Risk of loss of income from Tax, Business Rates (e.g. flood events where buildings unoccupied for several months
Risks of disruption or changes to requirements of some services (social care, public health, education, child servi
Risk to provision of home to school/ social care settings transport (responsible for getting children to and from sch
Risk of increased anti-social behaviour associated with extreme weather events (looting in floods, conflict in heat
Risk to demands on Council public health services from spread of diseases
Risk of challenges to Council planning services from flooding (river, surface, groundwater, coastal) - i.e., increase

Risk to provision of Council run public transport from extreme weather events
Risk of air pollution and associated health and safety risks from wildfires at waste disposal sites
Risk of air pollution and odour from waste disposal sites and associated health risks
Risk of increased insurance costs as a result of an increased percieved risk of damage
Risk of higher demands on car parks and visitor centres associated with increased tourism
Risk of heat stress from heatwaves (days above 25C+) to site staff, and office and home-based staff (due to lack o
Risk of moderate heat stress (30C+) to site staff, and office and home-based staff (due to lack of air conditioning)
Risk of strong/very strong heat stress (35C+) to site staff, and office and home-based staff (due to lack of air cond
Risk to health and discomfort due to tropical nights (above 20C)
Risk to health to non-office staff from temporary cold conditions
Risk to health to non-office staff from prolonged cold conditions
Risk of injury from incidence of flying debris and fallen trees
Risk of road traffic incidence for staff commuting or travelling related to storms and high winds
Risk of road traffic incidence for staff commuting or travelling related to snow or icy conditions
Direct risk to health of staff from river flash flood events
Risk to staff health from waterlogged wetlands/peatlands due to wetter winters; stakeholders noted these risks ca
Direct risk to health of staff from surface water flash flood events
Direct risk to health of staff from groundwater flood events
Risk of road traffic incidence for staff commuting or travelling from rockfalls (sheer rock faces) and landslides
Risk to staff health from rock falls (cliffs, quarries) associated with extreme weather (both inland and coastal) and
Risk to staff health from wildfires (e.g. smoke inhalation)
Risk to staff working near the coast from coastal flood events
Risk to staff mental health from extreme weather events
Risk to staff health from increasing prevalence of diseases due to warmer temperatures (e.g. tick-borne), wildlife (
Risk to Protected Landscape services from cascading risks
Risk to Protected Landscape services from storms and high winds
Risk to Protected Landscape services from snowfall
Risk to Protected Landscape services from wildfire
Risk of disruption to Protected Landscape services from major flood events (river, surface water, groundwater)
Risk to Protected Landscape services from coastal storm surges and coastal flooding
Risk to Protected Landscape services from hot days (30C+)
Increased demand on Protected Landscape services due to increased planning demand due to sea level change a
Risk to Protected Landscape services from a changing landscape character (conflict between preserve or adapt w

Organisations affected				
York and North Yorkshire Combined Authority	North Yorkshire Council	City of York Council	Yorkshire Dales National Park Authority	North York Moors National Park Authority
Material	Material	Material	Material	Material
Material	Material	Material	Material	Material
Material	Material	Material	Material	Immaterial
Material	Material	Material	Material	Material
Material	Material	Material	Material	Material
Material	Material	Material	Material	Immaterial
Material	Material	Material	Immaterial	Immaterial
Material	Material	Material	Material	Immaterial
Material	Material	Material	Immaterial	Material
Material	Material	N/A	N/A	N/A
Material	Material	N/A	N/A	N/A
Material	Material	Material	Material	Material
Material	Material	Material	Material	Material
Material	Material	Material	Material	Material
Material	Material	Material	Material	Material
Material	Material	N/A	N/A	N/A
Material	Material	Immaterial	Material	Immaterial
Material	Material	Material	Material	Immaterial
Material	Material	Material	N/A	N/A
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Material	Material	Material	N/A	N/A
Material	Material	Material	N/A	N/A
Material	Material	N/A	N/A	N/A
Material	Material	Material	N/A	N/A
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Material	Material	Material	N/A	N/A
Immaterial	Material	Material	N/A	N/A
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Immaterial	Material	Material	N/A	N/A
Material	Material	Material	N/A	N/A
N/A	Material	Material	N/A	N/A
Immaterial	Material	Material	N/A	N/A
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Immaterial	Material	Material	N/A	N/A
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Immaterial	Material	N/A	Material	Material
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N/A	Material	N/A	N/A	Immaterial
N/A	Material	N/A	Material	Material
N/A	Material	N/A	N/A	Material
Material	Material	N/A	Material	Material

Nidderdale National Landscape Authority	Howardian Hills National Landscape Authority
Immaterial	Material
Immaterial	Material
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Immaterial	Immaterial
Immaterial	Material
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Material	Material

Climate Projections | North Yorkshire | Median (50th perce	
Variable / Indicator / Proxy	**1.5°C GWL (Paris Agreement)**
N/A	
N/A	
Summer precipitation rate (%)	+2
Winter precipitation rate (%)	+3
Winter precipitation rate (%)	+3
Winter precipitation rate (%)	+3
Sea level anomaly (cm) compared to 1981 - 2000 average	+18
Winter minimum temperature (°C change)	+2.7
Met Office Fire Danger (Days/Year)	13
Sea level anomaly (cm) compared to 1981 - 2000 average	+18
Sea level anomaly (cm) compared to 1981 - 2000 average	+18
Number of Hot summer days (daily maximum temperature >30°C)	1
Icing days (daily maximum temperature <0°C)	1
Number of Frost days (daily minimum temperature <0°C)	43
N/A	
N/A	
N/A	
N/A	
N/A	
N/A	
Winter minimum temperature (°C change)	+2.7
Met Office Fire Danger (Days/Year)	13
Summer precipitation rate (%)	+2
Winter precipitation rate (%)	+3
N/A	
N/A	
N/A	
N/A	
Winter minimum temperature (°C change)	+2.7
Number of Hot summer days (daily maximum temperature >30°C)	1
Number of Summer days (daily maximum temperature >25°C)	12
N/A	
N/A	
N/A	
N/A	
N/A	
N/A	
N/A	
N/A	
N/A	
Winter precipitation rate (%)	+3

N/A	
Met Office Fire Danger (Days/Year)	13
Number of Summer days (daily maximum temperature >25°C)	12
N/A	
Number of Summer days (daily maximum temperature >25°C)	12
Number of Summer days (daily maximum temperature >25°C)	12
Number of Hot summer days (daily maximum temperature >30°C)	1
N/A	0
Number of Tropical nights (daily minimum temperature >20°C)	0
Number of Frost days (daily minimum temperature <0°C)	43
Icing days (daily maximum temperature <0°C)	1
N/A	
N/A	
Winter minimum temperature (°C change)	+2.7
Winter precipitation rate (%)	+3
Winter precipitation rate (%)	+3
Winter precipitation rate (%)	+3
Winter precipitation rate (%)	+3
N/A	
N/A	
Met Office Fire Danger (Days/Year)	13
N/A	
N/A	
N/A	
N/A	
N/A	
Winter minimum temperature (°C change)	+2.7
Met Office Fire Danger (Days/Year)	13
Winter precipitation rate (%)	+3
N/A	
Number of Hot summer days (daily maximum temperature >30°C)	1
Sea level anomaly (cm) compared to 1981 - 2000 average	+18
N/A	

ntile)		Present day 2030s (1.5°C GWL)			
2.0°C GWL (prepare)	4.0°C GWL (assess risks)	Likelihood	Magnitude	Likelihood score	Magnitude score
		3 - Possible	3 - Moderate	3	3
		1 - Highly Unlikely	3 - Moderate	1	3
-6	-25	2 - Unlikely	2 - Low	2	2
+5	+13	3 - Possible	4 - High	3	4
+5	+13	3 - Possible	3 - Moderate	3	3
+5	+13	1 - Highly Unlikely	2 - Low	1	2
+32	+68	1 - Highly Unlikely	2 - Low	1	2
+3.2	+5.7	2 - Unlikely	2 - Low	2	2
16	31	3 - Possible	2 - Low	3	2
+32	+68	3 - Possible	1 - Very Low	3	1
+32	+68	2 - Unlikely	2 - Low	2	2
1	7	3 - Possible	3 - Moderate	3	3
1	0	3 - Possible	2 - Low	3	2
35	12	2 - Unlikely	2 - Low	2	2
		4 - Likely	2 - Low	4	2
		2 - Unlikely	3 - Moderate	2	3
		1 - Highly Unlikely	3 - Moderate	1	3
		1 - Highly Unlikely	3 - Moderate	1	3
		3 - Possible	2 - Low	3	2
		3 - Possible	2 - Low	3	2
+3.2	+5.7	3 - Possible	2 - Low	3	2
16	31	1 - Highly Unlikely	1 - Very Low	1	1
-6	-25	2 - Unlikely	1 - Very Low	2	1
+5	+13	3 - Possible	4 - High	3	4
		1 - Highly Unlikely	1 - Very Low	1	1
		1 - Highly Unlikely	2 - Low	1	2
		1 - Highly Unlikely	1 - Very Low	1	1
		3 - Possible	1 - Very Low	3	1
+3.2	+5.7	2 - Unlikely	1 - Very Low	2	1
1	7	2 - Unlikely	1 - Very Low	2	1
15	34	1 - Highly Unlikely	1 - Very Low	1	1
		1 - Highly Unlikely	1 - Very Low	1	1
		2 - Unlikely	4 - High	2	4
		2 - Unlikely	3 - Moderate	2	3
		2 - Unlikely	3 - Moderate	2	3
		3 - Possible	2 - Low	3	2
		4 - Likely	2 - Low	4	2
		4 - Likely	1 - Very Low	4	1
		3 - Possible	1 - Very Low	3	1
		2 - Unlikely	3 - Moderate	2	3
+5	+13	1 - Highly Unlikely	1 - Very Low	1	1

		2 - Unlikely	1 - Very Low	2	1
16	31	1 - Highly Unlikely	1 - Very Low	1	1
15	34	2 - Unlikely	1 - Very Low	2	1
		4 - Likely	1 - Very Low	4	1
15	34	1 - Highly Unlikely	1 - Very Low	1	1
15	34	3 - Possible	1 - Very Low	3	1
1	7	1 - Highly Unlikely	2 - Low	1	2
0	1	1 - Highly Unlikely	2 - Low	1	2
0	0	1 - Highly Unlikely	1 - Very Low	1	1
35	12	4 - Likely	1 - Very Low	4	1
1	0	2 - Unlikely	2 - Low	2	2
		1 - Highly Unlikely	1 - Very Low	1	1
		1 - Highly Unlikely	3 - Moderate	1	3
+3.2	+5.7	3 - Possible	3 - Moderate	3	3
+5	+13	2 - Unlikely	3 - Moderate	2	3
+5	+13	1 - Highly Unlikely	1 - Very Low	1	1
+5	+13	1 - Highly Unlikely	2 - Low	1	2
+5	+13	1 - Highly Unlikely	1 - Very Low	1	1
		1 - Highly Unlikely	2 - Low	1	2
		1 - Highly Unlikely	4 - High	1	4
16	31	3 - Possible	1 - Very Low	3	1
		2 - Unlikely	2 - Low	2	2
		1 - Highly Unlikely	1 - Very Low	1	1
		3 - Possible	1 - Very Low	3	1
		3 - Possible	1 - Very Low	3	1
		3 - Possible	1 - Very Low	3	1
+3.2	+5.7	4 - Likely	1 - Very Low	4	1
16	31	3 - Possible	3 - Moderate	3	3
+5	+13	2 - Unlikely	1 - Very Low	2	1
		1 - Highly Unlikely	2 - Low	1	2
1	7	3 - Possible	1 - Very Low	3	1
+32	+68	1 - Highly Unlikely	1 - Very Low	1	1
		1 - Highly Unlikely	2 - Low	1	2

		Mid century 2050s (2°C GWL)				
Risk score	Risk Rating (2030, 1.5C)	Likelihood	Magnitude	Likelihood score	Magnitude score	Risk score
9	[3] Moderate	4 - Likely	3 - Moderate	4	3	12
3	[2] Minor	2 - Unlikely	3 - Moderate	2	3	6
4	[3] Moderate	3 - Possible	2 - Low	3	2	6
12	[4] Major	3 - Possible	4 - High	3	4	12
9	[3] Moderate	3 - Possible	3 - Moderate	3	3	9
2	[2] Minor	2 - Unlikely	2 - Low	2	2	4
2	[2] Minor	3 - Possible	2 - Low	3	2	6
4	[3] Moderate	3 - Possible	2 - Low	3	2	6
6	[3] Moderate	1 - Highly Unlikely	2 - Low	1	2	2
3	[2] Minor	3 - Possible	2 - Low	3	2	6
4	[3] Moderate	2 - Unlikely	3 - Moderate	2	3	6
9	[3] Moderate	3 - Possible	3 - Moderate	3	3	9
6	[3] Moderate	2 - Unlikely	2 - Low	2	2	4
4	[3] Moderate	2 - Unlikely	2 - Low	2	2	4
8	[3] Moderate	4 - Likely	2 - Low	4	2	8
6	[3] Moderate	2 - Unlikely	3 - Moderate	2	3	6
3	[2] Minor	1 - Highly Unlikely	3 - Moderate	1	3	3
3	[2] Minor	2 - Unlikely	3 - Moderate	2	3	6
6	[3] Moderate	3 - Possible	2 - Low	3	2	6
6	[3] Moderate	3 - Possible	1 - Very Low	3	1	3
6	[3] Moderate	2 - Unlikely	1 - Very Low	2	1	2
1	[1] Negligible	1 - Highly Unlikely	1 - Very Low	1	1	1
2	[2] Minor	3 - Possible	1 - Very Low	3	1	3
12	[4] Major	3 - Possible	4 - High	3	4	12
1	[1] Negligible	1 - Highly Unlikely	1 - Very Low	1	1	1
2	[2] Minor	2 - Unlikely	2 - Low	2	2	4
1	[1] Negligible	1 - Highly Unlikely	1 - Very Low	1	1	1
3	[2] Minor	3 - Possible	1 - Very Low	3	1	3
2	[2] Minor	2 - Unlikely	1 - Very Low	2	1	2
2	[2] Minor	3 - Possible	1 - Very Low	3	1	3
1	[1] Negligible	1 - Highly Unlikely	1 - Very Low	1	1	1
1	[1] Negligible	2 - Unlikely	2 - Low	2	2	4
8	[3] Moderate	3 - Possible	4 - High	3	4	12
6	[3] Moderate	3 - Possible	3 - Moderate	3	3	9
6	[3] Moderate	2 - Unlikely	3 - Moderate	2	3	6
6	[3] Moderate	3 - Possible	2 - Low	3	2	6
8	[3] Moderate	4 - Likely	2 - Low	4	2	8
4	[3] Moderate	4 - Likely	1 - Very Low	4	1	4
3	[2] Minor	3 - Possible	1 - Very Low	3	1	3
6	[3] Moderate	3 - Possible	3 - Moderate	3	3	9
1	[1] Negligible	2 - Unlikely	1 - Very Low	2	1	2

2	[2] Minor	2 - Unlikely	2 - Low	2	2	4
1	[1] Negligible	1 - Highly Unlikely	1 - Very Low	1	1	1
2	[2] Minor	2 - Unlikely	1 - Very Low	2	1	2
4	[3] Moderate	4 - Likely	2 - Low	4	2	8
1	[1] Negligible	2 - Unlikely	1 - Very Low	2	1	2
3	[2] Minor	3 - Possible	1 - Very Low	3	1	3
2	[2] Minor	2 - Unlikely	2 - Low	2	2	4
2	[2] Minor	1 - Highly Unlikely	2 - Low	1	2	2
1	[1] Negligible	1 - Highly Unlikely	1 - Very Low	1	1	1
4	[3] Moderate	3 - Possible	1 - Very Low	3	1	3
4	[3] Moderate	2 - Unlikely	2 - Low	2	2	4
1	[1] Negligible	1 - Highly Unlikely	1 - Very Low	1	1	1
3	[2] Minor	1 - Highly Unlikely	3 - Moderate	1	3	3
9	[3] Moderate	3 - Possible	3 - Moderate	3	3	9
6	[3] Moderate	3 - Possible	3 - Moderate	3	3	9
1	[1] Negligible	1 - Highly Unlikely	1 - Very Low	1	1	1
2	[2] Minor	2 - Unlikely	2 - Low	2	2	4
1	[1] Negligible	1 - Highly Unlikely	1 - Very Low	1	1	1
2	[2] Minor	1 - Highly Unlikely	2 - Low	1	2	2
4	[3] Moderate	1 - Highly Unlikely	4 - High	1	4	4
3	[2] Minor	3 - Possible	1 - Very Low	3	1	3
4	[3] Moderate	2 - Unlikely	2 - Low	2	2	4
1	[1] Negligible	2 - Unlikely	1 - Very Low	2	1	2
3	[2] Minor	3 - Possible	1 - Very Low	3	1	3
3	[2] Minor	3 - Possible	2 - Low	3	2	6
3	[2] Minor	3 - Possible	1 - Very Low	3	1	3
4	[3] Moderate	2 - Unlikely	1 - Very Low	2	1	2
9	[3] Moderate	4 - Likely	3 - Moderate	4	3	12
2	[2] Minor	2 - Unlikely	1 - Very Low	2	1	2
2	[2] Minor	1 - Highly Unlikely	2 - Low	1	2	2
3	[2] Minor	3 - Possible	1 - Very Low	3	1	3
1	[1] Negligible	2 - Unlikely	1 - Very Low	2	1	2
2	[2] Minor	2 - Unlikely	2 - Low	2	2	4

	End of century 2100 (2°C GWL)				
Risk Rating (2050, 2C)	Likelihood	Magnitude	Likelihood score	Magnitude score	Risk score
[4] Major	4 - Likely	3 - Moderate	4	3	12
[3] Moderate	3 - Possible	3 - Moderate	3	3	9
[3] Moderate	3 - Possible	2 - Low	3	2	6
[4] Major	3 - Possible	4 - High	3	4	12
[3] Moderate	3 - Possible	3 - Moderate	3	3	9
[3] Moderate	2 - Unlikely	2 - Low	2	2	4
[3] Moderate	4 - Likely	3 - Moderate	4	3	12
[3] Moderate	3 - Possible	2 - Low	3	2	6
[2] Minor	1 - Highly Unlikely	2 - Low	1	2	2
[3] Moderate	4 - Likely	3 - Moderate	4	3	12
[3] Moderate	3 - Possible	4 - High	3	4	12
[3] Moderate	3 - Possible	3 - Moderate	3	3	9
[3] Moderate	2 - Unlikely	2 - Low	2	2	4
[3] Moderate	2 - Unlikely	2 - Low	2	2	4
[3] Moderate	4 - Likely	2 - Low	4	2	8
[3] Moderate	3 - Possible	3 - Moderate	3	3	9
[2] Minor	2 - Unlikely	3 - Moderate	2	3	6
[3] Moderate	2 - Unlikely	3 - Moderate	2	3	6
[3] Moderate	3 - Possible	2 - Low	3	2	6
[2] Minor	3 - Possible	1 - Very Low	3	1	3
[2] Minor	2 - Unlikely	1 - Very Low	2	1	2
[1] Negligible	1 - Highly Unlikely	1 - Very Low	1	1	1
[2] Minor	3 - Possible	1 - Very Low	3	1	3
[4] Major	3 - Possible	4 - High	3	4	12
[1] Negligible	2 - Unlikely	1 - Very Low	2	1	2
[3] Moderate	2 - Unlikely	2 - Low	2	2	4
[1] Negligible	1 - Highly Unlikely	1 - Very Low	1	1	1
[2] Minor	3 - Possible	1 - Very Low	3	1	3
[2] Minor	2 - Unlikely	1 - Very Low	2	1	2
[2] Minor	3 - Possible	1 - Very Low	3	1	3
[1] Negligible	1 - Highly Unlikely	1 - Very Low	1	1	1
[3] Moderate	3 - Possible	2 - Low	3	2	6
[4] Major	3 - Possible	4 - High	3	4	12
[3] Moderate	3 - Possible	3 - Moderate	3	3	9
[3] Moderate	2 - Unlikely	3 - Moderate	2	3	6
[3] Moderate	3 - Possible	2 - Low	3	2	6
[3] Moderate	4 - Likely	2 - Low	4	2	8
[3] Moderate	4 - Likely	1 - Very Low	4	1	4
[2] Minor	3 - Possible	1 - Very Low	3	1	3
[3] Moderate	4 - Likely	3 - Moderate	4	3	12
[2] Minor	3 - Possible	2 - Low	3	2	6

[3] Moderate	2 - Unlikely	2 - Low	2	2	4
[1] Negligible	1 - Highly Unlikely	1 - Very Low	1	1	1
[2] Minor	2 - Unlikely	1 - Very Low	2	1	2
[3] Moderate	4 - Likely	2 - Low	4	2	8
[2] Minor	2 - Unlikely	1 - Very Low	2	1	2
[2] Minor	3 - Possible	1 - Very Low	3	1	3
[3] Moderate	2 - Unlikely	2 - Low	2	2	4
[2] Minor	1 - Highly Unlikely	2 - Low	1	2	2
[1] Negligible	1 - Highly Unlikely	1 - Very Low	1	1	1
[2] Minor	3 - Possible	1 - Very Low	3	1	3
[3] Moderate	2 - Unlikely	2 - Low	2	2	4
[1] Negligible	1 - Highly Unlikely	1 - Very Low	1	1	1
[2] Minor	1 - Highly Unlikely	3 - Moderate	1	3	3
[3] Moderate	3 - Possible	3 - Moderate	3	3	9
[3] Moderate	3 - Possible	3 - Moderate	3	3	9
[1] Negligible	1 - Highly Unlikely	1 - Very Low	1	1	1
[3] Moderate	2 - Unlikely	2 - Low	2	2	4
[1] Negligible	1 - Highly Unlikely	1 - Very Low	1	1	1
[2] Minor	2 - Unlikely	2 - Low	2	2	4
[3] Moderate	2 - Unlikely	4 - High	2	4	8
[2] Minor	3 - Possible	1 - Very Low	3	1	3
[3] Moderate	2 - Unlikely	2 - Low	2	2	4
[2] Minor	2 - Unlikely	1 - Very Low	2	1	2
[2] Minor	3 - Possible	1 - Very Low	3	1	3
[3] Moderate	3 - Possible	2 - Low	3	2	6
[2] Minor	3 - Possible	1 - Very Low	3	1	3
[2] Minor	2 - Unlikely	1 - Very Low	2	1	2
[4] Major	3 - Possible	3 - Moderate	3	3	9
[2] Minor	2 - Unlikely	1 - Very Low	2	1	2
[2] Minor	2 - Unlikely	2 - Low	2	2	4
[2] Minor	4 - Likely	1 - Very Low	4	1	4
[2] Minor	3 - Possible	1 - Very Low	3	1	3
[3] Moderate	2 - Unlikely	2 - Low	2	2	4

	End of century 2100 (4°C GWL)					
Risk Rating (2100, 2C)	Likelihood	Magnitude	Likelihood score	Magnitude score	Risk score	Risk Rating (2100, 4C)
[4] Major	5 - Very Likely	4 - High	5	4	20	[5] Severe
[3] Moderate	3 - Possible	4 - High	3	4	12	[4] Major
[3] Moderate	4 - Likely	2 - Low	4	2	8	[3] Moderate
[4] Major	4 - Likely	4 - High	4	4	16	[4] Major
[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major
[3] Moderate	3 - Possible	2 - Low	3	2	6	[3] Moderate
[4] Major	5 - Very Likely	4 - High	5	4	20	[5] Severe
[3] Moderate	2 - Unlikely	2 - Low	2	2	4	[3] Moderate
[2] Minor	3 - Possible	2 - Low	3	2	6	[3] Moderate
[4] Major	5 - Very Likely	4 - High	5	4	20	[5] Severe
[4] Major	4 - Likely	5 - Very High	4	5	20	[5] Severe
[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major
[3] Moderate	1 - Highly Unlikely	2 - Low	1	2	2	[2] Minor
[3] Moderate	1 - Highly Unlikely	1 - Very Low	1	1	1	[1] Negligible
[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major
[3] Moderate	3 - Possible	4 - High	3	4	12	[4] Major
[3] Moderate	2 - Unlikely	3 - Moderate	2	3	6	[3] Moderate
[3] Moderate	3 - Possible	3 - Moderate	3	3	9	[3] Moderate
[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major
[2] Minor	3 - Possible	1 - Very Low	3	1	3	[2] Minor
[2] Minor	1 - Highly Unlikely	1 - Very Low	1	1	1	[1] Negligible
[1] Negligible	2 - Unlikely	1 - Very Low	2	1	2	[2] Minor
[2] Minor	4 - Likely	1 - Very Low	4	1	4	[3] Moderate
[4] Major	4 - Likely	4 - High	4	4	16	[4] Major
[2] Minor	2 - Unlikely	1 - Very Low	2	1	2	[2] Minor
[3] Moderate	2 - Unlikely	3 - Moderate	2	3	6	[3] Moderate
[1] Negligible	1 - Highly Unlikely	1 - Very Low	1	1	1	[1] Negligible
[2] Minor	4 - Likely	1 - Very Low	4	1	4	[3] Moderate
[2] Minor	1 - Highly Unlikely	1 - Very Low	1	1	1	[1] Negligible
[2] Minor	3 - Possible	3 - Moderate	3	3	9	[3] Moderate
[1] Negligible	2 - Unlikely	2 - Low	2	2	4	[3] Moderate
[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major
[4] Major	4 - Likely	4 - High	4	4	16	[4] Major
[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major
[3] Moderate	2 - Unlikely	3 - Moderate	2	3	6	[3] Moderate
[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major
[3] Moderate	5 - Very Likely	2 - Low	5	2	10	[4] Major
[3] Moderate	5 - Very Likely	3 - Moderate	5	3	15	[4] Major
[2] Minor	4 - Likely	1 - Very Low	4	1	4	[3] Moderate
[4] Major	4 - Likely	4 - High	4	4	16	[4] Major
[3] Moderate	4 - Likely	2 - Low	4	2	8	[3] Moderate

[3] Moderate	3 - Possible	4 - High	3	4	12	[4] Major
[1] Negligible	2 - Unlikely	1 - Very Low	2	1	2	[2] Minor
[2] Minor	3 - Possible	2 - Low	3	2	6	[3] Moderate
[3] Moderate	5 - Very Likely	3 - Moderate	5	3	15	[4] Major
[2] Minor	3 - Possible	2 - Low	3	2	6	[3] Moderate
[2] Minor	4 - Likely	2 - Low	4	2	8	[3] Moderate
[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major
[2] Minor	1 - Highly Unlikely	2 - Low	1	2	2	[2] Minor
[1] Negligible	3 - Possible	1 - Very Low	3	1	3	[2] Minor
[2] Minor	2 - Unlikely	1 - Very Low	2	1	2	[2] Minor
[3] Moderate	2 - Unlikely	2 - Low	2	2	4	[3] Moderate
[1] Negligible	1 - Highly Unlikely	1 - Very Low	1	1	1	[1] Negligible
[2] Minor	1 - Highly Unlikely	3 - Moderate	1	3	3	[2] Minor
[3] Moderate	2 - Unlikely	3 - Moderate	2	3	6	[3] Moderate
[3] Moderate	4 - Likely	3 - Moderate	4	3	12	[4] Major
[1] Negligible	2 - Unlikely	1 - Very Low	2	1	2	[2] Minor
[3] Moderate	3 - Possible	2 - Low	3	2	6	[3] Moderate
[1] Negligible	2 - Unlikely	1 - Very Low	2	1	2	[2] Minor
[3] Moderate	2 - Unlikely	2 - Low	2	2	4	[3] Moderate
[3] Moderate	2 - Unlikely	4 - High	2	4	8	[3] Moderate
[2] Minor	3 - Possible	1 - Very Low	3	1	3	[2] Minor
[3] Moderate	3 - Possible	2 - Low	3	2	6	[3] Moderate
[2] Minor	2 - Unlikely	2 - Low	2	2	4	[3] Moderate
[2] Minor	3 - Possible	2 - Low	3	2	6	[3] Moderate
[3] Moderate	3 - Possible	2 - Low	3	2	6	[3] Moderate
[2] Minor	3 - Possible	1 - Very Low	3	1	3	[2] Minor
[2] Minor	1 - Highly Unlikely	1 - Very Low	1	1	1	[1] Negligible
[3] Moderate	4 - Likely	4 - High	4	4	16	[4] Major
[2] Minor	2 - Unlikely	1 - Very Low	2	1	2	[2] Minor
[3] Moderate	2 - Unlikely	2 - Low	2	2	4	[3] Moderate
[3] Moderate	5 - Very Likely	2 - Low	5	2	10	[4] Major
[2] Minor	4 - Likely	2 - Low	4	2	8	[3] Moderate
[3] Moderate	3 - Possible	2 - Low	3	2	6	[3] Moderate

	Urgency
Rationale to scores (Based on inherent risk before measures to mitigate, adapt to, or manage the risk are introduced)	**Urgency score**
As weather events become more severe, compound events will becom	TBC
As sea level changes, so will water tables, increasing the risk of damag	TBC
Drought conditions may cause cracks in the soil and increase the risk c	TBC
River flood risk will increase as the climate warms, from flash events ar	TBC
Surfce water flood risk will increase, with higher rainfall amounts and p	TBC
Risk of groundwater flooding may change as water tables change.	TBC
Risk of damage to buildings from estuary inundation will increase witho	TBC
Snowfall events projected to become less frequent or severe, although	TBC
Wildifres typically on land away from buildings and infrastructure, but r	TBC
Risk of damage to buildings from sea level change will increase without	TBC
Risk of buildings being lost of relocated will increase as sea level chang	TBC
Low likelihood of hot days until end of century in a high warming scenar	TBC
Whilst cold events will continue to be experienced, they are projected t	TBC
Impact from freeze-thaw likely to become reduced, as events happen l	TBC
Assets will be at risk from storm damage, and damage more widesprea	TBC
Excerbated by sea level changes, and more intense storms, assets in c	TBC
Risk of landslides/mass movement events will increase over time as m	TBC
Warmer and drier conditions could lead to increased soil shrinkage, wh	TBC
Risk to operations from extreme weather events and cascading impact	TBC
Storms will create impacts form time to time, effecting ability of staff to	TBC
Decreasing risk of snowfall as the climate warms. Impact on operation	TBC
Small risk to service disruption from wildfires, which will increase over	TBC
Risk of water scarcity or drought will increase over time, but impacts or	TBC
Increased risk of flooding, effecting Council services, will increase as p	TBC
Risk of some services near to the coast being effected by coastal flood	TBC
The risk of longer term disruption from chronic changes in the climate s	TBC
Uncertain on how the number of fog days will change. Fog has limited i	TBC
Impact on operations generally very small or adaptive measures alread	TBC
Decreasing risk of snowfall as the climate warms. Impact on operation	TBC
Potential risk of hot days at the end of century which could cause some	TBC
Risk will increase in later century high degree scenario, where building	TBC
Displacement of people domestically and globally could result in migra	TBC
Risk of supply chain disruption, impacting on critical services provided	TBC
Risk of supply chain disruption, impacting on critical services provided	TBC
The risk of Council owned trees falling and causing injury or damage re	TBC
Increased flood events may result in more buildings being unoccupied	TBC
Disruption to services from extreme events may become more frequen	TBC
Impacts generally localised and in specific areas affecting a small num	TBC
Potential increase in likelihood of anti-social behaviour associated wit	TBC
The spread of infectious diseases will evolve over time, with new types	TBC
Demand on planning services likely to increase due to challenges with	TBC

Risk of short-term transport disruption to Council run services, effectin	TBC
Risk of wildfire will increase into later century, but impacts localised ar	TBC
Low risk at present and into mid century. Small increase in risk by end c	TBC
Insurance will increase, and some assets may become uninsurable ove	TBC
Demands on car parks and visitor centres will potentially increase over	TBC
Risk of heat stress will increase over time due to a potential increase in	TBC
Risk of heat stress will increase by end of century with more days excee	TBC
Extreme heat days very unlikely at present and whilst possible by end o	TBC
Risk of tropical nights remains low	TBC
Whilst cold events will continue to be experienced, they are projected t	TBC
Whilst cold events will continue to be experienced, they are projected t	TBC
Unlikely occurrence and will effect small number of staff, although inju	TBC
Unlikely risk, but could result in injury of fatality, such as a tree falling o	TBC
Decreasing risk of snowfall as the climate warms. Risk to staff from acc	TBC
Changing precipitation patterns and intensity of rainfall events will incr	TBC
Wetter winters may increase risk of waterlogged peatlands, effecting a	TBC
More intense rainfall events will increase the risk of surface run off and	TBC
Changing winter precipitation patterns and changing water tables will i	TBC
Risk of landslides and rockfalls will increase over time as more extreme	TBC
Risk of landslides and rockfalls will increase over time as more extreme	TBC
Increased likelihood of wildfires occurring, but risk to staff health likely	TBC
Risk from coastal flood events will remain, and potentially more freque	TBC
Staff mental health may be effected by an increase in the frequency an	TBC
Risk from diseases remains a threat and has the potential to have great	TBC
Risk to operations from extreme weather events and cascading impact	TBC
Storms will occur from year to year, but impacts on operations are low a	TBC
Decreasing risk of snowfall as the climate warms. Impact on operation	TBC
Small risk to service disruption from wildfires, which will increase over	TBC
Impacts from river flooding generally occuring downstream. Some risk	TBC
Sea level change will increase the risk of coastal flooding and impacts t	TBC
Potential risk of hot days at the end of century which could cause some	TBC
Expected that demand on services will increase over time as pressure c	TBC
As the climate changes, some habitats and species will become more	TBC

scoring
Timeframe for action
TBC
TBC
TBC

TBC
TBC
TBC

#	Variable	Type
1	Other	Acute
2	Other	Chronic
3	Other	Chronic
4	Precipitation	Acute
5	Precipitation	Acute
6	Precipitation	Acute
7	Precipitation	Acute
8	Precipitation	Acute
9	Precipitation	Acute
10	Precipitation	Acute
11	Precipitation	Chronic
12	Precipitation	Chronic
27	Precipitation	Chronic
13	Sea level change	Chronic
14	Sea level change	Chronic
15	Temperature	Acute
16	Temperature	Acute
17	Temperature	Acute
18	Temperature	Acute
19	Temperature	Acute
20	Temperature	Acute
21	Temperature	Acute
22	Temperature	Chronic
23	Temperature	Chronic
24	Temperature + Precipitation	Acute
25	Temperature + Precipitation	Acute
26	Temperature + Precipitation	Acute
28	Temperature + Precipitation	Chronic
29	Temperature + Precipitation	Chronic

Hazard	NE+A	INF	HBE
Cascading	Material	Material	Material
Transitional	Material	Material	Material
Cascading	Material	Material	Material
Low rainfall - drought / water scarcity	Material	Material	Material
High rainfall - river flooding	Material	Material	Material
High rainfall - surface water flooding	Material	Material	Material
High rainfall - groundwater flooding	Material	Material	Immaterial
Snowfall	Material	Material	Material
Hail	Material	Immaterial	Immaterial
Wildfire	Material	Material	Material
Changing precipitation patterns - wetter winters	Material	Material	Immaterial
Changing precipitation patterns - drier summers	Material	Material	Immaterial
Mass movement - landslides/rockfalls	Material	Material	Material
Coastal erosion	Material	Material	Material
Coastal inundation and loss of land	Material	Material	Material
Extreme heat days (35C+)	Material	Material	Material
Hot days (30C+)	Material	Material	Material
Heatwaves (3 days above 25C)	Material	Material	Material
Tropical nights (20C+)	Material	Immaterial	Material
Coldwaves (3+ days below 0C)	Material	Material	Material
Sub zero days (<0C)	Material	Material	Material
Freeze-thaw conditions	Material	Material	Material
Milder winters	Material	Immaterial	Immaterial
Hotter summers	Material	Material	Material
Storms and high winds	Material	Material	Material
Storm surge and coastal flooding	Material	Material	Material
Fog	Material	Material	Immaterial
Mass movement - subsidence	Material	Material	Material
Changing seasonality	Material	Material	Immaterial

B&I	ASSETS	PEOPLE	SERVICES	Notes
Material	Material	Material	Material	
Material	Immaterial	Immaterial	Material	
Material	Material	Immaterial	Material	
Material	Material	Immaterial	Material	
Material	Material	Material	Material	
Material	Material	Material	Material	
Material	Material	Material	Material	
Material	Material	Material	Material	
Immaterial	Immaterial	Immaterial	Immaterial	
Material	Material	Material	Material	
Immaterial	Immaterial	Immaterial	Material	
Immaterial	Immaterial	Immaterial	Material	
Immaterial	Material	Material	Immaterial	
Material	Material	Immaterial	Material	
Material	Material	Immaterial	Immaterial	
Material	Material	Material	Material	Heat stress thresholds
Immaterial	Immaterial	Material	Material	Heat stress thresholds
Material	Material	Material	Material	A UK heatwave threshold is me
Immaterial	Immaterial	Material	Immaterial	Tropical nights, where the tem
Immaterial	Material	Material	Material	
Immaterial	Immaterial	Material	Material	
Immaterial	Material	N/A	Immaterial	
Immaterial	Immaterial	Immaterial	Immaterial	
Immaterial	Immaterial	Immaterial	Material	
Material	Material	Material	Material	
Material	Material	Material	Material	
Immaterial	Immaterial	Immaterial	Material	
Immaterial	Material	N/A	Immaterial	
Immaterial	Immaterial	Immaterial	Immaterial	

Source	Other
https://climate.copernicus.eu/heat-stress-what-it-and-how-i	
https://climate.copernicus.eu/heat-stress-what-it-and-how-i	
https://weather.metoffice.gov.uk/learn-about/weather/types	
https://www.metoffice.gov.uk/blog/2023/tropical-nights-in-s	

ssment methodology and scoring matrix

Table 1. Risk rating matrix

Risk Rating Matrix		Magnitude of potential consequences				
		Very Low	Low	Medium	High	Very High
Likelihood (levels of probability)	Very Likely	Moderate	Major	Major	Severe	Severe
	Likely	Moderate	Moderate	Major	Major	Severe
	Possible	Minor	Moderate	Moderate	Major	Major
	Unlikely	Minor	Moderate	Moderate	Moderate	Major
	Highly Unlikely	Negligible	Minor	Minor	Moderate	Moderate

Table 2. Risk and opportunity rating descriptions

Score	Risk rating	Risk rating definition	Opportunity rating	Opportunity rating definition
5	Severe	Severe impact expected, associated with a catastrophic consequence and almost certain probability of occurrence	Considerable	Considerable potential for benefit or gain from the opportunity being realised
4	Major	Major impact expected, from either high magnitude and moderate frequency events, or high frequency and moderate magnitude events	Major	Major potential for benefit or gain from the opportunity being realised
3	Moderate	Moderate impact expected from from events that could be low-high frequency and/or low-high magnitude	Moderate	Moderate potential for benefit or gain from the opportunity being realised
2	Minor	Minor impact expected, from either moderate magnitude and low frequency events, or moderate frequency and low magnitude events	Minor	Minor potential for benefit or gain from the opportunity being realised
1	Negligible	Negligible impact expected, associated with a minimal consequence and highly unlikely probability of occurrence	Negligible	Negligible potential for benefit or gain from the opportunity being realised

Table 3. Risk Scoring Matrix

Risk Scoring Matrix		Magnitude of potential consequences				
		1	2	3	4	5
Likelihood (levels of probability)	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5

Table 4. Risk and opportunity score

Score	Risk Rating	Min Score	Max Score	Opportunity rating
5	Severe	20	25	Considerable
4	Major	10	16	Major
3	Moderate	4	9	Moderate
2	Minor	2	3	Minor
1	Negligible	1	1	Negligible

Table 5. Likelihood (levels of probability) descriptions

Score	Rating	Qualitative Risk Definition A	Qualitative Risk Definition B	Probability*	Qualitative Opportunity Definition
5	Very Likely	Has historically occurred frequently and/or very likely to occur in the future	The risk in the process of materialising and may already be under active management as an event	90-100% probability	Very likely that the opportunity will come to fruition
4	Likely	Has historically occurred several times and/or likely to occur in the future	Past events have not been fully resolved, effective mitigations not yet identified, control weakness are known and are being managed	66-100% probability	Likely that the opportunity will come to fruition
3	Possible	Has historically occurred from time to time and/or possible to occur in the future	Past events satisfactorily resolved, mitigations are in place or are on track to be in place, control improvements are under active management	33-66% probability (i.e. about as likely as not)	Possible that the opportunity will come to fruition
2	Unlikely	Has historically occurred infrequently and/or unlikely to occur in the future	Events are rare, required mitigations in place, controls are effective	0-33% probability	Unlikely that the opportunity will come to fruition
1	Very Unlikely	Has historically not occurred and/or very unlikely to occur in the future	No known event or if known extremely rare, extreme industry-wide scenarios	0-10% probability	Very unlikely that the opportunity will come to fruition

*Based on terms and likelihood of outcome used in Table 1 in https://www.ipcc.ch/site/assets/uploads/2018/03/inf09_p32_draft_Guidance_notes_LA_Consistent_Treatment_of_Uncertainties.pdf)

Table 5. Downscaling parameters for the YNY region relative to the UK, to inform risk magnitude scoring

	City of York Council Region	North Yorkshire Council Re	YNYCA Region	UK	% YNYCA proportion of UK totals (downscale)
Land area (square miles)	105	2,483	2,588	94,060	2.753%
Land area (hectares)	27,195	643,897	670,292	24,346,000	2.753%
Population	202,821	605,000	818,000	68,300,000	1.198%
Active businesses (number of enterprises)	7,430	28,970	36,400	2,805,590	1.297%
GDP Per Capita, Yorkshire and Humber (£, 2022)			30,734		
Total GDP			25,140,412,000	2,526,428,000,000	0.995%

Table 6. Magnitude (levels of consequence) descriptions

									Organisation Register			
Score	Rating	Scale of Impact	Temporal Impact	Economic Impact (£)	Health Impact (#)	Land/Water Impact (%/#)	Habitat/Species Impact (%)	Natural Capital Impact (%)	Assets	People	Operations	Examples
5	Very High	Extreme annual damage and disruption or foregone opportunities:	Substantial change, affecting the YNYCA region for a prolonged period of time (e.g. many months or years) including irreversible changes	• Very high economic impact and/or very high proportion of YNYCA region affected economically • Ehundreds of millions in damage/impact (e.g. >£100 million)	• Very high proportion of people in YNYCA region affected and/or high number of deaths • A few or tens of deaths, hundreds of major health impacts, tens of hundreds of people affected / minor health impacts	• Very high proportion of land/river affected • Tens of thousand hectares of land lost or severely damaged, and/or hundreds of km of river water/km2 of water bodies affected	Extreme impact (>15% at regional level) to valued habitat or landscape types (e.g. BAP habitats, SSSFs), and/or extreme impact on or loss of species groups and/or keystone/important species/habitat	Extreme impact (15% or more at regional level) to an individual natural capital asset and associated goods and services	Severe and/or widespread damage to multiple assets	Very high percentage of staff affected	Severe disruption to some operations, including failure to provide key services	
4	High	Major annual damage and disruption or foregone opportunities:	Moderate change, affecting multiple parts of the YNYCA region for a relatively long period of time (e.g. months)	• High economic impact and/or high proportion of YNYCA region affected economically • Many Etens of millions of damage/impact (e.g. £10 million to £100 million)	• High proportion of people in YNYCA region affected and/or moderate number of deaths • A small number of deaths, tens of major health impacts, hundreds of people affected / minor health impacts	• High proportion of land/river affected • Thousands of hectares of land lost or severely damaged, and/or several tens of km of river water/km2 of water bodies affected	Major impact (~10% at regional level) to valued habitat or landscape types (e.g. BAP habitats, SSSFs), and/or major impact on or loss of species groups and/or keystone/important species/habitat	Major impact (10% or more at regional level) to an individual natural capital asset and associated goods and services	Major and/or relatively widespread dmaage to multiple assets	High percentage of staff effected	High disruption to some operations, including major inability to provide some key services	
3	Medium	Moderate annual damage and disruption or foregone opportunities:	Noticeable change, affecting some parts of the YNYCA region for a moderate amount of time (e.g. many weeks)	• Moderate economic impact and/or moderate proportion of YNYCA region affected economically • Emilions of damage/impact (e.g. £1 million to £10 million)	• Moderate proportion of people in YNYCA region affected. • No deaths (or 1 in 5 chance of fatality), tens of major health impacts, hundreds of people affected / minor health impacts	• Moderate proportion of land/river affected • Tens of hundred hectares of land lost or severely damaged, and/or tens of km of river water/km2 of water bodies affected	Moderate impact (~5% at regional level) to valued habitat or landscape types (e.g. BAP habitats, SSSFs), and/or moderate impact on or loss of species groups and/or keystone/important species/habitat	Intermediate impact (~5% or more at regional level) to an individual natural capital asset and associated goods and services	Notable damage to a few assets and/or minor damage to a large number of assets	Moderate percentage of staff affected	Moderate disruption to multiple operations, including delays to key services	
2	Low	Minor annual damage and disruption or foregone opportunities:	Small change, affecting isolated parts of the YNYCA region for a small amount of time (e.g. few weeks)	• Low economic impact and/or low proportion of YNYCA region affected economically • Ehundreds of thousands of damage/impact (e.g. £100,000 to £1 million)	• Low proportion of people in YNYCA region affected and/or very low or no deaths • No deaths, a few major health impacts,tens of people affected / minor health impacts	• Low proportion of land/river affected • Hundreds of hectares of land lost or severely damaged, and/or a few km of river water/km2 of water bodies affected	Minor impact (~1% at regional level) to valued habitat or landscape types (e.g. BAP habitats, SSSFs), and/or minor impact on or loss of species groups and/or keystone/important species/habitat	Minor impact (~1% at regional level) to an individual natural capital asset and associated goods and services	Minor damage to a small number of assets	Small percentage of key staff effected	Minor disruption to some operations	
1	Very Low	Minimal annual damage and disruption or foregone opportunities:	Negligible and/or unnoticeable change in the YNYCA region for a very small amount of time (e.g. few days)	• Very low economic impact and/or very low proportion of YNYCA region affected economically • Etens of thousands damage/impact (e.g. <£100,000)	• Very low proportion of people in YNYCA region affected and/or no deaths • No deaths or major health impacts, a few people affected / minor health impacts	• Very low proportion of land/river affected • Tens of hectares of land lost or severely damaged, and/or km of river water/km2 of water bodies affected	Minimal impact (~0.5% at regional level) to valued habitat or landscape types (e.g. BAP habitats, SSSFs), and/or minimal impact on or loss of species groups and/or keystone/important species/habitat	Minimal impact (~0.5% at regional level) to an individual natural capital asset and associated goods and services	Negligible damage to a very small number of assets	Very small percentage of key staff effected	Negligible disruption to operations	

Table 2.2 CCRA magnitude categories for UK and England.

	High Magnitude	Medium Magnitude	Low Magnitude
Quantitative evidence	*Major annual damage and disruption or foregone opportunities:[7]*	*Moderate annual damage and disruption or foregone opportunities*	*Minor annual damage and disruption or foregone opportunities*
	-Ehundreds of millions damage (economic) or foregone opportunities, and/or	-Eteins of millions damage (economic) or foregone opportunities, and/or	-Less than £10 million damage (economic) or foregone opportunities, and/or
	-Hundreds of deaths[7], 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[7], 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[8] 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.		

Source: UK CCRA3

UK_CCRA3_Chapter

Business and Industry
Health, Communities and the Built Environment
Infrastructure
International Dimensions
Natural Environment and Assets
N/A
Council services

CCC_System

Buildings
Business
Community preparedness and response
Energy
Finance
Food security
Health
Nature
Telecoms and ICT
Towns and cities
Transport
Water supply
Working lands and seas
N/A

Protected_Landscape_Theme
Built environment
Community & economy
Farming forestry & land management
Historical environment
Landscape
Natural environment
Recreation & tourism
N/A

Urgency scoring - followi
Category
More action needed
Further investigation
Sustain current action
Watching brief

Timeframe for action	Urgency score
2 years	More action needed
5 years	Further investigation
10 years	Sustain current action
Beyond 10 years	Watching brief

ing the framework used in the national CCRA3
Description
Additional adaptation is needed urgently, either over and above what is already happening, or in some cases adaptation needs to start where there is currently nothing happening.
Not enough evidence is available to make a robust judgement on what further action is needed.
The level of current action is in line with the magnitude of the risk or opportunity.
Further action is not currently justified, but monitoring the situation is.

YNYCA Rapid Adaptation Pathway Framework

Draft for Discussion v1.0

Collated Actions

Adaptation actions identified through the sectoral RAPA process and supporting climate action plans. Actions are presented by adaptation sector and comprise both 'C-series' and 'R-series' actions. The C-series actions are drawn from the York Climate Change Action Plan (City of York Council, 2024c) and primarily comprise carbon reduction measures that also contribute to climate resilience, with most closely aligned to the Built Environment and Infrastructure & Transport sectors. The R-series actions were identified by stakeholders through the sectoral Rapid Adaptation Pathway Assessment (RAPA) sessions and are specifically focused on strengthening resilience and adaptation, with delivery spanning local authorities, partnerships, and regional and national organisations. Some actions are duplicated across sectors where stakeholders identified the same or similar measures as supporting resilience across multiple systems or areas of responsibility. This reflects the cross-cutting and interconnected nature of climate adaptation rather than duplication in proposed delivery. Further detail, including the sector-specific adaptation pathways and supporting actions, is provided in Appendix 10 – Rapid Adaptation Pathways – Further Information.

Links + Resources

Supporting evidence, guidance and examples for adaptation actions. The table provides links to relevant guidance, policy, funding programmes, research and examples of good practice that may support the development and implementation of the identified actions. The sources are intended to provide additional context and illustrate potential approaches to delivery rather than prescribe specific interventions. They include national and regional guidance, local examples, sector-specific resources and evidence from wider practice that can inform future adaptation planning and implementation.

Ref	Action Summary
C01	Deliver 600 Passivhaus homes
C02	Develop large-scale retrofit mechanisms
C03	Provide home-retrofit funding
C04	Stock Condition Survey
C05	Identify routine retrofit opportunities
C06	Proactive landlord regulatory engagement
C07	Engage landlords on efficiency
C08	Run low-carbon retrofit pilots
C09	Plan council-building decarbonisation
C10	Improve health Care building Sustainability
C11	Create building risk register
C12	Give climate-smart planning advice
C13	Produce sustainability planning SPD
C14	Raise commercial environmental standards
C15	Issue retrofit planning guidance
C16	Grow sustainable construction skills
C19	Create transport risk register
C22	Funding bids for Net Zero
C23	Implement heat–cold response plans
C24	Mainstream adaptation in governance
C25	Expand climate-change communications
C26	Support York Climate Commission
C27	Promote citywide sustainability
C28	Share circular case studies
C29	Promote zero-waste businesses
C30	Enable circular economy growth
C31	Support SME decarbonisation
C32	Support business emissions reduction
C33	Develop green skills workforce
C34	Support business climate adaptation
C35	Promote regenerative local agriculture
C36	Promote local supply chains
C37	Facilitate business collaboration
C38	Deliver tourism strategy
C39	Implement biodiversity net gain
C40	Assess carbon sequestration opportunities
C41	Protect and manage trees
C42	Expand tree canopy cover
C43	Map natural capital opportunities
C44	Develop nature recovery strategy
C45	Map ecosystem health
C46	Develop carbon offsetting strategy
C20	Improve climate-risk mapping
C21	Weather and flood costs
C49	Monitor river water quality
C50	Identify district heating opportunities
C51	Deliver City LEAP project
C52	Optimise electric grid capacity
C53	Explore renewable generation opportunities
C54	Increase solar capacity deployment
C55	Assess Green Energy Park
R152	Resilience investment partnership
R153	Flexible (siesta) working
R154	Combined retrofit net zero / adaptation
R155	Air-conditioning installation
R156	Contractor heat-mitigation upskilling
R157	Property heat / humidity monitoring
R158	Urban tree planting
R159	Tree-planting guidance
R160	Homeowner heat advice
R161	Increased CAPEX

R162	Passive cooling adoption
R163	Extensions - Upgrade ventilation
R164	Private rental heat policy
R165	Designated cool spaces
R166	Cooling focused master planning
R167	Stronger building standards
R168	National SuDS consistency
C47	Upgrade flood defences
C48	Promote natural flood management
R171	Resilient development advocacy
R172	Biodiversity Net Gain
R173	Enhanced drainage maintenance
R113	Contingency planning - Flooding
R115	Flood protection schemes
R176	Climate-informed funding
R177	New home guidance
R117	Real-time flood info
R179	Multifunctional SuDS design
R180	Future Homes Standards
R181	Climate-ready long-term planning
R118	Flood-response training
R183	Cross-LRF collaboration
R12	Property flood resilience
R185	Resilient development strategy
R121	Resilience innovation support
R187	Developer engagement
R188	Retrofit SuDS
R122	Property flood resilience
R190	Climate-adaptive SFRA
R191	Climate-ready park planning
R192	Resilient archive storage
R110	Safe plant-waste disposal
R111	Flood Risk Adaptation Metrics
R112	Flood Guidance packs
R123	“York Is Open” messaging
R114	Managed retreat
R125	Infrastructure maintenance
R116	LRF adaptation support
R127	Flood action groups
R13	Tourism communications plan
R119	Strategic adaptation planning
R120	Business recovery guidance
R134	Business forum collaboration
R135	Funding guidance / support
R138	Urban tree funding
R124	Resilient storage facilities
R14	Resilient artefact storage
R126	Transport resilience measures
R144	Historic-building funding
R128	Extreme-weather planning
R129	Gutter/drainage upgrades
R130	Historic building maintenance
R131	Supply-chain contingency
R132	Inclusive adaptation communication
R133	Roads & bridges upgrades
R15	Infrastructure maintenance
R169	Mandatory YNYCA SuDS
R136	Resilience investment partnerships
R137	Water literacy promotion
R17	Community resilience groups
R139	Resilience-forum support
R140	Business resilience guidance

R141	Contingency planning - Extreme Heat
R142	Business sustainability programme
R143	“Water Me” scheme
R170	Catchment-scale joint SFRA
R145	Resilient archive storage
R146	Flexible working
R195	Unified severe-weather plan
R148	Cool public spaces
R149	Street-tree planting
R150	Post-event recovery
R151	Tree-planting strategy
R174	Community flood preparedness
R175	Managed retreat approach
R194	Prioritise essential NHS services
R178	Stronger building standards - Flooding
R196	Advocate climate-resilient funding
R197	LRF climate subcommittee
R182	LNRS flood integration
R199	Embed climate impacts
R200	Integrate climate risks
R184	Humber 2100 support
R202	Guidance and monitor resilience
R203	Adaptation awareness stories
R204	Structured adaptation training
R205	Resilient ambulance power
R206	Resilient emergency plans
R186	Land-use policy monitoring
R208	Care-home sustainability grants
R189	Property flood retrofits
R210	Apply adaptation framework - Flooding
R211	Assign adaptation responsibility
R212	Lobby care-home funding - Flooding
R213	Communicate heat-health risks
R214	Issue heat alerts
R215	Install climate monitors
R216	Apply adaptation framework - High Temperatures
R217	Guide and monitor resilience
R218	Track heat-related cancellations
R219	Embed resilience in plans
R220	Provide adaptation training
R221	Share case studies
R222	Consider long-term cooling costs
R223	Monitor vector-borne diseases
R193	Flooding stakeholder engagement
R225	Develop cooling spaces
R226	Assign adaptation leadership
R227	Coordinate LRF adaptation
R228	Protect critical NHS services
R229	Use procurement for resilience
R230	Advocate better building standards
R231	Ensure backup power
R209	Climate-resilient procurement
R233	Combine net-zero retrofits
R234	Expand climate-health monitoring
R235	Grant support for care homes
C17	Develop Movement and Place plan
C18	Sustainable active travel investment
R198	Strengthen flood-alert systems
C56	Develop renewable energy skills
R1	Develop Flood-risk metrics
R2	Public flood toolkit
R3	LRF contingency planning

R201	Check and manage floods
R207	Retrofit and flood-proof
R6	LRF adaptation support
R22	Climate-smart farming
R224	Unified severe-weather planning
R9	Climate-adapted planning
R10	Business resilience guidance
R11	Resilience innovation programme
R232	Lobby care-home funding - High temperatures
R240	Develop integrated water plans
R238	Collaborate on flood management
R242	Implement strategic catchment planning
R16	Transport resilience measures
R29	Soil moisture enhancement
R18	Water awareness campaigns
R19	Future resource modelling
R20	Sustainable land partnership
R32	SuDS implementation
R249	Avoid high-risk infrastructure sites
R23	Permeable surfaces promotion
R24	Water-efficiency incentives
R252	Co-ordinate drought-flood planning
R26	Behavioural water savings
R69	Blue-green strategy
R28	Reservoir approval reform
R71	Increase soil carbon
R30	Upland water storage
R31	Greywater reuse expansion
R75	Agroforestry adoption
R78	Agricultural resilience training
R34	Place-based renewables
R79	Farm tree planting
R36	Housing rainwater systems
R37	Reservoir capacity restoration
R38	Agricultural rain harvesting
R39	Water conservation incentives
R40	Leak reduction measures
R41	Mains renewal
R42	Treatment capacity expansion
R43	Efficiency-linked incentives
R44	Reservoir expansion
R45	Water-grid upgrades
R46	Raw-water transfers
R236	Guide care homes preparation
R237	Establish shared resilience targets
R147	Rainwater harvesting - Business premises
R239	Report climate adaptation progress
R4	Managed retreat implementation
R241	Align partner investment timing
R5	Flood-protection schemes
R243	Integrate climate in emergencies
R244	Plan for higher maintenance
R245	Coordinate LRF and utilities
R246	Maintain underground asset register
R247	Map critical infrastructure assets
R248	Harden and add redundancy
R57	Floodplain restrictions
R250	Apply updated climate allowances
R251	Continue collaborative reporting
R58	Updated land-use policy
R73	Rainwater harvesting
R48	Catchment planning

R49	Farming collaboration
R50	Landscape partnerships
R51	Joint funding
R52	Agricultural training on regenerative practices
R53	Improve livestock impact
R54	Soil aeration
R55	Expand hedgerows
R56	Adopt agroforestry
R64	Seasonal flooding support
R66	SuDS implementation
R59	Upper-catchment tree cover
R60	Catchment partnership support
R61	River restoration
R62	Protected species habitat
R76	Coordinated abstraction planning
R68	Natural flood management
R65	Wetland tourism assets
R7	Visitor flood updates
R83	Cross-sector water planning
R8	Flood Group training
R84	Soil health improvement
R33	Arid-region standards
R77	Reservoir legislation reform
R72	Climate-smart planning
R88	IDB funding access
R74	Cover crop expansion
R25	Landscape restoration
R67	Peatland restoration
R70	Landscape rewetting
R80	Increase water storage
R82	On-farm reservoir pilots
R86	Irrigation system integration
R81	Climate-resilient flora species research
R21	Drought-resilient planning
R27	Climate-ready design
R47	Groundwater exploration / new groundwater sources
R63	Rainwater harvesting
R85	Irrigation technology assessment
R87	Swales & drainage maintenance
R35	Desalination development
R89	Address invasive species
R90	Strengthen catchment collaboration
R91	Species-control agreements
R92	Implement GB INNS strategy
R93	Deliver regional INNS measures
R94	Utilise YW funding
R95	Expand citizen-science mapping
R96	Apply INNS legislation
R97	Increase biosecurity funding
R98	Coordinate public-land management
R99	Support INNS forum
R100	Enhance public awareness
R101	Integrated pest management
R102	Targeted trapping programmes
R103	AQUA accreditation uptake
R104	Rainwater-harvesting promotion
R105	Increase INNS resources
R106	Public INNS education
R107	Behaviour-change campaigns
R108	Implement RBMP actions
R109	Install wash-down stations

Action / Description

Deliver 600 new homes across the city on council-owned land to Passivhaus standards in accordance with the Council Design Manual
Explore new commercial mechanisms and delivery programmes for achieving domestic retrofit at scale — including setting up a “Retrofit One-Stop Shop”, regional loans, “comfort as a service”; ensure embodied carbon is considered in retrofits
Deliver funding programmes (e.g. Home Upgrade Grant (HUG) etc.) and identify new funding (e.g. Social Housing Decarbonisation Fund Wave 2) — to support retrofit / energy-efficiency improvements in homes
Complete a condition survey of Council property stock and produce archetype-specific plans for council homes — identify works needed to reach EPC C (or higher) and net-zero carbon standard
Identify “business as usual” retrofit opportunities in planned capital works, voids, and through support for vulnerable tenants
Proactive engagement with landlords around current and future regulatory obligations
Proactive engagement with landlords to support & enforce minimum energy-efficiency standards for private rented housing
Deliver local pilots / demonstrator projects that showcase low- and zero-carbon retrofit (through Retrofit One-Stop Shop / Passivhaus / Net-Zero funding schemes)
Develop a decarbonisation/resilience plan for all council-owned buildings (including schools) to identify viable solutions to achieve net zero by 2030 — building resilience/adaptation as part of retrofit/upgrade
Deliver actions in the health care sustainabilityprogrammes
Consider creating a register of buildings at-risk from weather events (e.g. extreme weather, flooding) — to support resilience planning
Provide climate-change advice and sign-off of planning conditions; issue guidance to developers on sustainability measures (including in conservation contexts)
Develop planning materials (i.e., documents that will superseded Supplementary Planning Documents) to raise sustainability / resilience standards for all developments across the city
Update Local Plan to require all new commercial developments to meet highest environmental standards (e.g. BREEAM Excellent)
Provide planning guidance & supporting documents for retrofit of existing buildings (including listed or historic buildings)
Develop construction skills and promote jobs in sustainable building industry — from school age to professionals — to support retrofit and future resilience building
Consider creating a register of transport infrastructure at-risk from weather events and flooding — to inform resilience planning
Bid for funding opportunities to progress projects aligned to Net Zero targets
Implement extreme heat / cold response plans (e.g. aligned to national health-security guidance) — to respond to weather-related health risks
Embed adaptation into council policies, strategies, risk registers, service plans — to mainstream resilience across all council activity
Increase climate-change communications and information for residents and city partners — via website, press releases, social media, monthly newsletter, events — to build awareness and support for adaptation & mitigation actions
Support ongoing operation of the York Climate Commission — with working groups across sectors (biodiversity, buildings/retrofit, transport, health & climate, waste/circular economy, etc.) to coordinate adaptation, mitigation and resilience actions city-wide
Engage with networks across the city to encourage sustainability actionsfrom a wide range ofcity stakeholders
Work with other localauthorities to sharecase studies frombusinesses on circulareconomy practices tomaximiseenvironmental andeconomicopportunities
Champion zero wastecafes and low wastebusiness to residentsto encouragebehaviour change tolow waste services
Support growth in the circular economy including the development of a circular economy roadmap for the city, which maps material flows to identify opportunities for circularity and colocation. Bring stakeholders together and create the conditions for a circular economy to flourish by supporting community groups to develop the
Support SME decarbonisation and access to green finance offering energy audits and potential grant funding
Engage withbusinesses tominimise emissionsacross a range ofbusiness areas
Develop green skillsand promote greenjobs for all levels ofeducation from schoolage to experienced professionals
Support business toadapt to climatechange
Encourage regenerative and localfood growing andagriculture
Encourage short, local, and consolidated supply chains
Provide forums forbusiness collaborationand highlighting ofbest practice
Support the delivery of the Tourism Strategy and Implementation Plan
Fully supportimplementation ofBiodiversity Net Gainon all developments
Consider Green &Blue infrastructurestrategy - Assess thecarbon sequestrationpotential of currentcouncil land andidentify opportunitiesto increasesequestration, lookinginto different naturalcarbon captureoptions
Develop a strategy toprotect and managemaintenance ofexisting trees in thecity as well as any newtrees planted
Grow York tree canopy cover to 13% by 2050 - include biodiverse and developing green corridors and improving access to nature
Conduct a mapping exercise to assess which areas of the city could be designated, natural capital enhancement through innovative investment
Create a Local Nature Recovery Strategy (York and North Yorkshire)
Consider a mappingexercise to create adatabase of ecosystemhealth
Develop anoffsetting/insettingstrategy to addressresidual emissions nottackled by directactions in the citywith a validatedoffsetting method
Consider improved mapping of climate-risk data (extreme weather, flooding, etc.) to support enhanced targeting of adaptation and resilience measures
Capture cost and impact of extreme weather events and flooding
Monitor water qualityin rivers and considercreating a register ofrisks from sewage andsurface waterpollution
Identify opportunitiesfor decarboniseddistrict heatingsolutions across thecity
Deliver City LEAPAccelerator project
Work withstakeholders toensure understandingand best use of thecity's electric gridcapacity
Explore opportunitiesfor renewablegeneration
Support increase ofsolar capacity acrossYork including homes,schools, andcommunity energyschemes
Assess opportunitiesfor a Green EnergyPark in York
Work with partners such as AVIVA through the YNYCA collaboration to mobilise investment in climate-resilience projects.
Introduce and encourage the use of flexible and siesta-style working practices to reduce heat exposure during peak temperature periods.
Retrofit buildings to achieve net-zero goals while integrating climate-adaptation measures at the same time.
Install air-conditioning or air-to-air heat-pump systems to provide effective cooling during extreme heat.
Train contractors to identify and install measures that minimise solar heat gain and improve ventilation.
Monitor heat and humidity inside properties to identify high-risk buildings and target interventions.
Expand street and urban planting of trees and shrubs to increase cooling through shading and evapotranspiration.
Provide guidance on street-tree planting to avoid negative impacts on underground infrastructure and foundations.
Offer clear advice to homeowners and tenants on heat-adaptation measures and available financial support.
Increase capital investment in building quality now to avoid higher future costs for installing passive and active cooling systems.

Apply passive cooling strategies—such as shading, ventilation, and reflective materials that have proven effective in warmer climates to new UK developments and retrofit to existing properties.
Require property extensions to upgrade the existing building to meet current new-build ventilation standards.
Develop policy and guidance to improve heat resilience within the private-rental sector.
Create designated cool spaces in public facilities to protect vulnerable residents during heatwaves.
Integrate cooling features—such as street trees and passive-cooling design—into master planning and urban-development frameworks.
Advocate for stronger climate-adaptation requirements within national building standards for heat resilience.
Establish consistent national SuDS requirements to give developers clarity and improve long-term resilience.
Upgrade and renewthe city's flooddefences to betterprotect homes andbusinesses againstsurface water flooding
Incentivise the uptakeof natural flood riskmanagementmeasures across theRiver Swale, Ure andNidd, Ousecatchments
Advocate for national planning-policy changes that strengthen the climate resilience of new developments.
Implement the YNYCA Biodiversity Net Gain Strategy to enhance ecological resilience.
Enhance drainage-system maintenance and upgrade infrastructure to cope with future climate pressures.
Strengthen flood contingency planning for businesses through Local Resilience Forum leadership.
Deliver major flood-protection schemes to safeguard business districts and industrial areas.
Factor climate-related impacts into future funding decisions for drainage maintenance and risk-management schemes.
Provide a New Home User Guide to ensure residents understand maintenance responsibilities for resilient features.
Offer real-time flood-status information to help visitors and businesses plan safely.
Implement multifunctional SuDS that combine vegetation, biodiversity benefits, pollutant removal, and accessible sediment-management design.
Adopt and align with future national standards for climate-resilient homes.
Embed climate-impact considerations into long-term YNYCA planning frameworks.
Expand flood-response training for community and business action groups.
Facilitate cross-LRF collaboration to share lessons learned and best practice on climate resilience.
Expand property-level flood-resilience support, including PFR information and grant/subsidy schemes.
Embed climate resilience within the YNYCA Development Strategy and Land-Use Framework.
Improve business protection through national Flood & Coastal Resilience Innovation Programme support.
Include developers as active partners in the region's climate-adaptation strategy.
Retrofit SuDS into existing developments to improve surface-water flood management.
Increase uptake of Property Flood Resilience measures through grants and subsidy schemes.
Incorporate adaptive actions into the next SFRA update to keep planning guidance climate-ready.
Integrate climate-impact considerations into park-management plans to protect green-space resilience.
Create a shared, climate-resilient storage facility for historic archives and collections.
Promote safe disposal of diseased or infected plant material (e.g., elm wood) to reduce pathogen transmission.
Develop a toolkit of indicators to help businesses monitor risk and resilience,
Provide public-facing guidance packs to support organisations during high-river events.
Use "York Is Open" messaging to maintain economic activity during and after flood events.
Support relocation or managed retreat for at-risk commercial sites.
Increase preventive maintenance of buildings and infrastructure to reduce flood vulnerability.
Enhance Local Resilience Forum assistance for business adaptation planning and funding access.
Expand community and business involvement in Flood Action Groups.
Implement a flood-communications plan to protect and sustain tourism.
Embed climate adaptation requirements within regional strategic planning processes.
Provide recovery and resilience guidance tailored to business continuity needs.
Build collaboration through local business forums for flood-watch and recovery support.
Provide Local Resilience Forum guidance on funding for businesses affected by floods or wildfires.
Work with partners to secure funding for planting trees in hard urban landscapes to reduce surface-water flooding.
Establish shared, climate-resilient storage facilities for artefacts and business assets.
Establish a shared, flood-resilient artefact-storage facility.
Strengthen transport resilience systems to support business supply chains and operations.
Advocate for government funding to help historic buildings adapt to climate risks such as flooding and overheating.
Encourage businesses to create extreme-weather and continuity plans for staff and assets.
Support upgrades to gutters and drainage on older and historic commercial buildings.
Improve maintenance of heritage buildings to prevent water damage and business disruption.
Promote supply chain contingency planning to reduce weather-related interruptions.
Use neutral, inclusive language in adaptation communications to support business engagement.
Upgrade roads and bridges to ensure resilient access for commercial activity.
Increase maintenance of buildings and infrastructure to boost resilience to all flood sources.
Maintain mandatory SuDS policies across YNYCA to manage surface-water flooding effectively.
Develop partnership programmes e.g.YNYCA and Aviva to increase resilience investment in business infrastructure.
Improve public understanding of water conservation and climate resilience by promoting water literacy.
Strengthen community resilience by supporting and expanding Flood Action Groups.
Collaborate with the Local Resilience Forum to support climate-adaptation planning and access funding opportunities.
Provide guidance and resources to help businesses strengthen their capacity and resilience to climate impacts.

Develop coordinated heat contingency plans with the Local Resilience Forum to prepare for extreme-weather events.
Deliver the YNYCA Business Sustainability Programme to help organisations adopt climate-resilient and sustainable practices.
Encourage community care for young trees through a “Water Me” scheme that labels trees needing watering during hot, dry periods.
Develop joint Strategic Flood Risk Assessments at catchment scale to resolve cross-boundary issues & support coordinated flood-risk planning.
Create a shared, climate resilient storage facility to safeguard historic archives and collections.
Support flexible working arrangements to maintain service continuity during severe weather and climate-related disruptions.
Ensure this is a unified severe-weather plan that combines cold-weather, flooding, and heatwave responses into one adverse-weather framework.
Promote designated cool spaces in York, such as the Art Gallery, to support public health during heatwaves.
Increase street-tree planting to reduce the urban-heat-island effect and cool built-up areas.
Provide post-event grants / loans and tourism-recovery packages to help communities and local economies recover after extreme-weather events.
Implement a tree-planting strategy that expands canopy cover and protects existing trees from climate impacts.
Strengthen community flood-preparedness initiatives to reduce local vulnerability.
Apply managed-retreat approaches where appropriate to reduce long-term flood risk.
Ensure NHS and local authority business continuity and critical service plans are in place to identify and prioritise essential health, social care, public health and other critical local services during climate-related disruptions.
Lobby national government to improve building standards for flood resilience.
Advocate for national funding to adapt NHS and care-sector buildings for climate resilience.
Establish an LRF sub-committee dedicated to coordinating climate-adaptation activity.
Integrate catchment management and flood-resilience measures into the LNRS.
Embed long-term climate impacts into NHS Emergency Preparedness, Resilience and Response (EPRR) arrangements and corresponding local authority emergency planning, business continuity and resilience frameworks.
Integrate climate-risk considerations into long-term NHS health planning and local authority health, public health and social care strategies.
Continue partnership support for the Humber 2100 flood-risk-management programme.
Provide guidance and monitor compliance across the primary-care estate to improve climate resilience.
Improve communication on adaptation through case studies and stories (e.g., Pam’s Story) to raise awareness across the sector.
Deliver structured climate adaptation training for NHS and local authority sustainability, estates, emergency planning and other relevant service teams.
Ensure ambulance stations and charging hubs have resilient backup power, such as generators or battery storage.
Build climate resilience into emergency preparedness plans, including contingencies for power loss.
Monitor implementation of land-use policies to ensure they actively reduce flood risk in new development.
Offer sustainability grants and support programmes for private care homes through the NYC Business Sustainability Programme.
Retrofit property-level flood-protection measures to reduce household and business vulnerability.
Apply the NHS Climate Adaptation Framework alongside relevant local authority adaptation and resilience frameworks to strengthen climate adaptation capabilities across health, public health, social care and wider local services.
Establish clear senior-level ownership and accountability for climate adaptation and resilience across NHS Trusts and local authorities.
Lobby for increased public funding to help care homes implement resilience measures.
Communicate heat-health measures – Improve awareness among staff and patients about heat stress risks and preventive actions to reduce health impacts.
Provide timely warnings and guidance to NHS and local authority staff, care providers, partner organisations and communities, enabling protective measures for vulnerable people and essential services during extreme heat events.
Install temperature/humidity monitors – Equip healthcare facilities with monitoring systems to track indoor climate conditions and identify areas needing intervention.
Apply NHS adaptation framework – Use the NHS Climate Adaptation Framework to strengthen adaptation planning and increase sector-wide resilience.
Guide and monitor resilience – Provide guidance and monitor compliance across primary care facilities to ensure buildings and operations are resilient to climate impacts.
Collect heat-related treatment data – Record incidents of cancelled treatments or heat-related health impacts to inform cost-benefit analyses and resilience planning.
Embed resilience in emergency plans – Include heatwave contingencies, power loss scenarios, and other climate risks in NHS Trust and local resilience forum emergency planning.
Deliver adaptation training – Provide structured training for sustainability, estates, and emergency planning teams to increase knowledge and preparedness. Offer entire healthcare workforce awareness training (private care sector)
Share adaptation case studies – Use stories and examples from across the sector to raise awareness of practical adaptation measures and their benefits.
Consider whole-life cooling costs – Factor in ventilation and air conditioning requirements when designing new care facilities to ensure long-term comfort and resilience.
Monitor vector-borne diseases – Conduct ongoing research and surveillance to detect emerging health risks that may be exacerbated by climate change. Local monitoring and response plans needed (UKHSA/LA)
Engage early with landowners and stakeholders on flood schemes to accelerate planning and delivery.
Develop cool spaces – Create designated cooling areas in healthcare and community settings to protect vulnerable populations during extreme heat events.
Assign adaptation responsibility – Ensure clear leadership within NHS Trusts in and all related agencies for climate adaptation and resilience actions.
LRF climate adaptation coordination – Establish Local Resilience Forum sub-committees to coordinate climate adaptation across health and emergency services.
Local authority and NHS business criticality planning – Identify, prioritise and protect essential council services to maintain critical operations and support vulnerable communities during extreme weather events.
Use procurement for care-home resilience – Include resilience requirements in care-home contracts to ensure commissioned facilities are prepared for heat and other climate risks.
Advocate improved building standards – Push for stronger national and local building regulations to ensure new and refurbished facilities are climate-resilient.
Resilient ambulance power provision – Ensure ambulance stations and electric vehicle charging hubs have reliable backup power, such as generators or battery storage.
Use commissioning and procurement processes to require care-home providers to meet climate-resilience conditions, including flood resilience.
Integrate resilience into net-zero retrofits – Combine energy efficiency, decarbonisation and climate adaptation measures when upgrading local authority and NHS buildings and estates to maximise sustainability and resilience to future climate impacts.
Expand climate-health impact monitoring – Extend monitoring of climate-related health impacts, including illness and hospital admissions, to support evidence-based interventions.
Provide grants/support for care homes – Offer financial and technical assistance to help private care homes implement climate-resilient measures.
Develop a “Movement and Place” Plan — reallocating road space to prioritise sustainable modes of travel (walking, cycling, public transport), creating high-quality public spaces that support nature recovery
Significant new investment in cycling walking and public transport planning integrating green areas and SUDS
Strengthen flood-alert systems – Improve early warning, communication and preparedness across NHS & local authority buildings, critical services, social care facilities and vulnerable communities.
Develop renewable energy skills and promote jobs in this sector for all levels of education from school age to experienced professionals
Develop a suite of metrics and indicators to monitor thresholds for action in YNYCA.
Produce a public information toolkit with guidance, checklists, and resources for residents and organisations during high river levels in York.
Strengthen contingency planning through Local Resilience Forum leadership.

Require health-care providers to check flood maps and actively manage property-level climate risks.
Combine net-zero retrofit works with flood resilience upgrades to Local Authority & NHS buildings.
Provide Local Resilience Forum support for adaptation planning and funding applications.
Strengthen agricultural resilience with farm reservoirs, swales, and enhanced soil-care practices to cope with drought and floods.
Unified severe-weather planning – Combine responses to cold, heat, and flooding into a single adverse-weather plan to ensure coordinated and efficient action. UKHSA Adverse Weather and Health Plan needs to be adopted and implemented by each agency
Integrate climate-adaptation measures into the YNYCA Strategic Planning Update.
Issue recovery and resilience guidance tailored to businesses.
Enhance local resilience through the Flood & Coastal Resilience Innovation Programme.
Lobby public funding for care homes – Secure additional funding to help care homes implement adaptation measures, protecting residents and staff from extreme heat and flooding.
Develop integrated water management plans – Plan water use and infrastructure holistically to manage risks from droughts, floods, and other climate extremes.
Collaborate on flood risk management – Work with multiple partners to identify, prevent, and mitigate flooding risks, reducing impacts across communities and infrastructure.
Implement strategic catchment planning – Plan and manage water and land use at the catchment scale to address combined flood, drought, and water-quality risks.
Improve transport-network resilience utilising adaptive reporting powers.
Increase soil organic matter to improve soil moisture retention and resilience to both drought and heavy rainfall.
Improve public understanding of water issues through education and awareness campaigns.
Create long-term water resource models to guide future housing development decisions.
Partner with Yorkshire Water's Beyond Nature programme to support sustainable land and water management.
Implement Sustainable Drainage Systems (SuDS) to improve infiltration and reduce runoff, supporting drought resilience.
Avoid siting new critical infrastructure in high-risk zones – Prevent future vulnerabilities by restricting development of essential services in areas prone to flooding, heat, or other hazards.
Promote the adoption of permeable driveway materials to increase groundwater recharge.
Provide financial incentives for water-efficient infrastructure, such as rainwater harvesting or drip-irrigation systems.
Integrate water resource and drought-flood planning at catchment scale – Co-ordinate strategies for both water scarcity and excess water to enhance resilience across multiple sectors and ecosystems.
Reduce water demand by encouraging long-term behavioural changes in water consumption.
Collaborate with Yorkshire Water on the Living with Water blue-green infrastructure strategy.
Update policies to simplify the approval and installation of farm reservoirs.
Increase soil organic carbon to boost water retention in agricultural land.
Enhance upland and moorland management to increase natural water storage capacity.
Expand greywater recycling for non-potable uses to reduce freshwater demand.
Encourage agroforestry practices to improve soil water storage and buffer crops against climate extremes.
Provide sector-wide training and cooperation within agriculture to increase awareness and adoption of resilience methods.
Use renewable energy solutions tailored to place, such as solar power to compensate for reduced hydropower during low-flow periods.
Increase tree and shrub planting on farmland to enhance habitat, shade, soil stability, and moisture retention.
Integrate rainwater harvesting systems into new housing developments.
Remove silt from reservoirs to restore and expand their storage capacity.
Encourage rainwater harvesting for agricultural operations.
Promote water conservation through incentives, such as smart metering and usage-based billing.
Increase efforts in leak detection and pressure management to minimise water loss.
Replace or renew water mains to improve network resilience and reduce leakage.
Construct new water treatment facilities to expand supply and improve abstraction capacity.
Offer reduced business rates or utility charges for buildings that achieve high water-efficiency standards.
Expand existing reservoirs to increase available water storage.
Upgrade the water grid to enable more flexible and robust water transfers.
Develop additional large-scale raw-water transfer connections with external suppliers.
Guide care homes on heat preparedness – Provide advice on medications, medical conditions, and practical steps to reduce risk during heatwaves.
Establish shared resilience targets – Agree on common goals across sectors and agencies to improve overall resilience to climate-related risks and ensure coordinated action.
Encourage businesses to adopt rainwater-harvesting systems to improve water efficiency and drought resilience.
Require climate adaptation reporting for utilities and transport – Ensure key sectors regularly report on their adaptation measures to track progress and identify vulnerabilities.
Implement managed retreat strategies in the most flood-prone areas.
Align financing and investment timing across partners – Coordinate funding and investment periods (e.g., with Yorkshire Water, Environment Agency, and local authorities) to maximise resilience improvements.
Deliver major flood-protection schemes, including the York (2039) project and forthcoming schemes for Tadcaster and Selby.
Integrate climate risks into emergency planning – Embed climate projections and potential cascading hazards into emergency response strategies to enhance preparedness.
Plan for higher maintenance costs due to climate impacts – Anticipate increased repair and upkeep needs for infrastructure affected by extreme weather and other climate impacts.
Coordinate emergency planning across LRF and utility services – Strengthen joint planning between Local Resilience Forums and utilities to improve response to interconnected risks.
Maintain and use a National Underground Asset Register (NUAR) – Keep an updated register of underground utilities to prevent damage, improve emergency response, and reduce cascading failures.
Map critical assets across agencies – Identify key infrastructure (e.g., masts, pumping stations, substations, roads) and dependencies to understand and mitigate cascading risks.
Harden and add redundancy to critical infrastructure – Install backup systems such as onsite power generation and reinforce structures to maintain service during extreme events.
Increase planning controls for development in floodplains.
Apply updated climate allowances in LRF risk registers – Use the latest climate projections to adjust risk assessments and emergency planning assumptions.
Continue collaborative adaptive reporting with stakeholders – Share data and lessons learned across agencies to improve understanding of interconnected risks and effective adaptation strategies.
Update the SFRA and develop land-use policies that consider flood and climate risks.
Promote rainwater collection systems for farming to support irrigation during dry periods.
Align land-use planning across the catchment to enable integrated catchment management.

Strengthen collaboration with groups such as Future Farmers Yorkshire.
Join or develop landscape restoration partnerships through schemes like the Landscape Enterprise Networks with organisations like Diageo and Nestlé.
Coordinate joint funding efforts for initiatives such as Slow the Flow.
Provide training to improve knowledge of soil-enhancing, water-absorbing farming practices.
Improve livestock management to reduce soil compaction / improve soil health.
Enhance soil health by increasing aeration and infiltration.
Expand hedgerow coverage to support landscape resilience.
Support adoption of new farming systems such as agroforestry.
Build acceptance of seasonal flooding and associated land-use transitions.
Implement SuDS to reduce surface-water flooding and improve natural drainage.
Promote land-use changes such as increased tree cover in upper catchments.
Support delivery of Ousewem and Catchment Partnership programmes.
Restore river systems through rewiggling and other natural channel restoration.
Create protected habitat areas for international species in alignment with Humber 2100.
Strengthen joint oversight and strategic planning between the Environment Agency and local authorities for sustainable water abstraction.
Apply natural flood management using wetlands to reduce peak river flows.
Develop visitor infrastructure—hides, trails, educational signage—to highlight wetland value.
Supply real-time flood-status information to visitors.
Foster cross-sector collaboration between industry and agriculture on long-term water resource planning.
Deliver LRF-led training for Flood Action Groups.
Promote soil-health improvements—such as adding organic matter and improving aeration—to boost infiltration and drought resistance.
Adopt lessons from arid-region infrastructure standards to strengthen local drought preparedness.
Advocate reforms to the Reservoirs Act and planning rules so farmers can more easily build small on-farm storage reservoirs.
Incorporate climate-impact mitigation into land-use planning frameworks.
Explore and promote Internal Drainage Board (IDB) funding to support climate-resilience investments.
Expand the use of cover crops to help soils retain moisture and withstand variable weather.
Restore natural water-retaining landscapes to counteract historic land-use changes that reduced drought buffering capacity.
Restore peatlands to enhance water storage and carbon sequestration.
Rewet landscapes by blocking drainage channels to raise water tables.
Support the expansion of on-farm water storage capacity to safeguard supplies during drought.
Run pilot projects to identify practical challenges and solutions in developing new on-farm water storage reservoirs.
Integrate sprinkler, drip, and solid-set irrigation systems where appropriate to increase efficiency and adaptability.
Conduct research into climate-resilient tree / flora species tailored to regional conditions / integrate resilient species lists from Natural England into forestry plans.
Boost community drought resilience by integrating water-scarcity planning into urban design and development standards.
Require developers to factor climate-change impacts into planning and design to ensure drought-resilient construction.
Explore new groundwater sources to diversify and increase water supply during drought.
Promote rainwater harvesting initiatives with Yorkshire Water.
Assess best-fit irrigation technologies suited to local climate and crop types.
Implement swales and improved field drainage maintenance to manage water more effectively and reduce flood impacts.
Develop desalination facilities as an alternative source of water during drought conditions.
Address invasive species pressures identified in the Nature Partnership Plan.
Strengthen regional catchment-based collaboration on invasive species management.
Use species-control agreements with landowners to support coordinated INNS intervention.
Implement actions aligned with the Great Britain Invasive Non-Native Species Strategy.
Deliver region-specific INNS adaptation measures under the YNYCA Invasive Species Strategy.
Secure and utilise Yorkshire Water funding to support INNS control and resilience measures.
Expand use of citizen-science INNS mapping tools to improve early detection and monitoring.
Apply relevant legislation (e.g., Invasive Alien Species Regulation) to manage ecological risks.
Increase investment in biosecurity and INNS response funds to enhance resilience.
Coordinate INNS management across local parks, greenspaces, and public land through YNYCA.
Support the Yorkshire Invasive Species Forum to strengthen regional action and knowledge-sharing.
Enhance public awareness through Yorkshire Water biodiversity teams and ranger engagement.
Promote integrated pest-management approaches to reduce ecological vulnerability.
Deploy targeted trapping programmes (e.g., American mink) to support species recovery initiatives.
Encourage uptake of AQUA Biosecurity Accreditation to improve water-related biosecurity standards.
Promote rainwater harvesting in new housing developments to support climate-resilient water use.
Advocate for increased resources to fully implement the regional INNS strategy.
Deliver public education on INNS risks and prevention to reduce spread under climate change.
Support behavioural campaigns such as Check, Clean, Dry to limit aquatic species transfer.
Implement INNS actions identified in River Basin Management Plans to strengthen catchment resilience.
Install biosecurity wash-down stations at high-risk recreational sites to prevent species spread.

Timeframe / Phas	Impact	Cost band	Adaptation Sector
L	3	£££	Built Environment
M	3	£££	Built Environment
M	2	££	Built Environment
S	2	££	Built Environment
S	1	££	Built Environment
O	2	££	Built Environment
O	2	££	Built Environment
M	3	£££	Built Environment
M	1	££	Built Environment
M	1	£	Built Environment
M	1	£	Built Environment
O	2	£	Built Environment
S	2	£	Built Environment
S	2	£	Built Environment
O	2	£	Built Environment
O	2	££	Built Environment
M	1	£	Infrastructure & Transport
O	3	£	Built Environment
M	1	£	Built Environment
O	2	£	Built Environment
S	1	£	Built Environment
O	2	£	Built Environment
O	2	£	Built Environment
M	1	£	Built Environment
O	1	£	Built Environment
O	2	££	Built Environment
S	1	££	Built Environment
O	3	£	Built Environment
O	2	££	Built Environment
O	2	£	Built Environment
O	2	£	Built Environment
M	3	£	Built Environment
O	2	££	Built Environment
O	2	£	Built Environment
O	2	££	Built Environment
M	3	££	Built Environment
M	2	££	Built Environment
L	3	£££	Built Environment
S	1	£	Built Environment
M	2	££	Built Environment
S	1	£	Built Environment
M	3	££	Built Environment
M	1	£	Health & Communities
M	1	££	Built Environment
M	2	££	Built Environment
O	1	£	Built Environment
M	3	£££	Built Environment
O	1	£	Built Environment
O	3	££	Built Environment
O	2	£	Built Environment
M	3	£££	Built Environment
E	2	£	Built Environment
M,L	1	£	Built Environment
M,L	3	££	Built Environment
M,L	2	££	Built Environment
E,M	2	££	Built Environment
E	1	£	Built Environment
M	2	££	Built Environment
E	1	£	Built Environment
E,M	1	£	Built Environment
M,L	3	££	Built Environment

M,L	2	££	Built Environment
M,L	2	£	Built Environment
E	1	£	Built Environment
M	1	£	Built Environment
M	2	££	Built Environment
E	2	£	Built Environment
E,M	2	£	Built Environment
O	3	£££	Built Environment
M	3	£££	Built Environment
E,M	1	£	Built Environment
E	2	££	Built Environment
E,M	2	££	Built Environment
E,M	2	£	Business & Industry
E,M	3	£££	Business & Industry
E	2	££	Built Environment
E	1	£	Built Environment
E,M	2	£	Business & Industry
E,M	2	££	Built Environment
E,M	2	£	Built Environment
E,M	2	£	Built Environment
E,M	1	£	Business & Industry
E,M	1	£	Built Environment
E	3	££	Infrastructure & Transport
E,M	2	£	Built Environment
E,M	2	££	Business & Industry
E	1	£	Built Environment
E,M,L	2	££	Built Environment
E	3	££	Business & Industry
E,M	2	£	Built Environment
E	2	££	Built Environment
E,M,L	2	££	Built Environment
NA	NA	NA	Business & Industry
E	1	£	Business & Industry
E	1	£	Business & Industry
E,M	1	£	Business & Industry
M,L	3	£££	Business & Industry
E,M	2	££	Business & Industry
E,M	2	££	Business & Industry
E,M	2	£	Business & Industry
E,M	1	£	Infrastructure & Transport
M	2	£	Business & Industry
E,M	1	£	Business & Industry
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E,M,L	2	££	Infrastructure & Transport
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E,M,L	2	££	Business & Industry
E,M,L	1	£	Business & Industry
E,M	2	£	Health & Communities
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E,M	2	££	Built Environment
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E,M,L	3	£	Health & Communities
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E,M,L	2	£	Health & Communities
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M	2	££	Health & Communities
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E,M	2	££	Health & Communities
E,M,L	2	££	Health & Communities
E,M,L	2	£	Health & Communities
E,M	2	££	Health & Communities
M	2	££	Infrastructure & Transport
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M,L	2	£	Infrastructure & Transport
E	1	£	Infrastructure & Transport
E,M	2	££	Infrastructure & Transport
E,M	1	£	Health & Communities
E,M	2	£	Interconnected
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E,M	3	££	Infrastructure & Transport
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M,L	3	£££	Infrastructure & Transport
E,M	1	£	Interconnected
E,M	3	£££	Infrastructure & Transport
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Agenda Item 7

Meeting:	Decision Session – Executive Member for Finance, Performance, Major Projects and Equalities.
Meeting date:	6 October 2026
Report of:	Director of Finance
Portfolio of:	Executive Member for Finance, Performance, Major Projects and Equalities

Decision Report: Application for Community Right to Bid under the Localism Act 2011

Subject of Report

1. This report details applications to list the following properties as Asset of Community Value (ACV) for consideration by the Council.

   a) Hempland Lane Allotment Community Wildlife Area, Hempland lane, York, YO31 0QG
   b) Hagg Wood, Intake Lane, Dunnington, York, YO19 5HY

2. The applications have been received, for a decision by the Executive Member in the Council's statutory capacity as an Asset of Community Value (ACV) listing authority.

Benefits and Challenges

3. This process is a statutory requirement. The process and the effects through the listing of an asset is set out in detail in this paper.

Policy Basis for Decision

4. The process is a statutory requirement.

Financial Strategy Implications

5. There are no financial strategy implications to this decision.

Recommendation and Reasons

6. The Executive Member is asked to consider the officer recommendation(s) to:

6.1 Approve the listing of:

a) Hempland Lane Allotment Community Wildlife Area, Hempland lane, York, YO31 0QG. An application has been received by Hempland Lane Allotment Association

Reject the listing of:

b) Hagg Wood, Intake Lane, Dunnington, York, YO19 5HY. An application has been made by Dunnington Parish Council.

Reason:
To ensure the Council meets its legislative obligations (pursuant to the Localism Act 2011 and the Assets of Community Value (England) Regulations 2012) and promotes community access to community facilities.

Background

7. The purpose behind the provisions regarding Assets of Community Value (ACV) in the Localism Act 2011 is to ensure that property (land and building) assets which are currently used for principal/non-ancillary use(s) which benefit the local communities are not disposed of without the local community being given an opportunity to bid for these assets when the owner wishes to dispose of the asset. This right is not simply to accommodate ‘public assets’ but also private assets, the test is whether such assets are viewed as ‘assets of community value’. These assets therefore could be currently owned by the public, private or voluntary sector.

8. Section 89(1)(a) sets out that land in the local authority's area may be listed on the ACV list only in response to a community nomination. Section 89(2)(b)(iii) of the Localism Act 2011 requires that the organisation nominating an asset to be an ACV is a person that is a voluntary or community body with a local connection to the asset nominated. Further, the legislation requires that the nominating organisation must include in the nomination form information about the asset nominated, in accordance with part 6 of the Assets of Community Value (England) Regulations 2012.

9. The definition of 'land of community value' is set out in section 88 of the Localism Act 2011. To be considered as an asset of community value the land or property must satisfy either of the following criteria:
   a. s88(1) an actual current non-ancillary use of the building or other land furthers the well-being or social interests of the community and whether it is realistic to think that there can continue to be non-ancillary use of the building or other land which will further (whether or not in the same way) the social well-being or social interests of the local community.

   OR

   b. s88(2) there is a time in the recent past when an actual non-ancillary use of the building or other land furthered the social well-being or social interests of the local community and it is realistic to think that there is a time within the next 5 years when there could be non-ancillary use (whether or not the same use as before) that would further the social well-being or social interests of the local community.

10. There is no exhaustive list of what is considered to be an asset of community value, but cultural, recreational and sporting interests are included. Excluded specifically are residential type properties (such as hotels, housing in multiple occupation and residential caravan sites) and operational land of statutory undertakers.

The Process

11. The regulations set out how potential assets can be listed which in brief are as follows:
    - **Nomination** – this can be by a voluntary or community body with a local connection. This includes parish councils, neighbourhood forums, charities, community interest groups but excludes public or local authorities (except parish councils).

- **Consideration** – the local authority has 8 weeks to make the decision. Under the Council's procedures the Executive Member is the decision maker. If the nomination is successful, the asset details are entered onto the 'Community Value list' – see further details in the report – and also the local land charges register. If unsuccessful, then the details are entered onto an 'unsuccessful nominations' list for a period of 5 years to prevent repeat nominations. The owner can request a review of the decision which must be completed within 8 weeks and the owner can further appeal within 28 days of the review outcome to a Tribunal. Neither the Localism Act nor the ACV Regulations give the nominating organisation any right to appeal a decision of the local authority that the nominated property is not an asset of community value/does not satisfy the necessary S.88 criteria referred to above.
- **Disposal of assets on the ACV list** – if a building or piece of land which is on the list is going to be disposed of (by way of either a freehold sale or granting of a lease for a Term of 25 years or more) with vacant possession, then the owner of the asset needs to give notice to the local authority. There is then a 6-week moratorium period for any community group to express interest in writing. If they do, then a 6-month period (commencing from the date on which the Council had received notice of the owner's intention to dispose of the asset) is provided for that group to prepare its bid. After that period the owner can market the property and any bid from the community group will be considered with bids from other interested parties. There is no guarantee that the offer from the community group will be successful as the owner of the asset will dispose of the property in accordance with its own criteria for disposal. There are a number of exceptions contained within the legislation that mean that this moratorium period does not apply and the owner does not need to give notice of its intention to sell. This includes when there is a legally enforceable requirement, which pre-dates the listing, to sell to a specific party.
- **Compensation** – the presence of the land or building asset on the community value list may result in additional expenditure or a loss to the owner and therefore the owner can apply for compensation from the local authority. The figure is limited to costs or losses incurred only whilst the asset is on the list and could include such items as legal expenses for appeals, costs relating to the delay in the sale (such as maintenance, security, utility costs, loss of value).

Hempland Lane Allotments Community Wildlife Area

A. The eligibility of the nominating organisation and the nominated asset to be an ACV.

12. The application nominating the nomination land ("Hempland Lane Allotments Community Wildlife Area") has been made by Hempland Lane Allotments Association. When making the application, the applicant seeks to assert its status as a community body under section 89(2)(b)(iii) of the Localism Act 2011 ("The Act").

13. Hempland Lane Allotments Association are an eligible body, The application meets the qualifying test set out in section 89(1)(a) of the Act as an application made by way of a community nomination.

    The application sets out that the freehold of Hempland Lane Allotments is owned by City of York Council, west offices, Station Rise, York, YO1 6GA, as stated in freehold title registered at the Land Registry. There is a leasehold title registered at the Land Registry in the name of York Allotments (CEO 10805) (Registered Charity No. 1174306), registered office, Popeshead Court Offices, Peter Lane, York, YO1 8SU. In accordance with the regulations, the freehold & leasehold owners of the property, have been informed in writing that the application has been made and have been invited to make representations regarding the nomination. No response has been received from the freehold owners. York Allotments has confirmed support for the nomination.

14. The application provides a clear description and postcode of the land nominated on the first page of the form and has attached to it a map setting out the extent of the land. The nominated land does not come within the categories of land which may not be ACVs.

15. The applicant has provided their reasons for thinking that the Council should conclude that the land is of community value, at section 3.

16. Legal Services have confirmed that a nomination must be considered by the Council, if the nominator is someone who meets the eligibility criteria specified in the relevant legislation, and if the nomination form includes the information specified in regulation 6 of

the ACV Regulations 2012. Legal Services considers the Nominator fulfils the criteria.

B. Is the current or recent usage of the nominated land an actual and non-ancillary use, does the usage further social wellbeing or social interest, and is it realistic to think that there can continue to be non-ancillary use of the building which will further (whether or not in the same way) the social wellbeing or social interests of the local community.

17. This application concerns the listing of Hempland Lane Allotments Community Wildlife Area on the Council's ACV list. The past and current usage of the area as a venue for community activities/events is set out below and indicates that the current and recent usage of the nominated land is an actual and non-ancillary use pursuant to section 88(1) and section 88(2) of the Act.

18. Hempland Lane Allotment Association state the wildlife area was created by volunteers in the year 2000, with approval from City of York Council, to convert a former derelict paddock area into a quiet space where nature could thrive and be enjoyed by local residents, allotment holders, and the general public.

19. They state that or over 25 years the Community Wildlife Area has supported the social recreation and wellbeing of the local community. There are two distinct areas within the site, a community woodland to the north, planted with native deciduous trees and including two seasonal ponds which help to drain the surrounding land, and a central clearing. To the south is an open area planted with grasses and wildflowers

20. Hempland Lane Allotment Association state that the wildlife area provides peace and tranquillity offering and escape for visitors including wildlife lovers, allotments holders, local children and residents. It is a haven for flora and fauna and a habitat for many species such as Bats, Owls and Willow Warblers. They state that a pond has been recently redesigned by Froglife to aid frogs and newts to flourish

21. Hempland Lane Allotment Association also states that ACV status will help to preserve the wildlife areas availability for continued use

by the local community where they can be at one with nature, thereby furthering the social interests and wellbeing of the overall community. Memorial benches are also located in this area for lost loved ones.

22. Full details are provided in the nomination form in Annex 1 & 2

23. The Hempland Lane Allotment Community Wildlife Area has developed a community focus and, for the reasons set out above and further in the nomination form, the community appears to have been using the land in a way which engages and strengthens community bonds, adding to the social value of the community; therefore the application meets the criteria of the legislation.

24. The application meets the criteria for listing and it is therefore recommended that Hempland Lane Allotment Community Wildlife Area should be listed on the ACV register.

Hagg Wood

A. The eligibility of the nominating organisation and the nominated asset to be an ACV.

25. The application nominating the nomination land ("Hagg Wood") has been made by Dunnington Parish Council. When making the application, the applicant seeks to assert its status as a community body under section 89(2)(b)(iii) of the Localism Act 2011 ("The Act").

26. Dunnington Parish Council are an eligible body; The application meets the qualifying test set out in section 89(1)(a) of the Act as an application made by way of a community nomination. The application sets out that the freehold of Hagg Wood is owned by Church Commissioners for England, Church House, Great Smith Street, London, SW1P 3AZ , as stated in freehold title registered at the Land Registry. There is a leasehold title registered at the Land Registry in the name of Forestry England, 620 Bristol Business Park, Coldharbour Lane, Bristol, BS16 1EJ. In accordance with the regulations, the freehold and leasehold owners of the property, have been informed in writing that the application has been made and been invited to make representations regarding the nomination.

Respresentations have been received from Fisher German on behalf of the freehold owners. No response has been received from the leasehold owners.

27. The application provides a clear description and postcode of the land nominated on the first page of the form and has attached to it a map setting out the extent of the land. The nominated land does not come within the categories of land which may not be ACVs.

28. The applicant has provided their reasons for thinking that the Council should conclude that the land is of community value, at section 3.

29. Legal Services have confirmed that a nomination must be considered by the Council, if the nominator is someone who meets the eligibility criteria specified in the relevant legislation, and if the nomination form includes the information specified in regulation 6 of the ACV Regulations 2012. Legal Services considers the Nominator fulfils the criteria.

30. Legal Services do not consider that Hagg Wood, the nominated asset meets the eligibility criteria specified in the relevant legislation. Under The Act, regulations list a number of situations where buildings or land are exempted from inclusion on the listing or moratorium, this includes Church of England land holdings.

31. Paragraph 12 of the ACV Regulations 2012 states that s95(1) of the Localism Act (which deals with the moratorium period) will not apply to a disposal of church together with any church land: therefore if Church of England land is exempt from a moratorium, a listing as an ACV would afford no protection.

32. The Church of England has its own governance framework requirements when disposing of property, under the Church Property Measure 2018 and also under the Charities Act 2011. An ACV moratorium would conflict with these statutory requirements

B. Is the current or recent usage of the nominated land an actual and non-ancillary use, does the usage further social wellbeing or social interest, and is it realistic to think that there can continue to be non-ancillary use of the building which will further (whether or not in the same way) the social wellbeing or social interests of the local community.

33. This application concerns the listing of Hagg Wood on the Council's ACV list. The past and current usage of the land as a venue for community activities/events is set out below and indicates that the current and recent usage of the nominated land is an actual and non-ancillary use pursuant to section 88(1) and section 88(2) of the Act.

34. Dunnington Parish Council state that Hagg Wood located on the edge of Dunnington, in the parish of Kexby & Scoreby was established as a community woodland in 2003 by agreement between the freehold owners of the land who suspended their shooting rights in the wood, the Friends of Hagg Wood and The Forestry Commission. Whilst the original agreement was for 5 years, the land has continued to be used, and the shooting rights not re-let.

35. Dunnington Parish Council in the nomination state that The Friends of Hagg Wood who are all local volunteers have been involved in 'managing' the wood since the group was formed in 1996 to enable the wildlife and the rich ecological features of the original ancient woodland to be restored and to promote its values. The Two well used public rights of way which run through the wood provides ease of access and a means by which to observe the flora and fauna close at hand.

36. The Parish Council advises that residents use the wood for walking, running, bird watching, dog walking and horse riding (with the consent of Forestry England). Local schools and community groups use the woodland for environmental education, nature studies and volunteering projects

37. Full details are provided in the nomination form and further information in Annex 3 & 4

38. On behalf of The Church Commissioners for England, their Agents Fisher German advise that whilst the woodland does provide recreational and amenity benefits to the local community, these are ancillary to its principal use as a managed forestry asset. They advise that the relevant statutory tests are set out in S88 of the Localism Act 2011 and subsection 1 being the relevant clause to consider for The Friends of Hagg Woods ancillary use of the land.

39. Fisher German make reference to the 2003 agreement between their client, the Forestry Commission & the Friends of Hagg Wood and highlighted that no executed copy of this agreement exists. Only an unsigned draft Memorandum of Understanding could be found. They advise that the Foresty Commission Forest Plan included with the Nomination is a forestry management plan which gives clear evidence that Hagg Wood is being managed for forestry purposes whilst recognising its recreational benefits.

40. Full details are provided in Annex 5

41. Three further emails of objection have been made to Hagg Wood being granted ACV status, details are provided in Annex 6

42. Hagg Wood appears to have developed a community focus and, for the reasons set out above and further in the nomination form, has been using the land in a way which engages and strengthens community bonds, adding to the social value of the community; therefore the application meets the criteria for this part of the legislation.

43. The application however does not meet the eligibility criteria for listing. It is therefore recommended that Hagg Wood should rejected as an ACV.

Nominations for Renewal of ACV Listings

44. Successful nominations are added to the Asset of Community Value register and remain on the list for a period of 5 years. Following expiry, the entry is removed.

45. It is proposed that any renewal nomination received for a property that has been listed on the Asset of Community Value register be referred to the Director of Finance in consultation with the Director of Governance for decision.

46. For the avoidance of doubt, new nominations will continue to be sent for Executive Member decision.

Consultation Analysis

As required by the Assets of Community Value Regulations, the owners of the properties have been consulted regarding the applications and have been invited to make representations. No representations have been received from the registered owner regarding the listing.

Options Analysis and Evidential Basis

47. The applications to list Hempland Lane Allotment Community Wildlife Area & Hagg Wood as Assets of Community Value can either be accepted or rejected. There are no other options, as it is considered that sufficient information has been provided for a decision to be made.

48. If the decision is to approve the ACV nomination application, then the owner of the property has a statutory right to request a review of that decision by submitting a review request to the Council within 8 weeks of the decision date. (If the decision is to reject the ACV nomination application, the legislation does not give the nominating group any right to appeal that request, though they could potentially seek a Judicial Review of the decision by submitting a claim to the High Court.)

Organisational Impact and Implications

49.

- **Financial** – Compensation may be payable by the Council to the owner of any property which is listed. The figure is limited to costs or losses incurred only whilst the asset is on the list and could

include such items as legal expenses for appeals, costs relating to the delay in the sale (such as maintenance, security, utility costs, loss of value).

- **Human Resources (HR)** – None
- **Legal** – Advice and comments have been sought from Legal Services and incorporated in this report.
- **Procurement** – None

- **Health and Wellbeing** – The added protection of an ACV around a physical activity facility which caters for some of our more vulnerable and poorer residents has health and wellbeing benefits which should be considered in decision making.
- **Environment and Climate action** – No direct environmental impacts but buildings of community value are key and underpin a sense of place
- **Affordability** – None
- **Equalities and Human Rights** – None
- **Data Protection and Privacy** – Data protection impact assessments (DPIAs) are an essential part of our accountability obligations and is a legal requirement for any type of processing under UK data protection and privacy legislation. Failure to carry out a DPIA when required may leave the council open to enforcement action, including monetary penalties or fines.
    - DPIAs helps us to assess and demonstrate how we comply with all our data protection obligations. It does not have to eradicate all risks but should help to minimise and determine whether the level of risk is acceptable in the circumstances, considering the benefits of what the council wants to achieve.
    - The DPIA screening questions identified that whilst there is processing of personal, it is not likely to result in a high risk to the rights and freedoms of individuals. Therefore, a simple DPIA was completed which identified the data protections risks as well as the mitigations either in place or that need to be put in place, to minimise these identified risks such as redacting or withholding personal identifiable information from the public report where we do not have a lawful basis to publish it

- **Communications** – This is a routine statutory process. However, given the high level of community use and support for the venue, there may be public or stakeholder interest. Should this arise, communications will be able to support. Proactive messaging opportunities also exist to highlight the value of Assets of Community Value in sustaining vibrant neighbourhoods.
- **Economy** – None
- **Specialist Implications Officers** – None

Risk Management

50. The freeholder may appeal against the Council's decision to list their property as an asset of community value. In the first instance the property owner should ask the council to review its decision. If the Council upholds its decision to list the owner may appeal to the First-Tier Tribunal. If the decision is to reject the ACV nomination application, the nominating organisation may seek a Judicial Review of the decision by submitting a claim to the High Court. In both cases this can be a long and costly procedure.

Wards Impacted

Osbaldwick & Derwent
Heworth

Contact Details

For further information please contact the authors of this Decision Report.

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Report approved:	Yes	Yes
Date:		

Annexes

- Annex 1 – Hempland Lane Allotment Community Wildlife Area – Redacted Application to add to the list of assets of community value.
- Annex 2 – Hempland Lane Allotment Community Wildlife Area – redacted Supporting Names & Signatures
- Annex 3 – Hagg Wood – Redacted Application to add to the list of assets of community value.
- Annex 4 – Hagg Wood – Forest Plan FP56 2024
- Annex 5 – Hagg Wood – Agent response on behalf of freeholder
- Annex 6 – Hagg Wood – Redacted objection correspondence to nomination
- Annex 7- Current list of Assets of Community Value

Abbreviations used in the used in the report.

- ACV – Assets of Community Value
- DPIA – Data Protection Impact Assessment
- CAMRA – Campaign for Real Ale

ASSETS OF COMMUNITY VALUE NOMINATION FORM

If you need assistance completing this form, then please refer to the guidance document which can be downloaded from the website www.york.gov.uk/assetsofcommunityvalue or alternatively call 01904 553360.

Section 1
About the property to be nominated

Name of Property:	Hempland Lane Allotments Community Wildlife Area
Address of Property:	Hempland Lane Allotments, Hempland Lane, Heworth, York
Postcode:	YO31 0QG

Property Owner's Name:	City of York Council
Address:	West Offices, Station Rise, York
Postcode:	YO1 6GA
Telephone Number:	01904 551550
Current Occupier's Name:	Hempland Lane Allotment Association

Section 2
About your community organisation

Name of Organisation:	Hempland Lane Allotment Association
Title:	[redacted]
First Name:	[redacted]
Surname:	[redacted]
Position in Organisation:	Chairperson
Email Address:	[redacted]
Address:	[redacted]
Postcode:	[redacted]
Telephone Number:	[redacted]

Organisation type:
Click in field for options

Unincorporated community group

Organisation size

180

How many members do you have

Section 3
Supporting information for nomination

Any information entered in this section only may be copied and passed onto the owner of the property you are nominating. Definition of an asset of community value can be found in the guidance document.

Why do you feel the property is an asset of community value? Please give as much information as possible.

The Hempland Lane Allotments Community Wildlife area was created by volunteers from Hempland Lane Allotment Association in the year 2000, with approval from City of York Council, to convert a former derelict paddock area into a quiet space where nature could thrive and be enjoyed by local residents, allotment holders, and the general public.

For over 25 years this Community Wildlife Area has supported the social recreation and wellbeing of the local community.

There are two distinct areas:

- community woodland to the north, planted with native deciduous trees. This area includes two seasonal ponds which help to drain the surrounding land, and a central clearing.
- open area to the south, planted with grasses and wildflowers.

A path runs through both areas, connecting them to the allotments to the south and northeast.

The allotments are owned by CYC, but are leased to and managed by York Allotments Charitable Incorporated Organisation (YACIO). The Community Wildlife area that is the subject of this application was never transferred to YACIO. It is managed by Hempland Lane Allotment Association on behalf of CYC.

The Community Wildlife area provides peace and tranquility, offering a serene escape for its visitors, including nature enthusiasts and wildlife lovers. It is a haven for a rich variety of flora and fauna, and is a crucial habitat for many species, including bats, owls, goldfinches, great tits, blue tits, woodpeckers, willow warblers, frogs and newts.

It is regularly visited and used by allotment holders, local schoolchildren, and nearby residents as a quiet place to rest, contemplate, and be at one with nature. Recently the pond was redesigned by Froglife to aid frogs and newts to flourish.

The clearing in the woodland houses three memorial benches, paid for and placed there by people who have lost loved ones who enjoyed this quiet place.

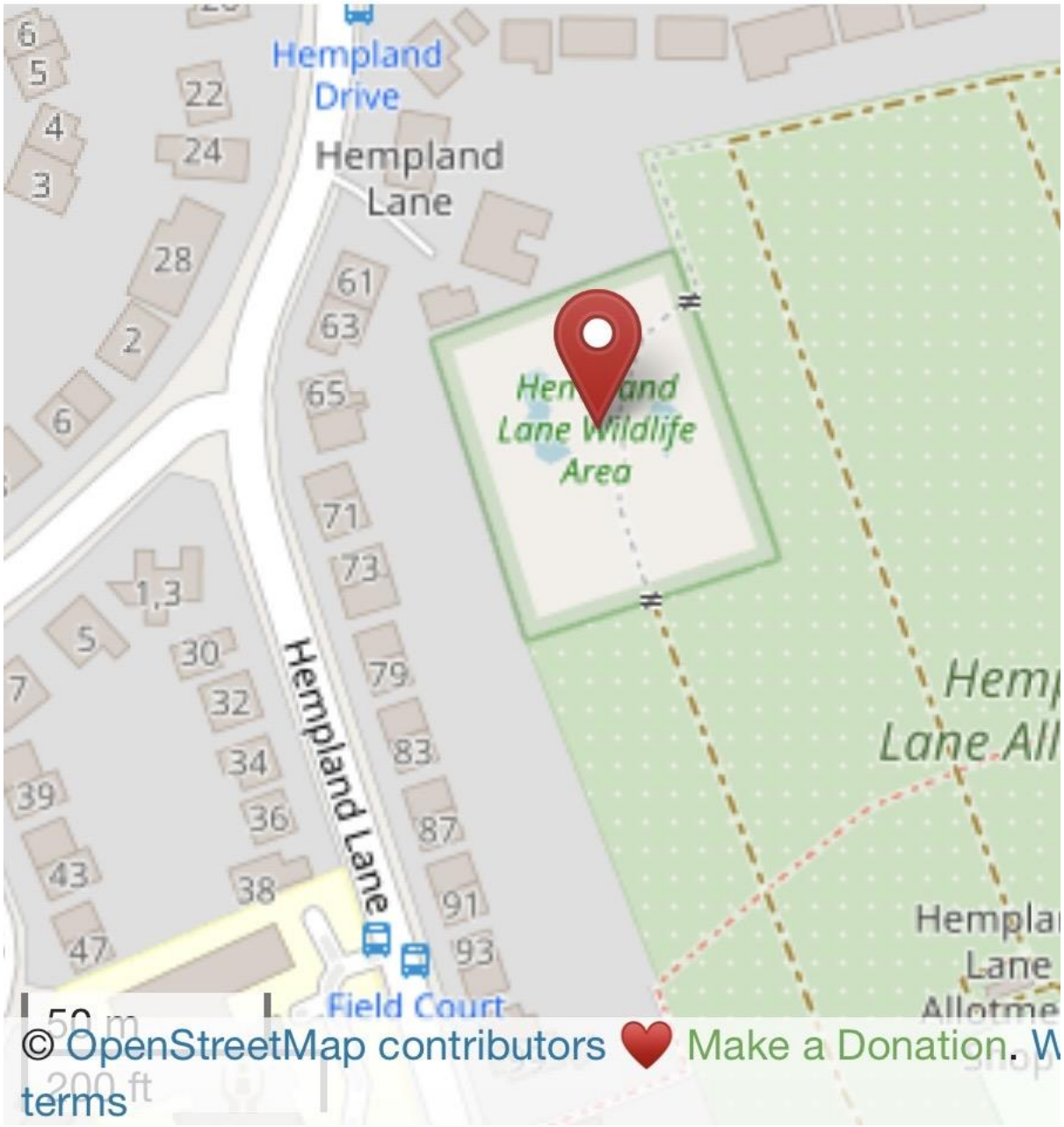
The application area is listed as an open space in the CYC local plan.

Listing this area as an asset of community value would formally recognise its value to the local community. In light of recent approval to develop the site immediately due north, it may also help to preserve it for future generations.

Section 4
Boundary of Property

What do you consider to be the boundary of the property? Please give as much detail/be as descriptive as possible. Please include a plan.

- The northern boundary is the southern boundary fence of Number 45 Hempland Lane
- The eastern boundary is the western edge of plots 56, 57, 58 and 59 on Hempland Lane Allotments
- The southern boundary is the northern edge of plots 99 and 104 on Hempland Lane Allotments
- The western boundary is the eastern boundary fences of 65-79 Hempland Lane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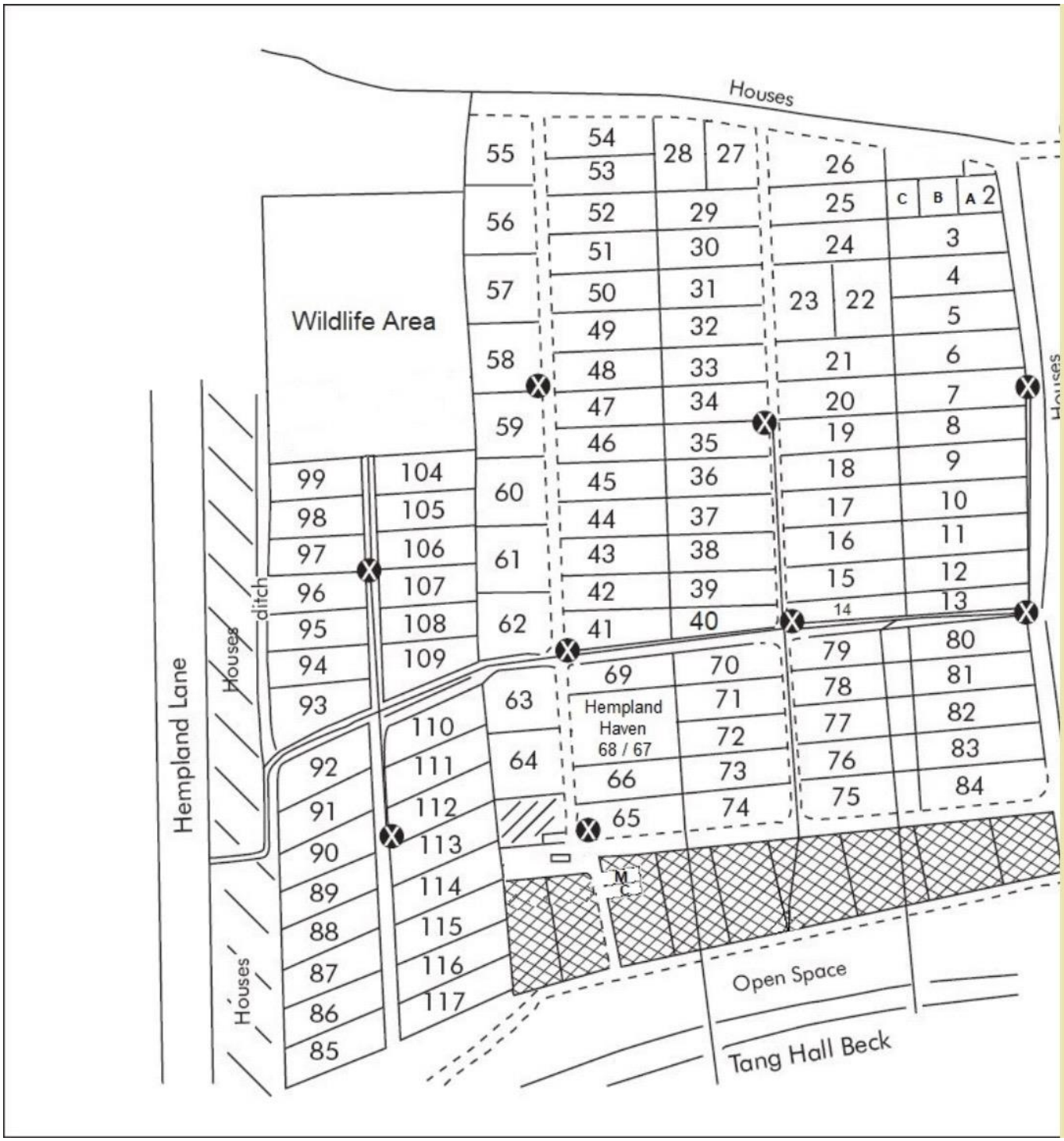
Hempland Lane
Hempland Lane Wildlife Area
Hempland Lane
Field Court
50 m
200 ft
© OpenStreetMap contributors
Make a Donation.
terms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Hempland Lane
Houses
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Hempland Haven 68 / 67
Open Space
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Section 5
Attachment checklist

- ☐ Copy of group constitution (if you are a constituted group)
- ☐ Name and home address of 21 members registered to vote in nomination area (if group is not constituted)
- ☐ Site boundary plan (if possible)

Section 6
Declaration

I can confirm that to the best of my knowledge the information contained in this nomination form is complete and accurate.

Signed: [redacted] Dated: 7th July 2026

.....

Please e-mail your completed form to **property.services@york.gov.uk** or post to:
Asset and Property Management
City of York Council
West Offices
Station Rise
York
YO1 6GA

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Annex 2:

ASSETS OF COMMUNITY VALUE SUPPOPRTING NAMES AND HOME ADDRESS

No.	Full Name	Home Address
1	[redacted]	
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
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[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
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[redacted]	[redacted]	[redacted]
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ASSETS OF COMMUNITY VALUE NOMINATION FORM

If you need assistance completing this form, then please refer to the guidance document which can be downloaded from the website www.york.gov.uk/assetsofcommunityvalue or alternatively call 01904 553360.

Section 1
About the property to be nominated

Name of Property:	Hagg Wood
Address of Property:	Intake Lane, Dunnington, York
Postcode:	YO19 5HY

Property Owner's Name:	Church Commissioners for England
Address:	Church House, Great Smith Street, London
Postcode:	SW1P 3AZ
Telephone Number:	02078981000
Current Occupier's Name:	Forestry England for forestry activities

Section 2
About your community organisation

Name of Organisation:	Dunnington Parish Council
Title:	[redacted]
First Name:	[redacted]
Surname:	[redacted]
Position in Organisation:	Parish Clerk
Email Address:	parish.clerk@dunningtonparishcouncil.gov.uk
Address:	Withheld
Postcode:	
Telephone Number:	[redacted]

Organisation type:

Local Government Body

Organisation size
How many members do you have?

Section 3
Supporting information for nomination

Any information entered in this section only may be copied and passed onto the owner of the property you are nominating. Definition of an asset of community value can be found in the guidance document.

Why do you feel the property is an asset of community value? Please give as much information as possible.

Protecting Hagg Wood: The Case for Asset of Community Value Status

1. Introduction Hagg Wood, a cherished Planted Ancient Woodland on the outskirts of Dunnington Parish in the Parish of Kexby and Scoreby, is more than just a wood, it is a living, breathing part of the community's heritage, ecology, and wellbeing. Designating Hagg Wood as an Asset of Community Value (ACV) under the Localism Act 2011 would formally recognise its importance and give the community a stronger voice in safeguarding its future.

2. Background Hagg Wood can be traced back to the Domesday Book in 1086. In the Middle Ages Hagg Wood would have been part of the Ouse and Derwent Forest over which the Crown exercised strict control. Over time the Hagg Wood diminished and in 1936 the Church Commissioners bought the freehold of the wood and granted the Forestry Commission a 999 year lease in 1952. After being heavily felled for timber during the Second World War it was replanted by Forestry England in the 1950's Hagg Wood was established as a community woodland in 2003 by agreement between the freehold owners of the land, the Church Commissioners, who suspended their shooting rights in the wood, the Friends of Hagg Wood, and the forestry lease holders, the Forestry Commission. While the agreement was initially for five years, the land, and the many paths over it, have since then continued to be widely used by many residents of the adjacent urban area for healthy exercise and mental refreshment, with the shooting rights not let. The substantial community value associated with the asset of the ownership of the freehold of Hagg Wood that has been achieved in the past can continue to be achieved if its ownership is motivated by such community value.

3. Community Significance Hagg Wood is deeply woven into the social and cultural fabric of Dunnington and Kexby with a combined population of around 3,500 people who have access: • Recreation & Wellbeing: Residents use the wood for walking, running, bird watching, dog walking and horse riding (with consent of Forestry England) together with quiet reflection. Access to green space is proven to improve mental and physical health. • Education & Engagement: Local schools and community groups use the woodland for environmental education, nature studies, and volunteering projects. • Cultural Identity: Generations of residents have enjoyed Hagg Wood, making it a shared landmark and a source of local pride. FINAL • Friends: The Friends of Hagg Wood are all local volunteers who have been involved with "managing" the wood since they were formed in 1996 to enable the wildlife and the rich ecological features of the original ancient woodland to be restored and to promote its values. • Social: The use of the wood is enjoyed by many and provides a social environment for all demographics. • Public Rights of Way: There are two, very well used, fully adopted public rights of way running east west and north south through the heart of the wood which provides ease of access and a means by which to observe the flora and fauna close at hand. • Historical: In 1944 craters were created when a flight had taken off from Elvington Airfield and had to return after twenty minutes because of a technical problem. As a consequence part of a bomb load was dropped before the aircraft returned to base creating craters which have been made more accessible with suitable planting to encourage amphibians.

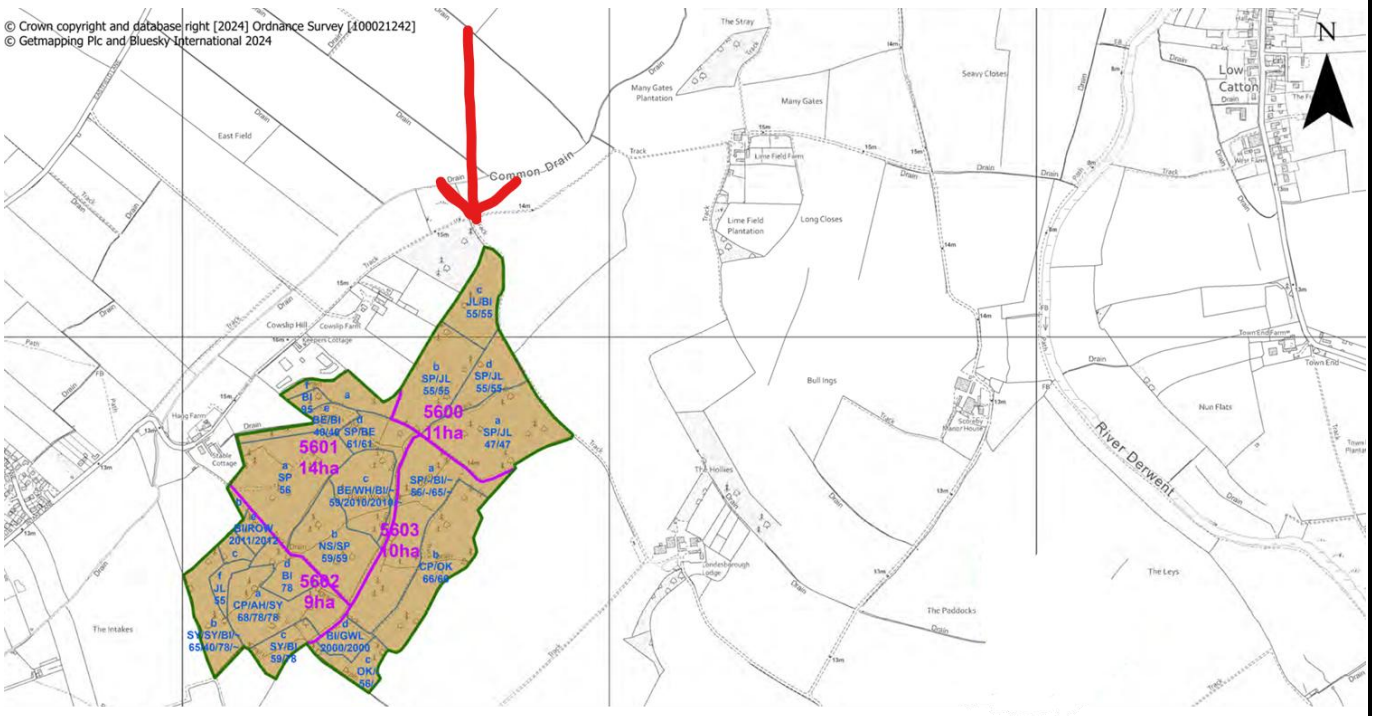
4. Environmental Value The Forestry England management plan for Hagg Wood aims to increase broadleaf cover to over 80% by 2054, enhancing biodiversity and resilience. It is therefore important to retain this woodland to help achieve this objective which supports: • Climate Resilience: Trees act as carbon sinks, help regulate local temperatures, and reduce flood risk. • Habitat Connectivity: Hagg Wood forms part of a wider ecological network, supporting wildlife corridors. • Wildlife: Recent ecological surveys have found 571 different species of flora and fauna, including 96 different bird species. 5. Conclusion Hagg Wood is not just a woodland it is a cornerstone of Dunnington's and Kexby's identity, a sanctuary for wildlife, and a vital space for community wellbeing. ACV status would retain the history and ensure that future generations can continue to enjoy and care for this treasured place. The community has both the passion and the responsibility and local support to protect Hagg Wood.

Section 4
Boundary of Property

What do you consider to be the boundary of the property? Please give as much detail/be as descriptive as possible. Please include a plan.

Hagg Wood is located between OS SE680 to the west and OS SE688 to the East.It is located between OS SE543 to the North and OS522 to the south.

The woodland owned by the Church Commissioners on the bondary to Dunnington and leased by Forestry England link attached. The parcel is the large wood included in the plan within the document of link attached and below marked with an arrow to the area in question. Hagg Wood Forest Plan.pdf



Section 5
Attachment checklist

- ☐ Copy of group constitution (if you are a constituted group)
- ☐ Name and home address of 21 members registered to vote in nomination area (if group is not constituted)
- ☐ Site boundary plan (if possible)

Section 6
Declaration

I can confirm that to the best of my knowledge the information contained in this nomination form is complete and accurate.

Signed [redacted] Dated: 17 07 2026

Please e-mail your completed form to **property.services@york.gov.uk** or post to:
Asset and Property Management
City of York Council
West Offices
Station Rise
York
YO1 6GA

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Hagg Wood Forest Plan FP 56

2024

Yorkshire Forest District

Forestry England forests and woodlands have been certified in accordance with the UK Woodland Assurance Standard (UKWAS)

Forestry England - Property

Forest District:	Yorkshire
Woodland or property name:	Hagg Wood
Nearest town, village or locality:	Dunnington
OS Grid reference:	SE 681 528
Local Authority district/unitary Authority:	City of York Council

Areas for approval

	Conifer	Broadleaf
Felling	0	0
Lower Impact Silvicultural Systems regeneration felling	15.6	8.7
Restocking	≤4.9	≥17.0

1. I apply for Forest Plan approval for the property described above and in the enclosed Forest Design Plan.

2. I confirm that the pre-consultation, carried out and documented in the Consultation Record attached, incorporated those stakeholders which FS agreed must be included. Where it has not been possible to resolve specific issues associated with the Plan to the satisfaction of consultees, this is highlighted in the Consultation Record.

3. I confirm that the proposals contained in this Plan comply with the UK Forestry Standard.

4. I undertake to obtain all permissions necessary for the implementation of the approved Plan.

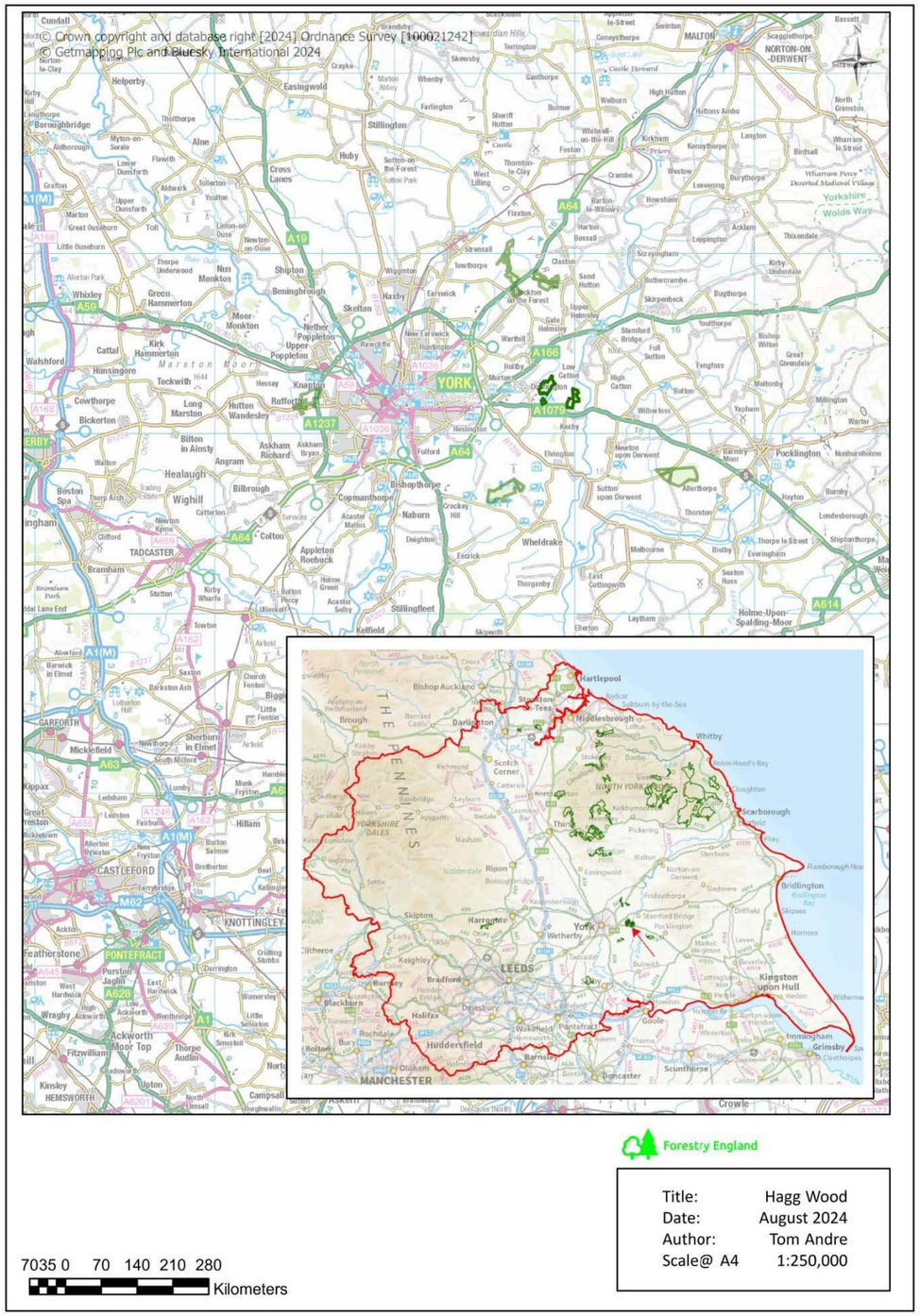

Figure 1 - Map showing the location of Hagg Wood.

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Summary

This Forest Plan sets the strategic management direction of Hagg Wood for the period until 2034. It builds upon previous plans and is informed by the forest's context and composition, including landscape, heritage, ecology, forest structure, tree species and habitats.

Opportunities and constraints are identified and these inform a selection of management objectives. These objectives will contribute to Forestry England's strategic objectives for wildlife, people, and for climate.

The plan then provides detail on implementation and associated monitoring. The plan explains how Forestry England will continue to sustainably harvest timber using a range of silvicultural systems. We are designing forest resilience into our plan for Hagg Wood by diversifying species composition and forest structure. The plan's approach to Plantation on Ancient Woodland (PAWS) is provided as well as detail on how forest management will be implemented to benefit Hagg Wood's wildlife.

A variety of maps and appendices are provided to support understanding.

General Principles

All operations within the forest will be carried out in accordance with the following standards:

- U.K. Woodland Assurance Standard
- U.K Forestry Standard 5th edition (published 2023)

All of our forests and woodlands are certified to the Forest Stewardship Council®(FSC®) licence code FSC-C123214 and the Programme for the Endorsement of Forest Certification (PEFC) licence code PEFC/16-40-1001 standards. We will maintain the land within our stewardship certified against the UK Woodland Assurance Standard, as independently assessed by annual surveillance audits.

Operational Planning - Before any major forest operations are undertaken, an Operational Site Assessment (OSA) is completed. The OSA details operational proposals and outlines all known environmental, social and operational considerations. It is an important reference document during the planning phase, at operational pre-commencement meetings, and for supervisory visits during the operation. The OSA is retained along with other related documents. Forestry England staff will monitor all work through regular site visits ensuring that guidelines and contract conditions are adhered to.

We will protect and where appropriate enhance all known sites of archaeological and ecological importance including areas of ASNW and PAWS, managing designated sites, such as scheduled monuments, in accordance with statutory requirements and in line with agreed management plans.

We apply local and national policy and best practice guidance to the management of riparian corridors, improving and enhancing the habitat network and benefiting protected species. Developing species and structural diversity will benefit habitats for priority woodland bird species throughout the woodland (Appendix 1 – Priority species).

Routine maintenance operations (e.g. fencing, ride mowing, survey work etc.) follow local policy[4].

Forest Resilience - We will continue to improve forest resilience to plant health, biosecurity and climate change threats through species and structural diversification.

Forest Development Types - During the lifetime of this plan, we will look to introduce the concept of Forest Development Types (FDTs)[1]: *"A Forest Development Type is a long-term vision of how the species composition and structure of a forest stand is intended to develop. The concept encourages the greater use of mixed-species stands and a wider variety of stand structure than previously deployed in British forests"*[1].

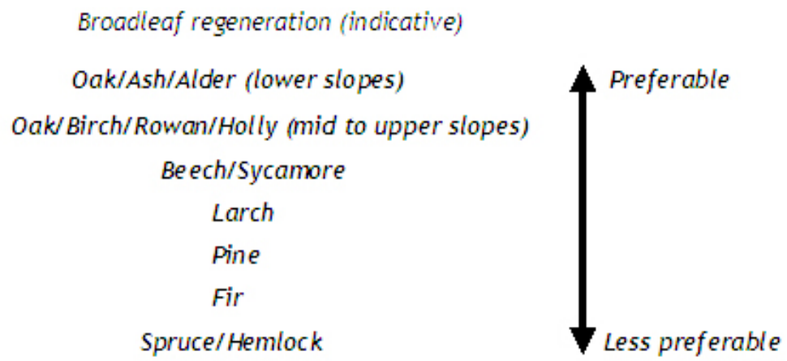
Lower Intervention Silvicultural Systems (LISS) - All plans consider LISS based on methodologies in available guidance[2]. LISS with associated scale felling will contribute towards a varied and intimate internal and external forest landscape, with simple and complex stand structures creating a diverse visitor experience, whilst contributing toward structural diversity. Where existing coupes are not identified for LISS management, we may consider managing these on an extended rotation basis to be thinned and monitored for future consideration for conversion to LISS. See Appendix 2 – LISS Justification.

Using the FC Forest Research Agency, Ecological Site Classification system (ESC), a range of conifer species are considered 'optimum' to 'unsuitable' for LISS where timber production is considered as an objective.

Wildlife Management - Successful establishment of restocking sites through planting and/or natural regeneration requires effective control of crop damaging mammals. Although deer are present within the forest and surrounding farmland, good levels of natural regeneration indicate that browsing pressure is low. Damage levels will be monitored and managed[3].

Wildfire - Regarding wildfire, we will follow guidance as set out in 'FC Practice Guide – Building wildfire resilience into forest management planning'[5]. This will be applied proportionately dependant on a particular forest or woodland.

Natural Regeneration - Natural regeneration in PAWS will be assessed and the risks to the plan's objectives will be considered. Where dense shade tolerant or invasive species (i.e. Western hemlock) threaten native woodland communities, natural regeneration will be removed as part of routine felling or thinning operations.



Native Woodland - Threats to our native woodlands can be immediate and absolute (e.g. loss to infrastructure or development) or slower and subtler (e.g. shading from conifer species or invasive species such as Rhododendron)[6]. There are also more widespread environmental changes, such as diffuse pollution and climate change, which may threaten in the long term.

Major threats to native woodland are:

- Climate change and fragmentation
- Excessive browsing and grazing by deer, livestock and grey squirrels
- Inadequate or inappropriate management

- Invasive and non-native plant species
- Diffuse pollution
- Pests and diseases
- Inappropriate recreational use
- Development and boundary incursions

We will continue to apply local and national policy[6,7] and best practice guidance for the management and development of our existing and new native woodlands.

Open space - Within woods we will continue the management of open space habitat, developing heathland, neutral grassland and acid mires where locally appropriate, in line with Forestry England's Open Habitat Policy[8]. Maintaining a mixed resource of temporary and permanent open space with diverse flora will provide habitat for priority species.

Woodland Composition - Over the lifetime of the plan where maintaining semi-naturalness is important, such as Ancient Woodland Sites, we will monitor and record levels of change through the Sub-Compartment Database and the resulting Semi Natural Class scores (Table 1). Across these sites we will maintain stands at SN Class 1 and gradually manage other sites towards this target composition.

Class 1	**Semi-Natural Woodland**
Includes native coppice woodland and high forest or site-native plantation with a relatively high percentage of native self-sown or coppice understorey.	
Class 2	**Reasserting Semi-Natural Woodland**
Plantation or ex-plantation with 50-80% site-native species. Includes coppice regeneration and/or strong natural regeneration amongst planted trees.	
Class 3	**Plantation**
Plantation with 20-50% site-native trees under established plantation stands	
Class 4	**Plantation**
Plantation with less than 20% site-native species. Includes all non-native broadleaves and beech planted outside its natural range in England.	

Table 1 – Semi- Natural Class descriptions

Haulage - We will continue discussions with the relevant Highways Authority to agree haulage routes and discuss annual tonnages. All timber traffic will be managed in line with the Road Haulage of Round Timber Code of Practice, Fifth Edition (2020)[9], which aims to improve the safety and environmental standards of the timber haulage industry.

Hagg Wood Forest Plan

81.0 Hectares (Ha)

Period of Plan: 2024 - 2034

1.0 Describing the site

Hagg Wood woodlands are located due east of Dunnington village (SE67025261, W3W///coping.named.decisions) and are made up of three areas of woodland: Hagg Wood (43.3 ha), Scoreby Wood (33.2 ha) and Cottage Plantation (4.2 ha). All areas of woodland are owned under leasehold. The surrounding land is primarily arable farmland.

1.1 Geology and Soils (FP Map 01)

Underlying superficial deposits of Lacustrine deposits and Devensian sand gravel overlay sandstone bedrock.

Soils are generally heavy mineral in nature with a high clay content and imperfect drainage. Areas of the north and west of Hagg Wood contain more acidic soils with sandy podzolic drifts. The resulting gley and brown earth soils provide a 'moist' soil moisture regime and 'medium' soil nutrient regime (although ranging from 'poor' to 'rich'). As a result, the woods can support a wide range of broadleaf and conifer species.

1.2 Tree Species (FP Map 02)

Hagg Wood is made up of a range of broadleaf and conifer tree species. Conifer is the dominant species group (64%), comprised mainly of pine species (47%) and larch species (13%). Broadleaf areas (33%) contain mainly oak (11%) and beech (6%) with birch, alder, sycamore, ash, rowan and other species present.

Tree species diversity can be measured using the Shannon Index which combines the number of species present with their relative abundance. The Shannon Index score for Hagg Wood in 2024 is 1.95, which is less diverse than the average for Yorkshire Forest District (2.17).

Species Composition *	2012 (%)	2017 (%)	2023 (%)
Broadleaf	27	33	33
Pine	49	47	47
Larch	16	13	13
Spruce	2	2	2
Other evergreen conifers	3	2	2
Open/felled	3	3	3

*Table 2 - Species composition by main species.*including as a component in mix with other species.*

Semi-Natural Class	Area (Ha)
1	5.7
2	0
3	32.6
4	42.7
Total	**81.0**

Table 3 - Areas of Semi Natural Classifications (see General Principles) across Hagg Wood.

1.3 Wind Hazard

Wind Hazard Class ranges from 1 to 3, indicating the woods are relatively windfirm and significant windblow events are unlikely. As a result, Lower Impact Silvicultural Systems (LISS) continue to be a viable management option across Hagg Wood.

1.4 Landscape

The woods sit within the Vale of York National Character Area where the landform is generally flat or gently undulating and woodland cover is low (5%). They are located within a medium-scale arable landscape of largely geometric field patterns.

The topography is flat and lies between 10m and 20m elevation.

1.5 People and Community (FP Map 04)

Hagg Wood is very well used by local people and dog walkers, with a comprehensive network of public footpaths, internal forest rides and tracks. Hagg Wood is well supported in the local community and has benefited from the Friends of Hagg Wood (FHW) community group since 1996.

The Minster Way long-distance footpath runs through Scoreby Wood before heading towards the banks of the River Derwent.

Cottage Plantation is not as well served for pedestrian access and has less capacity to support and develop its recreational use.

Sporting rights on the leasehold are retained by the lessor.

1.6 Natural Heritage (FP Map 04)

Hagg Wood and Scoreby Wood are designated as ancient woodland sites, principally consisting of Plantation on Ancient Woodland Site (PAWS). The central and southern parts of Hagg Wood are designated as a Site of Importance for Nature Conservation under criteria Wd3 (Acid Woodland) and Wd5 (Bluebell Wood). Ancient woodland indicator species are present across the woodlands, notably the bluebell in the south of Hagg Wood.

Cottage Plantation is a secondary plantation mixed conifer and broadleaf wood. The creation of wetland areas and ponds has provided the opportunity to develop favourable habitat conditions for associated flora and fauna (i.e. bat species).

The forest supports a wide range of nationally and regionally important bird species across different habitat types (see Appendix 1). In particular birds associated with developed woodland edge and shrub layer and woodland rides and glades.

1.7 Cultural Heritage (FP Map 04)

Hagg Wood

In the Domesday Book of 1086 Hagg Wood was recorded as woodland pasture. It supported livestock and the woodland floor was covered in grassland. The wood has been managed for a variety of products, according to the needs of the time, including timber for building, forage for animals, and shelter for game. After being heavily felled for timber during the Second World War it was replanted by Forestry England in the 1950s.

Scoreby Wood

The undesignated ancient monument at Mill Hill mound in the south of Scoreby Wood is evidence of the medieval and post-medieval agricultural activity in the landscape in and around Hagg Wood. Earthwork surveys described in "Hagg Wood, Past, Present and Future" indicate a network of medieval ditches and rectangular and circular platforms circa prehistoric/Romano-British exist in the south-west corner of compartment 5604. There is evidence of extensive ridge and furrow in and around Scoreby Wood, which may have become arable land in the Middle Ages, and reverted to woodland, possibly due to a decrease in population dependent on the land.

Cottage Plantation

There is little recorded heritage within Cottage Plantation, but extensive Roman and Iron age activity is recorded adjacent.

In addition, a survey carried out in 2000 by English Heritage Field Survey team noted slight earth banks which were interpreted as late medieval boundary features in the agricultural fields between Hagg Wood and Cottage Plantation. These have mostly been levelled by agricultural practices.

2.0 Describing the Project

2.1 Project Brief

Forestry England's purpose is to secure and grow the social, economic and natural capital value of the nation's forests. Different forests will deliver against our purpose in different ways depending on site conditions, constraints, and opportunities.

Forest Plans provide a holistic and long-term approach to planning and forest design. Forest plans will refer to other documentation, such as SSSI management plans, where appropriate.

Throughout the period of this plan, we will balance objectives for wildlife, people, climate and economy by considering the opportunities and constraints present at Hagg Wood.

2.2 Opportunities & Constraints

Opportunities

- High levels of public access and engagement, especially through the Friends of Hagg Wood, present significant opportunities for social benefit.
- An enhanced thinning programme over the last plan period (2012-2023) has prepared much of the site for the implementation of Lower Impact Silvicultural systems (LISS) and associated improvements to forest resilience through tree species and structural diversity.
- The ecological value of Hagg Wood within the wider agricultural landscape mean that ecological recovery, including continued PAWs restoration, is a high priority.

Constraints

- Projected climate change scenarios and forest pest and diseases are likely to challenge current tree species suitability into the future.
- Phytophthora ramorum (P. ramorum) has been identified on larch and rhododendron in woodlands across the area and wider district (though none locally to date). Larch components (13%) and significant rhododendron across the Hagg Wood block increase the risk of plant health issues on-site. Dothistroma septosporum (DNB) could have a significant impact owing to a high proportion of pine (47%). Dendroctonus micans (D.micans) represents a notable but less significant risk due to low proportion of spruce (2%).
- Areas of invasive rhododendron and associated impact on ground flora and tree regeneration.
- Grey squirrel populations currently impact the timber quality of broadleaf trees. This will have an increased impact as broadleaf regeneration is encouraged through successive LISS interventions. Deer management is also challenging across Hagg Wood due to high levels of public use and limited deer glades/sight lines.

2.3 Objectives and Implementation

	Objectives	Implementation
Wildlife	• Protect and enhance the ecological value of Hagg Wood. • Continue the restoration of PAWS to native dominant woodland. • Continue rhododendron control with the development of a long-term and justified programme.	• All work sites are surveyed prior to any operations being carried out to audit information records and to identify opportunities to further improve the ecological value of the woodlands. • Increase and improve the deadwood resource[10] by retaining different types of deadwood (especially deadwood from native tree species) where safe to do so. • Restore Plantation on Ancient Woodland Sites (PAWS) in line with guidance[5,6,11]. • Increase the diversity of tree species and age structure to maintain and improve favourable conditions for target species and identified habitats. • *Rhododendron ponticum* is recorded across Hagg Wood. A programme of vegetation management will be developed over the duration of this plan where this is likely to impact on high value conservation sites or present a high-risk to tree health.
People	• Continue to provide an open and accessible woodland area at Hagg Wood for a variety of suitable recreational pursuits. • Protect and enhance the cultural and heritage value of Hagg Wood.	• The scale and shape of LISS shelterwoods will be designed in-keeping with the scale of the forest and the surrounding landscape. The resulting diversity in structure will enhance external and internal views of Hagg Wood. • All heritage features will receive the same level of care during the planning and execution of forest operations. Operational planning will identify appropriate measures for the protection of heritage features before work begins, and, where possible, opportunities to enhance the condition of heritage features will be taken.
Climate	• Improve forest resilience to climate change and plant health risks by increasing tree species and structural diversity.	• Appropriate scale LISS felling will continue the process of restructuring the woodland to improve structural diversity. • A wide range of appropriate tree species will be considered for restocking using Forest Research's Ecological Site Classification tool and other climate planning tools to increase species diversity and resilience to future climate change. We will follow guidance and research to implement adaptation including the acceptance of naturalised species and assisted migration[12,13]. • Consideration and further development of the use of Forest Development Types (FDTs) will continue throughout the lifetime of this plan. A long list of site appropriate FDTs is available in Appendix 5.
Economy	• Maintain a sustainable supply of timber from LISS and a diverse range of site-appropriate species.	• Timber will be sustainably harvested through LISS and thinning interventions. • Species selection for restocking will prioritise PAWS restoration using site suitable and productive tree species.

Table 4 – Hagg Wood Forest Plan objectives and implementation table. Note: A monitoring plan is provided in Appendix 3 showing how each plan objective will be measured.

3.0 Methodology – Forest Operations

The design concept map (FP Map 07) highlights some of the key factors to be addressed through this Forest Plan. Other Forest Plan maps show the operational plan, including proposed Management Types (FP Map 05) and Future Habitat and Restock (FP Map 06).

3.1 Felling

Felling	Area - hectares	% of total area (excl. SSSI)	Projected volume (m^3)
Clearfell 2024 – 2028	0	0	0
Clearfell 2028 – 2034	0	0	0
Net Area to be managed under LISS	24.3	30%	6970

Table 5 - Breakdown of felling areas within the plan period (FP Map O5).

3.2 Lower Impact Silvicultural Systems (LISS)

All areas of Hagg Wood (81.0 ha) will be managed using LISS, including group shelterwood and irregular shelterwood systems. Appendix 2 – LISS justification – provides a rationale for the choice of silvicultural system. There are no planned clearfells at Hagg Wood.

Table 5 provides a breakdown of felling areas over the period of the Forest Plan and FP Map 05 shows the distribution of different types of LISS over the extent of Hagg Wood.

During the plan period, areas of LISS with trees over 25 years old will be assessed for a silvicultural intervention (thinning/regeneration felling). No more than 30% of stems within any single compartment will be removed at one time over the plan period; as a result, the associated area will be regenerated through a combination of restocking and natural regeneration.

3.3 Restocking

All restocking at Hagg Wood, including natural regeneration and planting, will use predominantly broadleaf species (≥80%) at the scale of a restocking coupe. Broadleaf species will be at least 80% native species. Site-native species will be favoured. These may be supplemented with 'honorary native' or 'naturalised species' such as sycamore. These are species whose climate envelope will move from their current range to encompass some or all of the UK, including Hagg Wood.

Natural regeneration will be favoured but planting may be used when:

- Past experience, evidence or specific site factors suggest a low chance of successful regeneration.
- The mix of species needs to be diversified or enriched to meet wood production, biodiversity or resilience to climate change objectives.
- Natural regeneration is likely to be of mainly non-native species.
- Genetic diversity or quality needs to be increased or improved by introducing new provenances.

Natural regeneration of conifer species in PAWS woodland will be assessed against the risk posed to the objectives of the plan. Where dense shade-tolerant or invasive species (i.e. Western hemlock or Sitka spruce) threaten the native woodland community, it will be removed during routine forest operations.

The Future Habitat and Restock map (FP Map 06) shows the distribution of restocking. Table 6 shows the expected distribution change of habitat types at year 10 (2034) and year 30 (2054). Habitat classifications are presented according to the UK Biodiversity Action Plan definitions for broad habitats and priority habitats[14,15].

Habitat type (based on principle species planted)	Area - hectares			% of total area		
	2024	2034	2054	2024	2034	2054
Broadleaved; mixed/yew woodlands	51.5	56.0	65.0	63.6%	69.1%	80.2%
Lowland Mixed Deciduous Woodland*	5.9	10.8	32.8	7.3%	13.3%	40.5%
Coniferous woodlands	29.5	25.0	16.0	36.4%	30.9%	19.8%

*Table 6 – Expected changes to the distribution of habitat type 2024-2054. *'Lowland Mixed Deciduous Woodland' is a priority habitat and is a subset of the broad habitat type 'Broadleaved; mixed/yew woodlands'.*

4.0 Monitoring

A detailed monitoring plan is provided in Appendix 3. This plan outlines how we will monitor delivery against the forest plan objectives, operational implementation, and forest certification.

4.1 Forest Plan Monitoring

All forest plans are formally reviewed at year 5 ('mid-term review') and year 10. At each review, the plan is assessed against its objectives. This plan will be formally reviewed in 2029 with the opportunity to share information where requested. This period may be shortened if circumstances change significantly or if parts of the plan prove detrimental to the overall aims and objectives.

Where an amendment to the Forest Plan is required, the Forestry Commission Practice Delivery Note 01 – Tolerance Table will be applied as set out in Appendix 4.

4.2 UKWAS Compliance Table

We will maintain the land within our stewardship certified against the UK Woodland Assurance Standard, as independently assessed by annual independent surveillance audits.

	Forest Plan Area (ha)	Forest Plan Percentage	Forest District Area (ha)	Forest District Percentage
Total Area	81	100	21045	100
Total Wooded area	81	100	18585	88
Natural Reserves - Plantation (1%)	0	0	294	1.8
Natural Reserves - Semi-natural (5%)	0	0	102	5
Long-term Retentions and Low Impact Silvicultural Systems (>1%)	81	100	10636	50.5
Area of conservation Value (15%) including designations; SSSI, PAWS, ASNW, NR, LTR, LISS	81	100	10636	50.5
Planned Open/Other	0	0	3114	15

Table 7 – UKWAS Compliance Table.

Bibliography

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3. Yorkshire Forest District Deer Management Strategy.
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7. Ancient Woodland on the Forestry Commission Estate in England (March 2002)
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9. Road Haulage of Round Timber Code of Practice, Fifth Edition (2020)
10. Deadwood - Policy, Procedures, Guidance (PPG) 51 (March 2022)
11. Plantations on Ancient Woodland Sites (PAWS) Restoration – PPG 70 Policy Document
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14. Jackson, D.L. (2000). Guidance on the interpretation of the Biodiversity Broad Habitat Classification (terrestrial and freshwater types): Definitions and the relationship with other classifications, JNCC Report No. 307, JNCC, Peterborough, ISSN 0963-8091.
15. BRIG (2011). UK Biodiversity Action Plan: Priority Habitat Descriptions. JNCC, Peterborough.

Appendices

Appendix 1 - Priority species

Bird Species [1]	Forest location	Habitat enhancement
Dunnock Willow warbler Willow tit Marsh tit Lesser redpoll Song Thrush Black Cap Bullfinch Chiff Chaff Garden warbler Goldcrest Green finch Nuthatch Yellow Hammer Spotted Flycatcher	Developed shrub layer	Continue selective thinning and regeneration felling as part of LISS management, this will allow the development of shrub layer structure and increased structural and species diversity. Create and maintain successional woodland (birch and oak)/scrub habitat and standing deadwood.
	Woodland edge, ride, glade	Continue selective thinning and regeneration felling as part of LISS management, this will create increased structural and species diversity. Expand road and ride margins to extend herb and invertebrate rich roadside verges, increase habitat connectivity and woodland edge habitat with surrounding arable fields. Create and maintain successional woodland (birch and oak)/scrub habitat and standing deadwood.
Invertebrates[2]	**Forest location**	**Habitat enhancement**
Water beetles – nationally scarce *Agabus Liginosus*, *Agabus chalconatus*	Ponds and ditch systems	Maintain ponds/ ditch systems in favourable condition and increase wet habitat where possible through planned operations.
Woodland flora	**Forest location**	**Habitat enhancement**
Ancient woodland indicator species e.g. bluebells, wood anemone and primrose	Woodland edge, ride, glade	Continue selective thinning and regeneration felling as part of LISS management, this will create increased structural and species diversity whilst maintaining shade conditions woodland species require. Expand road and ride margins to extend herb and invertebrate rich roadside verges, increase habitat connectivity and woodland edge habitat.

[1] BirdTrack - BirdTrack is organised by the BTO for the BTO, RSPB, BirdWatch Ireland, SOC and WOS.

[2] Martin Hammond Ecology report.

Appendix 2 - LISS justification - Hagg Wood

Most of Hagg Wood has been managed using LISS during the previous Forest Plan. LISS – irregular shelterwood and group shelterwood systems – are prescribed in this Forest Plan because Hagg Wood are suited to this management approach and this approach will help to deliver the plan's objectives.

Stand Appraisal

Stand form – overall stand form across most conifer species is good and developing but more variable across broadleaf species.

Thinning history – Regular thinning has been carried out across the majority of broadleaf and conifer stands where justified. Most stands are suitably thinned for LISS to be applied. There is generally good evidence that a range of broadleaf species are capable of developing through natural regeneration across sites, although light levels, ground cover and deer damage will need to be monitored.

The impact from P.ramorum, *D.septosporum, D.micans* and *Chalara* on larch, pine, spruce and ash species will need to be monitored as to how this might impact on future stand composition, depending on what the management objectives are for those sites.

Access –There is good internal forest access for forest operations across the site which will facilitate ongoing thinning and LISS management.

Site Factor	Suitability Score	Comment
Wind Hazard Classification: Majority of the forest is WHC range 1 - 3	1	Well-thinned stands with typically deep rooting soils.
Soil fertility: Medium	2	ESC modelled soil nutrient regime ranging from 'poor' to 'rich'. Previous on-site appraisal of 'medium' used in analysis.
Current species suitability: Very suitable (SP, POK, SBI, SY)	1	Using modelled soil moisture regime (moist) and 'medium' soil nutrient regime. Advanced natural regeneration occurs across a range broadleaf and species. Understory developing where light levels are suitable. Regeneration limited by rhododendron and bramble ground cover.

On the basis of the above information, we will continue to implement LISS for the across Hagg Wood with the aim of increasing species diversity using a range of species depending on site objectives.

Irregular shelterwood and group shelterwood systems (up to 0.6 ha in size) will be applied to a range of stand types where the felling of small coupes will contribute toward the development of more resilient, diverse woodland stands.

Future wildlife management issues may arise where deer browsing could impact Shelterwood systems as more palatable species are introduced. Site monitoring and adherence to the District Deer Management strategy will help inform future management.

Ecological Site Classification Report

Eastings(m)	Northings(m)	Grid Reference	Climate Scenario	Site Class	Filter	Brash	Drainage	Fertiliser/Nurse
468418	452661	SE684526	Medium-High 2080 (A1b/3q0)	Very warm - Sheltered - Slightly dry	Native species only	No brash present	No drainage installed	No fertiliser

Site Description and Variables

The site has a very warm, sheltered and slightly dry climate. The soils are moist moisture status and medium nutrient status. Tree species recommendations in ESC do not take account of each countries regulatory approval process, so prior to including species in a forest plan advice should be sought from relevant forestry authorities.

Modifications	AT	CT	DAMS	MD	SMR	SNR
Default	2746.0	8.0	12.0	250.0	4.0(Moist)	3.0(Medium)
Final	2746.0	8.0	12.0	250.0	4.0(Moist)	3.0(Medium)

Species	Abbr.	Suit(Ecol)	Suit(Timber)	Yield	Limiting	AT	CT	DAMS	MD	SMR	SNR	Version
Scots pine	SP	●	●	10	MD	●	●	●	●	●	●	3.3(A)
Downy birch	PBI	■	■	0	MD	■	●	●	■	●	●	3.2(A)
Silver birch	SBI	●	▲	3	AT5	●	●	●	●	●	●	3.2(A)
Beech	BE	■	■	1	MD	▲	●	●	■	●	●	3.1(A)
Ash	AH	■	■	0	MD	●	●	●	■	●	●	3(A)
Pedunculate oak	POK	●	●	4	MD	●	●	●	●	●	●	3.1(A)
Sessile oak	SOK	▲	▲	3	MD	●	●	●	▲	●	●	3.2(A)
Aspen	ASP	●	▲	4	AT5	●	●	●	●	●	●	3.2(A)
Common alder	CAR	●	●	7	MD	●	●	●	●	●	●	3.2(A)
Rowan	ROW	●	●	2	MD	●	●	●	●	●	●	3.3(A)
Wild service tree	WST	●	●	5	SMR	●	●	●	●	●	●	3(A)
Hornbeam	HBM	●	●	10	MD	●	●	●	●	●	●	3(A)
Small-leaved lime	SLI	●	▲	5	MD	●	●	●	●	●	●	3(A)
Wych elm	WEM	■	■	2	MD	●	●	●	■	●	●	3(A)
Wild cherry	WCH	●	▲	5	MD	●	●	●	●	●	●	3(A)
White willow	WWL	■	■	1	MD	●	●	●	■	●	●	3(C)
Holly	HOL	▲	▲	2	MD	●	●	●	▲	●	●	3(C)
Willow (SRC)	SRC	●	●	9	MD	●	●	●	●	●	●	3(C)

Appendix 3 - Monitoring Plan

Appendix 3 - Hagg Wood Monitoring Plan			
Objective	**Method**	**Frequency/Timings**	**Actions**
Wildlife			
Protect and enhance the ecological value of Hagg Woods.	Ecological records are maintained and utilised in operational planning.	At plan renewal, mid-term review and 10-year review, and when significant data from other monitoring becomes available.	Update Forester Web GIS sub-compartment database and conservation module.
	Review sample of Operational Site Assessments.	In line with District Operational Site Assessment Policy.	Provide feedback where management is not compliant with recommendations.
Conserve ancient and veteran trees and continue the restoration of PAWS to native dominant woodland.	Use semi-natural scores to measure progress of PAWS restoration as per PAWS policy.	At plan renewal, mid-term review and 10-year review, and when data from other monitoring becomes available.	Update Forester Web GIS sub-compartment database. If required, modify LISS prescriptions (including felling and restocking) to achieve objective for PAWS restoration.
	Review sample of Operational Site Assessments.	In line with District Operational Site Assessment Policy.	Provide feedback and take corrective action if management is not compliant with recommendations.
	Ancient Woodland Condition Assessment to survey ground flora, NVC and tree inventory (including canopy cover).	Decadal, where funding is available. Previous assessment in 2014.	Utilise the next ancient woodland condition assessment and incorporate into mid-term review.
Continue rhododendron control with the development of a long-term and justified programme.	Assessment of delivery against the plan for rhododendron control.	At mid-term review.	An evidenced and justified plan for rhododendron control has been developed by mid-term review and assessed thereafter.
People			
Continue to provide an open and accessible woodland area at Hagg Wood for a variety of recreational pursuits.	Qualitative assessment of access and ad-hoc feedback from community groups and the public.	Year 0 baseline, mid-term review, 10-year review. Ad-hoc when feedback is received.	Review at mid-term review.
Protect and enhance the cultural and heritage value of Hagg Woods.	Historic environment records are maintained and utilised in operational planning.	Annually or as data becomes available. At time of Year 0 baseline, mid-term review, 10-year review.	Update Forester Web GIS Heritage module. Provide feedback and take corrective action if management is not compliant with recommendations.

Climate			
Improve forest resilience to climate change and plant health risks by increasing tree species and structural diversity.	Tree species diversity will be measured using the Shannon Index which accounts for the number and relative abundance of species. Structural diversity will be measured using age class distribution.	Year 0 plan renewal, mid-term review, 10-year review.	Update sub-compartment database following operations. At 5-year review, take action to understand and correct delivery if increased diversity is not occurring.
Economy			
Maintain a sustainable supply of timber from LISS and a diverse range of site-appropriate species.	Update Forester Web GIS; sub-compartment database, Operational Thinning Layer, Management Coupe Layer.	Following forest operations and at End Of Year updates. Year 0 plan renewal, mid-term review, 10-year review.	Review long-term changes in productive capacity through the Production Forecast at the point of plan renewal and across the wider District.
Operational			
Restock & Future Habitat Coupes - Mixed broadleaf habitat. Establish at least 1100 broadleaf stems per ha through natural regeneration by year 10 since date of felling.	On-site stocking density plot surveys.	Beat-up surveys between years 1 to 4. Year 5 stocking assessment, internal guidance PPG4.	Carry out enrichment planting where stocking density falls below prescribed number of trees/ha to achieve full stocking.
Wildlife management - Identify problem sites where mammal damage is affecting crop establishment or degrading woodland flora.	On-site stocking density plot surveys. Damage, Impact and Activity Assessments as set out in YFD Deer Management Strategy.	To be informed from results of beat-up surveys between years 1 to 4 and year 5 stocking assessment, internal guidance PPG4.	Target deer control in line with District strategy.
Forest Plan			
Ensure the plan's objectives are being met and implementation is being delivered.	Utilise this monitoring plan and conduct a mid-term and 10-year review.	At mid-term review in 2029.	Take corrective action or modify the plans aims and/or objectives where these are no longer compatible with National or District Policy. Significant plan changes will require consultation and formal amendment from the Forestry Commission.
Certification			
All of our forests and woodlands are certified to the Forest Stewardship Council®(FSC®) licence code FSC-C123214 and the Programme for the Endorsement of Forest Certification (PEFC) licence code PEFC/16-40-1001 standards. We will maintain the land within our stewardship certified against the UK Woodland Assurance Standard.	Independent surveillance audit across the organisation.	Annually	Implement corrective actions as required.
	Independent surveillance audit across the District.	As per audit sample.	Implement corrective actions as required.

Appendix 4 Agreed Tolerance table *for Forestry England Yorkshire Forest District, England*

	Adjustment to felling coupe boundaries	Swapping of felling coupes	Adjustment to felling operation	Clearance of standing trees associated with wind-blown areas[7]	Delayed restocking - including natural regeneration	Species choice	Tree health
Formal assessment and approval by FC area team required	>25% of the coupe area	Where changes to the felling sequence is likely to result in a significant breach[1] of the UKFS adjacency rules	From unconditional felling (thinning or low-intervention management) to conditional felling such as: • regeneration felling • strip felling[2] • clear felling and where ≥50% of standing tree volume is to be removed	Individual work area that is either: >5ha of standing trees associated with wind-blow areas or Proposals result in cumulative additional felling[8] affecting >20% of the Forest Plan area[9]	N/A – dealt with via FC Area team approval (below)	From mixed, predominantly broadleaves to predominantly conifer	Where no SPHN is issued but felling of ≥65% standing tree volume is required in response to a plant health issue
Written approval only required from FC area team[3]	Between 10-25% of the coupe area	Where changes to the felling sequence is likely to result in a minor breach[4] of the UKFS adjacency rules	From unconditional felling (thinning or low-intervention management) to conditional felling where between 30%-50% of standing tree volume is to be removed such as: • regeneration felling • strip felling or From lower intensity regeneration felling to higher intensity regeneration felling, (as defined by the felling operation hierarchy[5]) where <50% of standing tree volume is to be removed	Individual work area that meets both the criteria: 1-5ha of standing trees associated with wind-blow areas, (Where there is an immediate and significant risk to health and safety or access, felling of ≥5ha of standing trees associated with wind-blow areas) and Proposals result in cumulative additional felling[8] affecting <20% of the Forest Plan area[9]	Planting: Where this is ≥ 4 planting seasons from the date of felling. Natural regeneration: where necessary intervention to secure natural regen is not implemented within 4 full planting seasons from date of felling	Deciduous conifers to predominantly evergreen conifers	Where no SPHN is issued but felling between ≥50% and < 65% of standing tree volume is required in response to a plant health issue
No formal or written approval by FC area team required[6]	< 10% of the coupe area	Where changes to the felling sequence does not result in a breach of the UKFS adjacency rules	Clear felling to strip felling, shelterwood or regenerative felling systems, or thinning or From more severe regeneration felling to less severe regeneration felling as defined by the regeneration felling hierarchy[5]	<1ha of standing trees associated with wind-blow areas (Where there is an immediate and significant risk to health and safety or access, felling of 1ha-5ha of standing trees associated with wind-blow areas) and Proposals result in cumulative additional felling[8] affecting <10% of the Forest Plan area[9]	For any changes to the timing of restocking where this occurs <4 full planting seasons from the date of felling	Any other changes	Where an SPHN is issued Or Thinning / regenerative felling <50% of standing tree volume is required in response to a plant health issue

[1] Greater than 20% of the coupe boundary
[2] Felling strips with a width ≤ 1.5 x treelengths, with a length appropriate to site constraints.
[3] Approval letter retained for compliance inspection purposes.
[4] 20% or less of the coupe boundary
[5] Lower impact operation to higher impact operation hierarchy: thinning, selection system, uniform shelterwood, irregular shelterwood, group shelterwood, strip felling, clear felling.
[6] District must keep all **assessment and decision-making** records in respect of amendments for **audit purposes** and compliance inspections
[7] Operations remain subject to other approvals for sensitive areas (e.g. SSSI, SAM etc). Subject to agreement of this tolerance table by relevant protected landscapes.
[8] Cumulative additional felling = 5 year rolling total area of growing trees felled (excludes dead and completely windblown trees) that were not approved for felling within the relevant felling period, in the initial approved Forest Plan. This includes both FS approved amendments and felling below thresholds. The intention is to identify instances where events result in more substantial shift in management requiring increasing need for review of forest plan proposals.
[9] For Yorkshire Forest District the "Forest Plan Area" will be utilized rather than "Forest Management Unit" when considering cumulative impact.

Appendix 5 - Forest Development Types - Long List

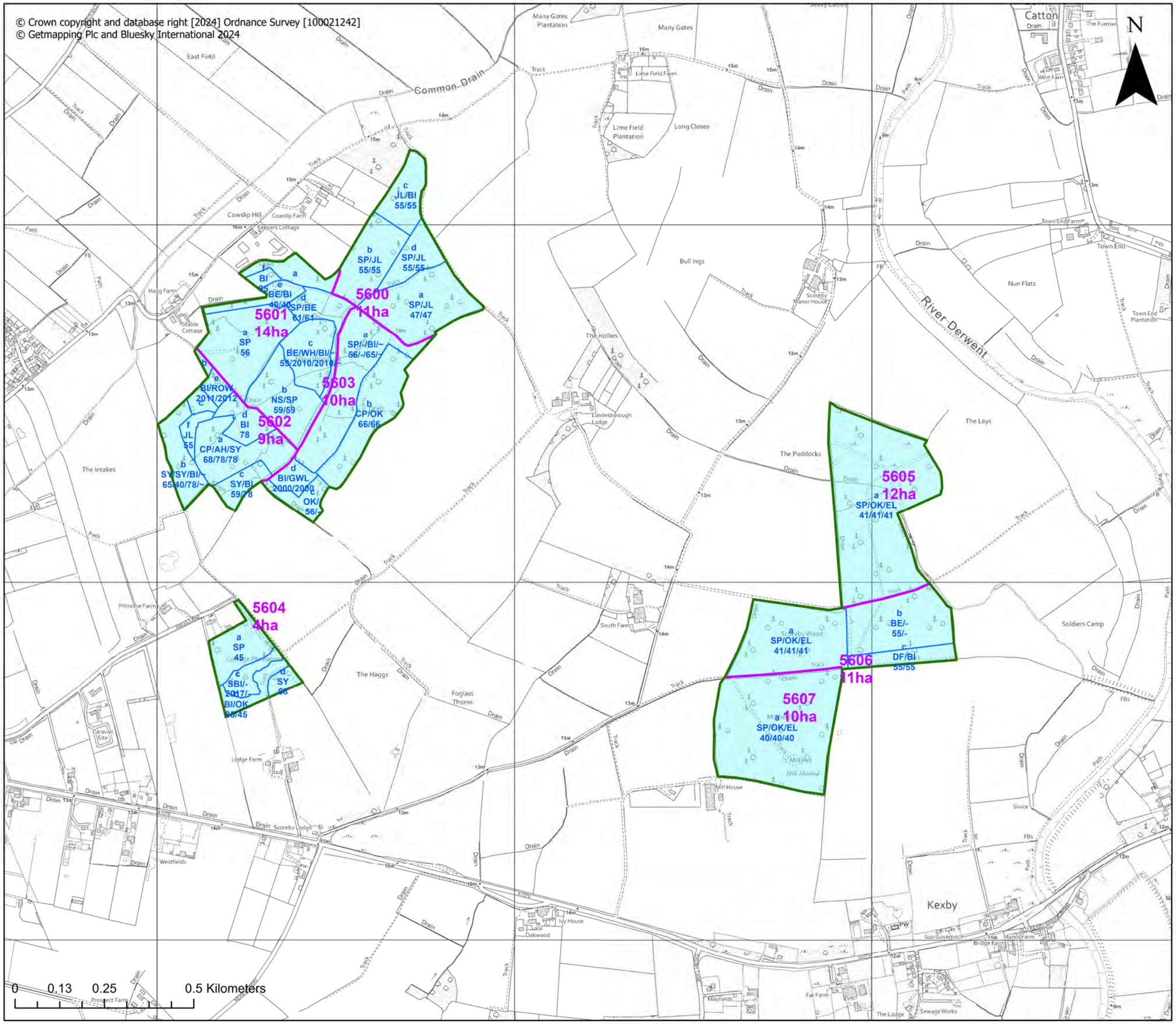
"A Forest Development Type is a long-term vision of how the species composition and structure of a forest stand is intended to develop. The concept encourages the greater use of mixed-species stands and a wider variety of stand structure than previously deployed in British forests".

As can be seen from the table below, there are a range of FDT's suitable to Hagg Wood and the objectives of this Forest Plan.

Code	Description	Future Climate		Future Climate (AWC)		Primary Species	Primary Proportion	Secondary Species	Secondary Proportion	Even aged		Uneven aged		Flashcard
		2050	2080	2050	2080					Unthinned	Thinned	Simple	Complex	
2.1.5	Scots pine with sessile oak	Suitable	Suitable	Suitable	Suitable	SP	50-70	SOK	20-40				x*	FDT_2_1_5_SP_and_SOK_V1.pdf
2.1.6	Scots pine with beech	Suitable	Suitable	Suitable	Suitable	SP	60-80	BE	20-40		x	x*	x	FDT_2_1_6_SP_and_BE_V1.pdf
5.1.1	pedunculate oak with hornbeam	Suitable	Suitable	Suitable	Suitable	POK	70-90	HBM	10-30			x*	x	FDT_5_1_1_POK_and_HBM_V1.pdf
5.2.1	sessile oak with birch	Suitable	Suitable	Suitable	Suitable	SOK	50-80	BI	20-50		x	x	x*	FDT_5_2_1_SOK_and_BI_V1.pdf
5.2.2	sessile oak with Scots pine	Suitable	Suitable	Suitable	Suitable	SOK	50-70	SP	20-40		x	x	x*	FDT_5_2_2_SOK_and_SP_V1.pdf
5.3.1	oak with beech	Suitable	Suitable	Suitable	Suitable	OK	60-80	BE	20-40			x*	x	FDT_5_3_1_OK_and_BE_V1.pdf
5.3.2	oak with long lived broadleaves	Suitable	Suitable	Suitable	Suitable	OK	50-70	XBLL	30-50			x	x*	FDT_5_3_2_OK_and_XBLL_V1.pdf
5.3.3	oak with hazel	Suitable	Suitable	Suitable	Suitable	OK	80-100	HAZ	abundant coppice			x*		FDT_5_3_3_OK_(XBLL)_and_HAZ_V1.pdf

Code	Description	Future Climate		Future Climate (AWC)		Primary Species	Primary Proportion	Secondary Species	Secondary Proportion	Even aged		Uneven aged		Flashcard
		2050	2080	2050	2080					Unthinned	Thinned	Simple	Complex	
6.1.1	beech even aged	Suitable	Suitable	Suitable	Suitable	BE	90-100			x	x*			FDT_6_1_1_BE_V1.pdf
6.1.2	beech uneven aged	Suitable	Suitable	Suitable	Suitable	BE	80-90					x	x*	FDT_6_1_2_BE_V1.pdf
6.1.3	beech with shade tolerant conifers	Suitable	Suitable	Suitable	Suitable	BE	50-70	XCST	30-50			x	x*	FDT_6_1_3_BE_and_XCST_V1.pdf
6.1.4	beech with long lived broadleaves	Suitable	Suitable	Suitable	Suitable	BE	50-70	XBLL	30-50			x	x*	FDT_6_1_4_BE_and_XBLL_V1.pdf
7.1.1	birch even aged	Suitable	Suitable	Suitable	Suitable	BI	70-100			x	x*			FDT_7_1_1_BI_V1.pdf
7.1.2	birch and short lived broadleaves	Suitable	Suitable	Suitable	Suitable	BI	50-70	XBSL	30-50	x	x*			FDT_7_1_2_BI_and_XBSL_V1.pdf
7.2.2	silver birch and sessile oak	Suitable	Suitable	Suitable	Suitable	SBI	50-80	SOK	20-50			x	x*	FDT_7_2_2_SBI_and_SOK_V1.pdf
8.1.1	sweet chestnut	Suitable	Suitable	Suitable	Suitable	SC	80-100					x	x*	FDT_8_1_1_SC_coppice_V1.pdf
8.1.2	sweet chestnut with long lived broadleaves	Suitable	Suitable	Suitable	Suitable	SC	50-80	XBLL	20-50		x	x*	x	FDT_8_1_2_SC_and_XBLL_V1.pdf

Code	Description	Future Climate		Future Climate (AWC)		Primary Species	Primary Proportion	Secondary Species	Secondary Proportion	Even aged		Uneven aged		Flashcard
		2050	2080	2050	2080					Unthinned	Thinned	Simple	Complex	
8.3.1	sycamore	Suitable	Suitable	Suitable	Suitable	SY	80-100				x	x*	x	FDT_8_3_1_SY_V1.pdf
8.3.2	sycamore with long lived broadleaves	Suitable	Unsuitable	Suitable	Unsuitable	SY	50-70	XBLL	30-50			x	x*	FDT_8_3_2_SY_and_XBLL_V1.pdf
9.1.1	common alder	Suitable	Suitable	Suitable	Suitable	CAR	80-100				x*			FDT_9_1_1_CAR_V1.pdf



Forestry England

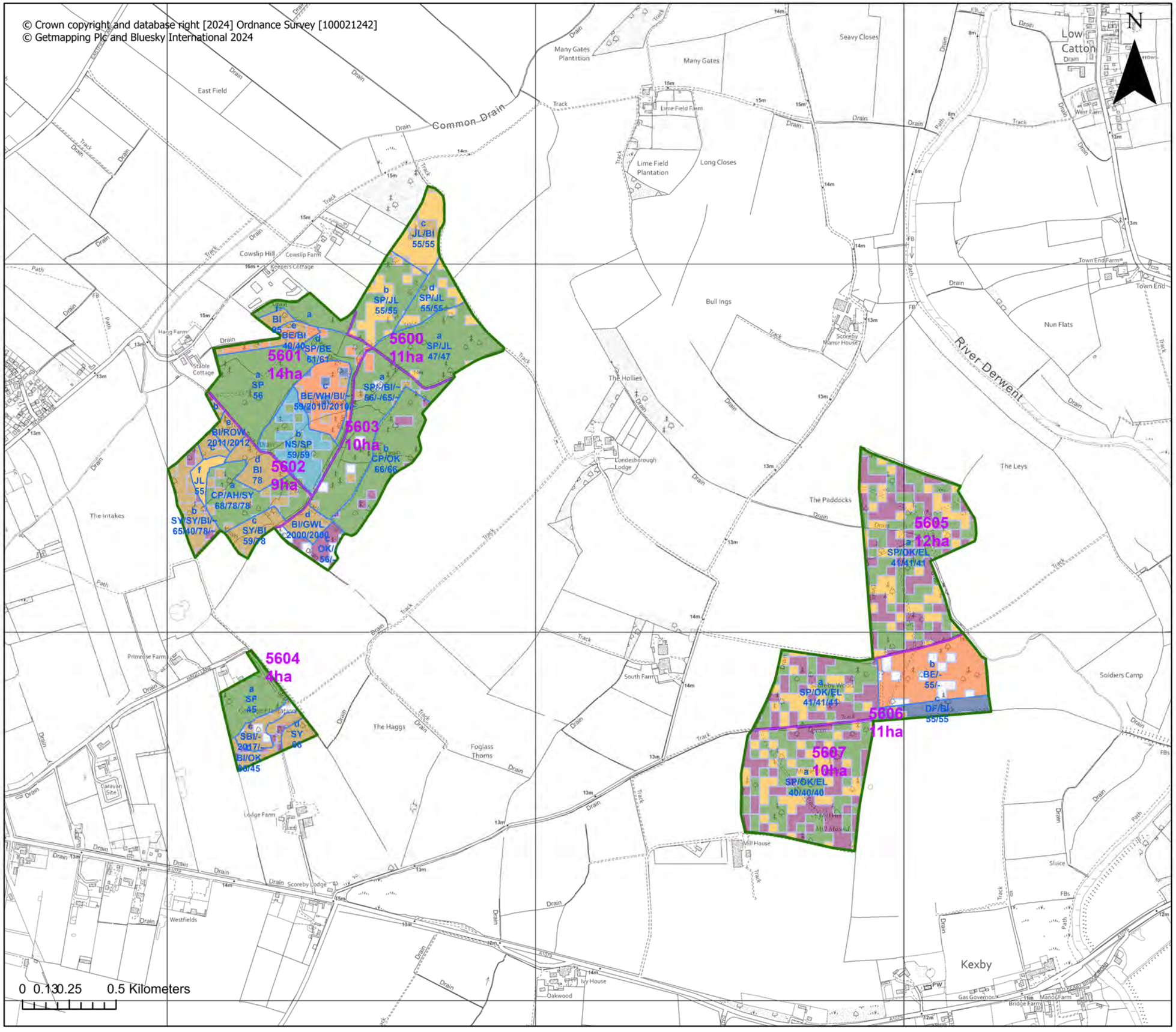
Hagg Wood Forest Plan

FP Map 01 - Soils

Scale : 1:10,000
when Printed @ A3

Created: April 2024

Ground Water Gley



Forestry England

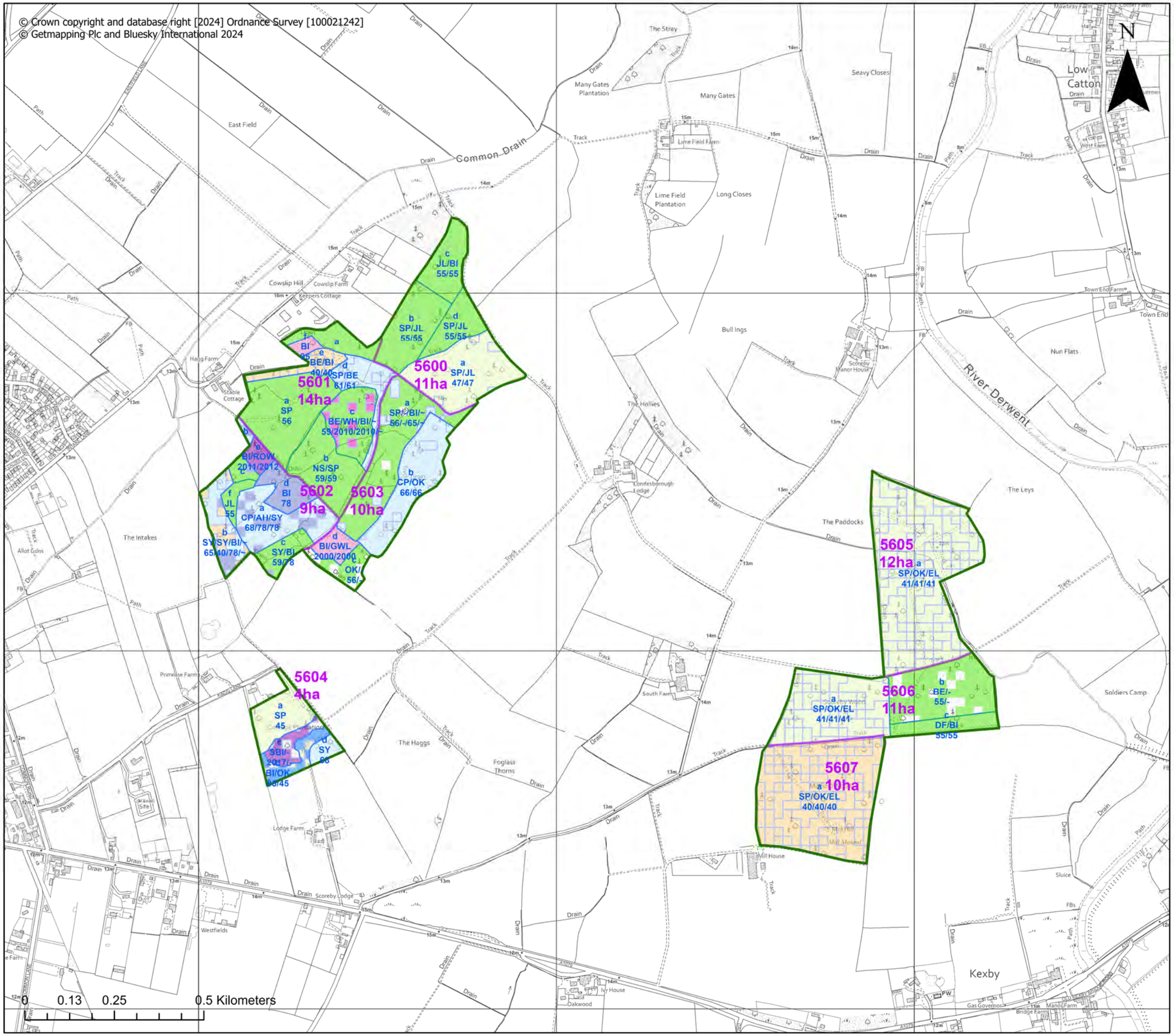
Hagg Wood Forest Plan

FP Map 02 - Current Species

Scale : 1:10,000
when Printed @ A3

Created: April 2024

- Beech
- Larch
- Oak
- Other Broadleaves
- Other Conifers
- Pine
- Spruce
- No Species

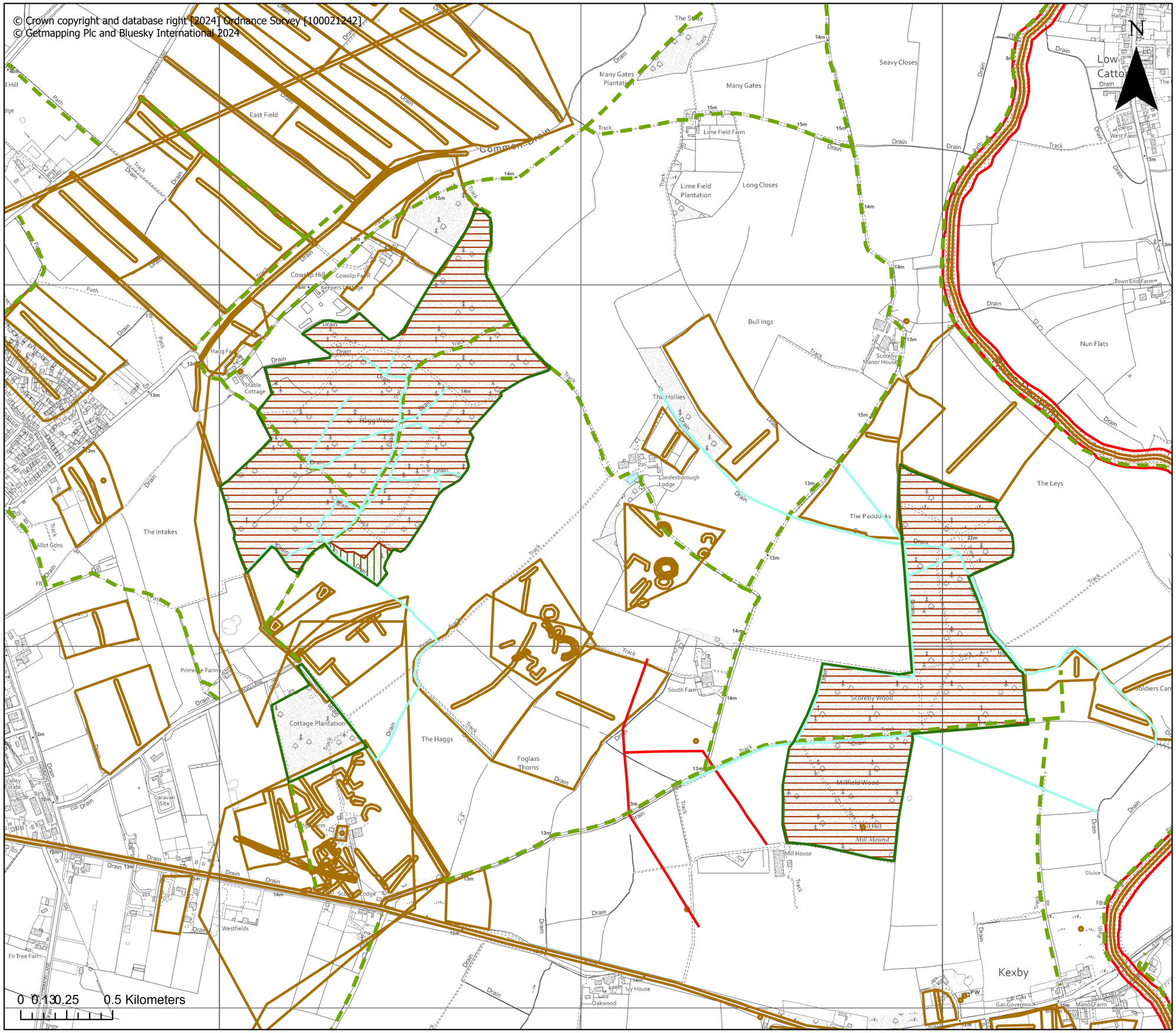


Forestry England

Hagg Wood Forest Plan

FP Map 03 - Age Class
Scale : 1:10,000
when Printed @ A3
Created: April 2024

- 1931 - 1940
- 1941 - 1950
- 1951 - 1960
- 1961 - 1970
- 1971 - 1980
- 1981 - 1990
- 1991 - 2000
- 2001 - 2010
- 2011 - 2020



Forestry England

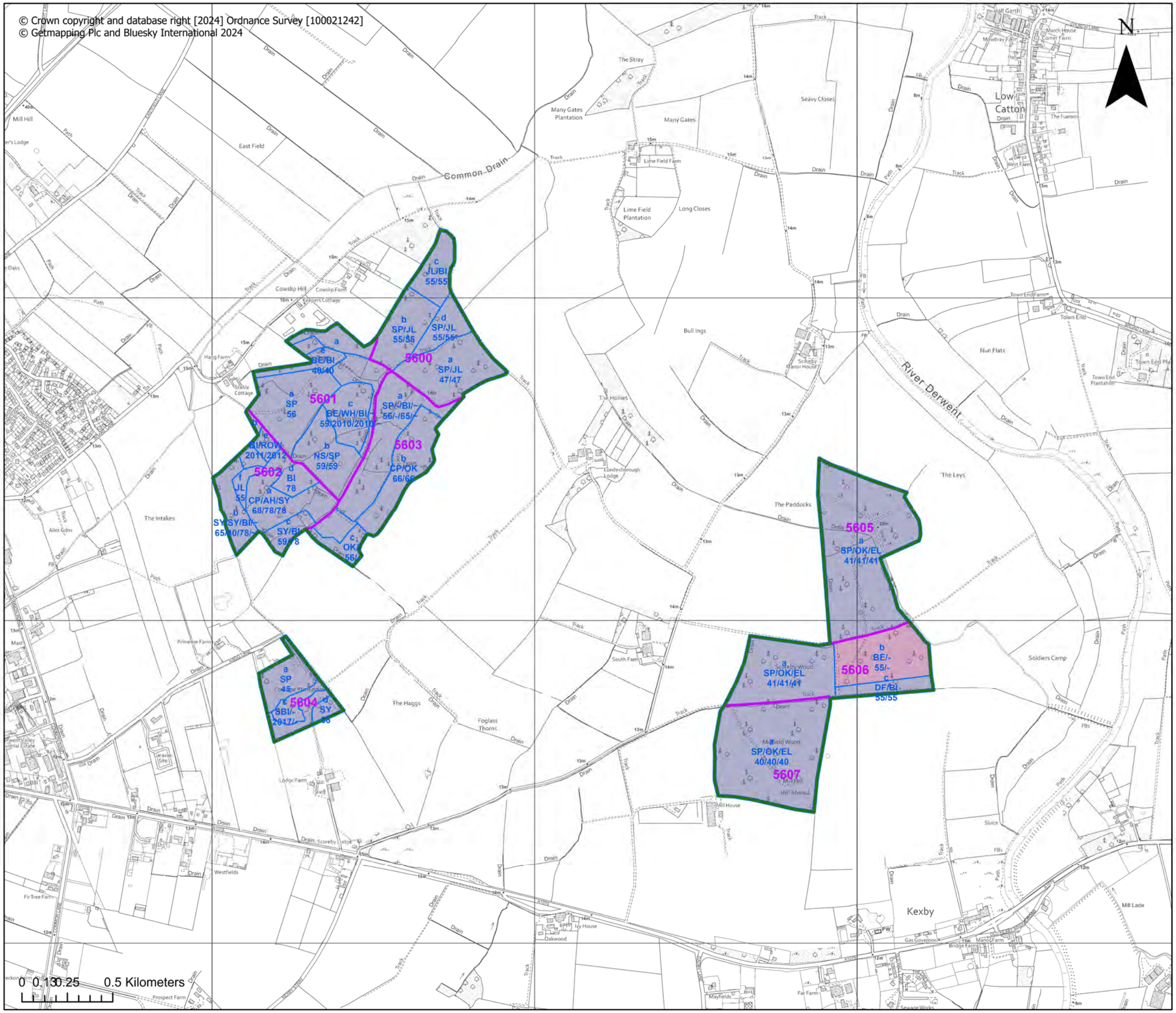
Hagg Wood Forest Plan

FP Map 04 - Management Information

Scale : 1:10,000
when Printed @ A3

Created: April 2024

- Forest Block
- Watercourses
- Public Rights of Way
- Open Water
- Overhead powerline
- Sites of Special Scientific Interest
- Ancient & Semi-Natural Woodland
- Ancient Replanted Woodland
- Heritage & Conservation



Forestry England

Hagg Wood Forest Plan

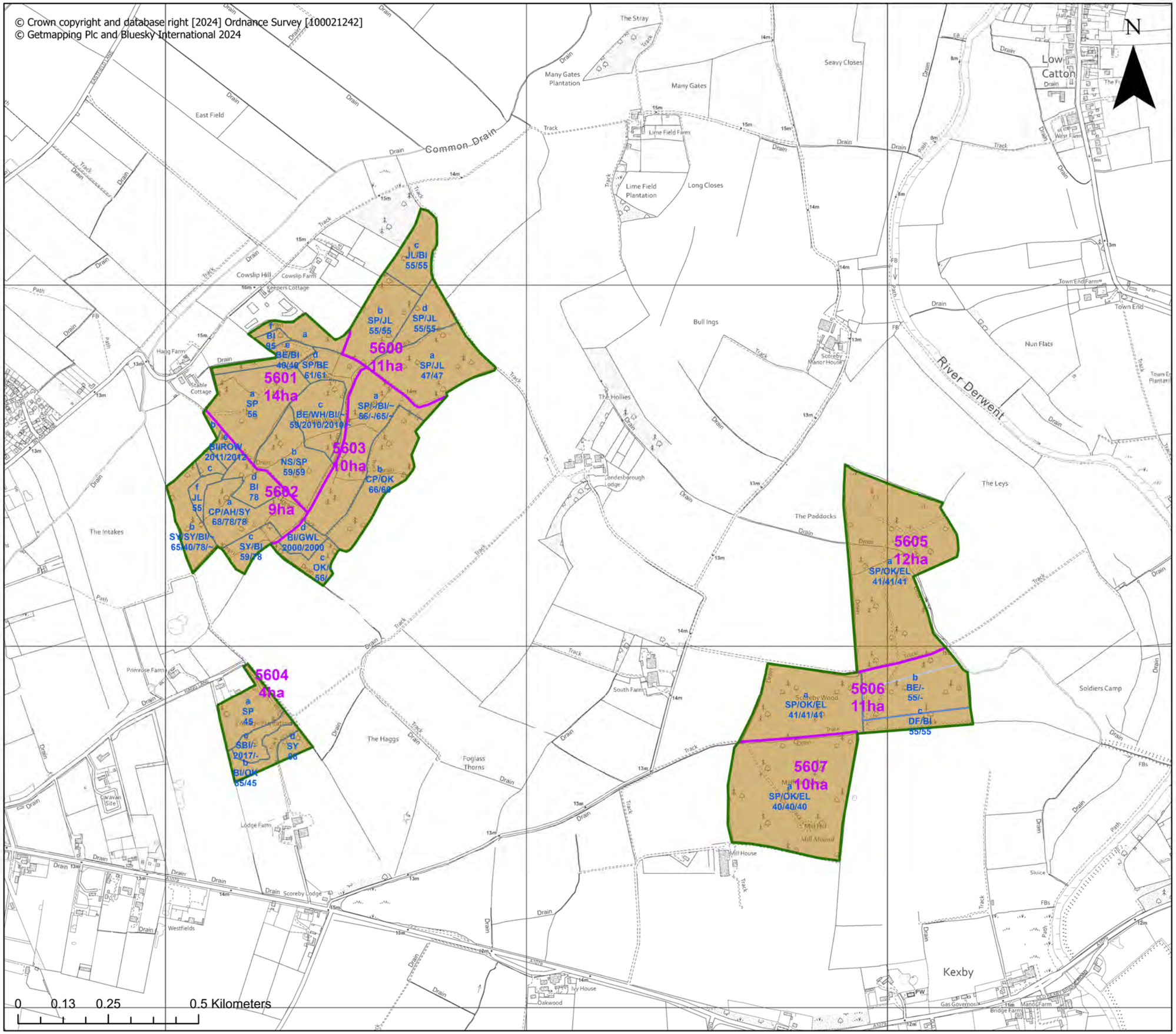
FP Map 05 - Management Type

Scale : 1:10,000
when Printed @ A3

Created: April 2024

Group shelterwood

Irregular shelterwood (general)



Forestry England

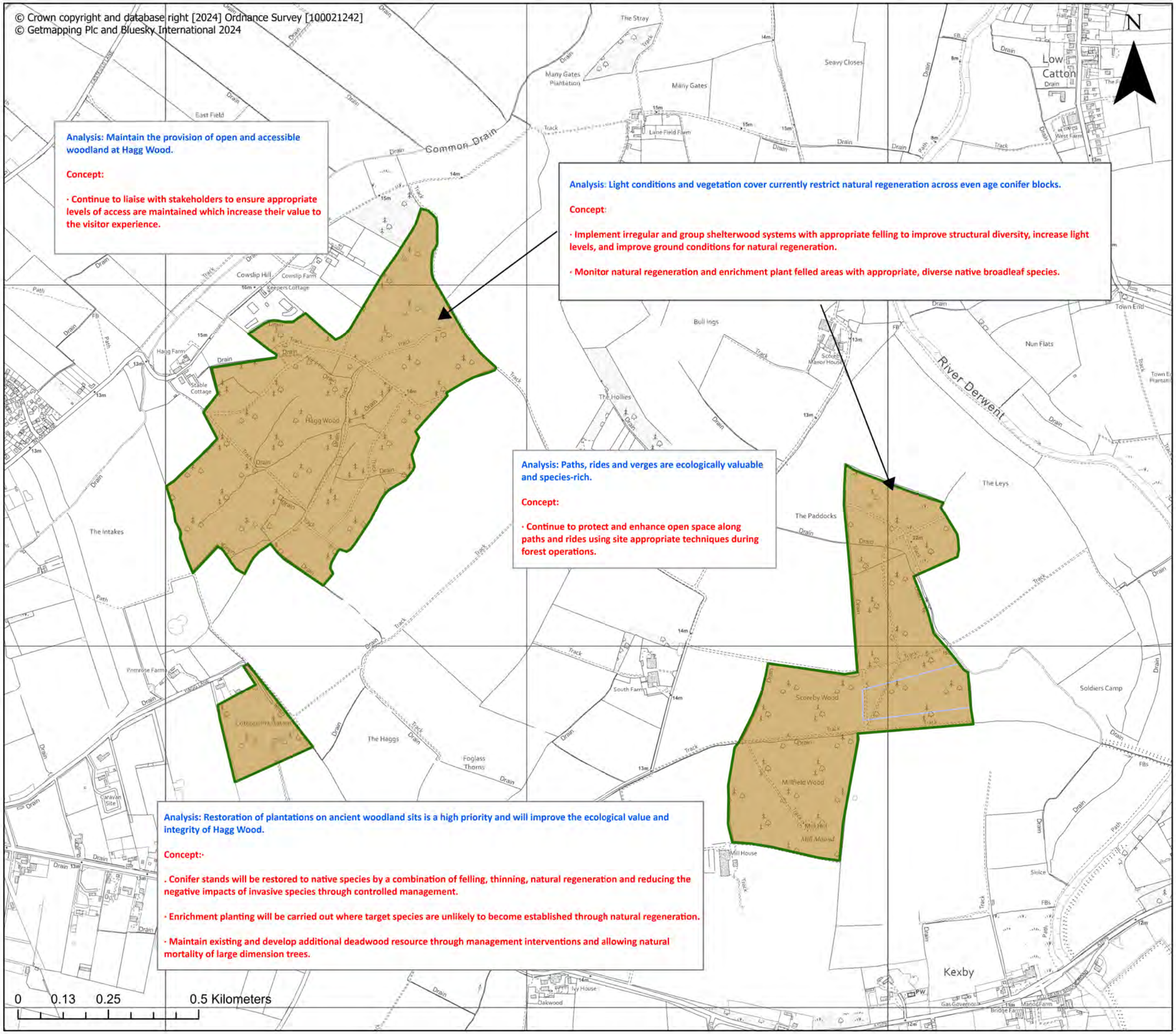
Hagg Wood Forest Plan

FP Map 06 - Future Habitat & Restock

Scale : 1:10,000 when Printed @ A3

Created: April 2024

Predominantly Mixed Broadleaves



Forestry England

Hagg Wood Forest Plan

FP Map 07 - Analysis & Concept
Scale : 1:10,000
when Printed @ A3
Created: August 2024

Predominantly Mixed Broadleaves

Annex 5:

fisher german

Fisher German LLP
Unit 2 Carolina Court
Lakeside Business Park
Doncaster
DN4 5RA

01302 243930
fishergerman.co.uk

26 August 2026

By email only: [redacted]

City of York Council
West Offices
York
YO1 6GA

Dear [redacted]

Hagg Wood– ACV Nomination Comments

We write as the duly authorised agent for the Church Commissioners for England, the freehold owner of Hagg Wood, in response to the nomination of Hagg Wood as an Asset of Community Value, as detailed in your letter dated 27 July 2026.

Background

Hagg Wood is subject to a 999-year lease dated 25 September 1952 made between (1) the Church Commissioners for England and (2) The Minister of Agriculture and Fisheries. The current tenant of the lease is the Secretary of State for Environment Food and Rural Affairs care of Forestry Commission, and Hagg Wood is actively managed by Forestry. Whilst the woodland provides recreational and amenity benefits to the local community, these are ancillary to its principal use as a managed forestry asset.

Relevant Statutory Tests

The relevant statutory tests are set out in section 88 of the Localism Act 2011 ("2011 Act") with our emphasis added -

Current non ancillary use

"(1) For the purposes of this Chapter but subject to regulations under subsection (3), a building or other land in a local authority's area is land of community value if in the opinion of the authority—

(a) an actual current use of the building or other land that is not an ancillary use *furthers the social wellbeing or social interests of the local community, and*

(b) it is realistic to think that there can continue to be non-ancillary use of the building or other land which will further (whether or not in the same way) the social wellbeing or social interests of the local community."

Or in the alternative, a non-ancillary use in the recent past (subsection 2 of s88) -

"(2) For the purposes of this Chapter but subject to regulations under subsection (3), a building or other land in a local authority's area that is not land of community value as a result of subsection (1) is land of community value if in the opinion of the local authority—

(a) there is a time in the recent past when an actual use of the building or other land that was not an ancillary use furthered the social wellbeing or interests of the local community, and

(b) it is realistic to think that there is a time in the next five years when there could be non-ancillary use of the building or other land that would further (whether or not in the same way as before) the social wellbeing or social interests of the local community."

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fisher german

We consider the test in subsection 1 to be the relevant one to consider as there is a current use by the Friends of Hagg Wood but that use is ancillary to the primary use of the land.

Current ancillary use

The community benefits relied on in the application arise through Forestry England's long-standing management of the woodland under the leasehold interest rather than through the ownership of the freehold. The Secretary of State for Environment Food and Rural Affairs care of Forestry Commission will remain the leaseholder irrespective of any disposal of the freehold (as the land would not be disposed of with vacant possession), and therefore the current ancillary use is unlikely to change and the statutory test in section 88(1)(a) of the 2011 Act has not been satisfied.

Applicants' reliance on unsigned agreement

Reference has been made in the nomination form to a 2003 "agreement" between the Church Commissioners for England, the Forestry Commission and the Friends of Hagg Wood. We would highlight that no executed copy of this document has been located by the Church Commissioners for England or the Forestry Commission (or provided in the application) and, accordingly, whether it exists (and therefore the legal basis on which the Friends of Hagg Wood use the woodland) remains uncertain.

The Church Commissioners for England have, however, located a draft (unsigned) memorandum of understanding dated 5 May 2003 which is expressed to be made between (1) The Forest District Manager, Forestry Commission (2) the Church Commissioners and (3) the Friends of Hagg Wood and which, in any event, is expressed to be for a fixed term of five years only and establishes that any activities undertaken by the Friends of Hagg Wood will remain subordinate to and should not frustrate the primary use of forest management by the Forestry Commission. Therefore, even if the memorandum of understanding had been executed, its existence would not support the statutory test set out in subsection 1 of the section 88 of the 2011 Act.

No earlier application to list as ACV

We also note that the Friends of Hagg Wood was established in 1996 and has therefore been active as an organisation for approximately three decades. Since the relevant provisions in the 2011 Act came into force, no application has been made to register the woodland as an Asset of Community Value.

The current nomination seems to have only arisen following the public marketing of the Church Commissioners for England's wider Scoreby Estate and, at this point, Hagg Wood and the wider estate are already under offer to a proceedable purchaser. Whilst the timing of the current nomination may be seen as irrelevant, it does not alter the longstanding and primary use of the woodland as a forestry asset.

It is also notable that the nomination has been made by Dunnington Parish Council and as such, whilst the Church Commissioners for England have received engagement from Friends of Hagg Wood and its members directly, to date no contact has been forthcoming from Dunnington Parish Council regarding the community use of the woodland or their intent or interest to seek to acquire the site. We also note that section 96 of the 2011 Act (which defines any "relevant disposals" that will be subject to the notification requirements and process set out in section 95) indicates that only a disposal of the freehold estate with vacant possession is subject to the requirements of section 95. As outlined above the proposal is for the freehold estate to be sold subject to the lease in favour of the Forestry Commission.

The nomination is accompanied by Forestry England's Forest Plan FP56 (2024-2034). We would respectfully note that this document is fundamentally a forestry management plan and provides clear evidence that the woodland is being actively managed for forestry purposes. Whilst the plan recognises the recreational benefits enjoyed by the local community, it also demonstrates that timber

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production, woodland management, ecological/habitat restoration and long-term forest resilience remain key management objectives of the Forestry Commission and the primary use of the land.

For these reasons, we do not consider that the statutory criteria for listing have been satisfied and respectfully request that the nomination be refused. In due course please notify us of your decision.

Your sincerely

[redacted]

[redacted] **MSc MRICS**

Surveyor

For and on behalf of Fisher German LLP

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Annex 6:

Hogben, Graham

From: [redacted]>
Sent: [redacted]
To: [redacted]
Subject: Haggwood ACV

This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Dear Sir
[redacted] i would like to place my objection to this ACV.
Firstly this is not in our parish
This is also not budgeted for by the parish council .
Originally this woodland was not and still isnt classed as community woodland as specified by the Estate agents Fisher German this is easily proven by not being in the sales particulars and was verbally agreed by staff on several phone calls .
Purchase of the Wood would be a financial burden on the parish with out the full ageement of the parish residents currently there is only several people pushing to purschase the wood.

[redacted]

The Local pressure group the FRIENDS OF HAGGWOOD have been massive instigators in this and have had several members visited by the police regarding there actions these people at this moment are infuencing the parish council.
Our last police report regarding them was classed by NYP as Anti social.
After a recent FOI to york council it was verified that Haggwood was not registered as community woodland so on that basis and the fact that people have been tresspassing for several years in Haggwood this is not a community asset based on the criminal actions civil matters of the public.
It is not recognised by the current owners the Church Commisioners who allegedly agreed to a memorendum of understanding in 2003 which after a current FOI was unsigned and not agreed and it was this narrative then spun to the village that they had an agreement this was a untrue.
As it stands there is 2 perfectly good rights of way in the woodland so purchase of the wood is pointless.
My final point is to say that this woodland is private with 2 good PROW though the middle of it giving the public access 24hrs a day regardless of any sale and would give if any rights to the public be minimal .
This woodland has 999 yr lease with the forestry commision offering several benefits by its own bylaws which again renders its purchase pointless and of little benefit.
We also think the ACV if used at a sale would be corrupted by private money and and control would be lost by the parish or influenced by outsiders .
I hereby Object .

[redacted]

Hogben, Graham

From: [redacted]
Sent: 09 September 2026 12:52
To: [redacted]
Subject: Hagg wood kexby

Follow Up Flag: Follow up
Flag Status: Flagged

This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Good afternoon,
I am writing to object to dunnington parish councils application to have an acv put on hagg wood.
Firstly if dpc have that amount of money I'm sure we have lots of things in OUR parish that need attention.
Secondly hagg wood is in the parish of kexby not dunnington so how does that work.
Hagg wood has 2 legal footpaths running though it so the public will still be able to enjoy a walk through the wood.
I believe the friends of hagg wood a local pressure group have lobbied dpc to apply for the avc.
I have been to several meetings on the sale of the scorby estate which includes hagg wood, this pressure group have been very vocal at these meetings.
I regularly walk in hagg.
But do object to the sale to dpc.
My worry is the cost to parishioners for the cost of the sale and the upkeep.

Many thanks
[redacted].

Hogben, Graham

From: [redacted]
Sent: 09 September 2026 15:05
To: [redacted]
Subject: ACV - Hagg Wood, York

This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.
Good Afternoon [redacted]

As a resident of Kexby, York I am trying to understand the logic behind the application for an ACV for Hagg Wood which has been applied for by Dunnington Parish Council. [redacted] and as you know Hagg Wood sits within our Parish not Dunnington.

Could you therefore please explain the criteria used when considering such an application?

My understanding so far:-

A Google search shows that an ACV cannot be applied for when the land is owned by the Church of England??
As confirmed by a land agent, it is more difficult to apply for an ACV with a sitting tenant (The Forestry Commission)??
As confirmed by the land agent's solicitors, Hagg Wood is not a community woodland??
This application has been instigated by a working party known as Friends of Hagg Wood who have been operating in the wood for many years under an unsigned MOU between themselves and The Forestry Commission and who have carried out criminal activities, threats, vandalism, abusive behaviour and tried to ban horse riding within the wood - all can be confirmed with photographs and police incident numbers - so how could this be an Asset of Community Value??

As you will also be aware, the Scoreby Estate including Hagg Wood has now been sold (stc) to a private company - are they aware that this ACV has been applied for??

Is there anything that the Parish can do to prevent Dunnington Parish Council from being granted this ACV? Talks were held between Dunnington Parish Council, Friends of Hagg Wood and The Forestry Commision before [redacted] were made aware.

Look forward to your comments.

Thanks.

[redacted]

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Annex 7:

Current list of Assets of Community Value

1. The Golden Ball Public House, 2 Cromwell Road, York, YO16 6DU - approved 6th March 2014. Renewed on 19th September 2024.
2. New Earswick and District Bowls Club, Huntington Road, York, YO32 9PX – approved 6th November 2014. Renewed on 24th July 2020, renewed 24th April 2025
3. Holgate Allotments, Ashton Lane, Holgate, York, YO24 4LX – approved 29th June 2015. Renewed on 14th February 2022.
4. The Derwent Arms, 29 Osbaldwick Village, Osbaldwick, YO10 3NP – approved 14th March 2016. Renewed on 11th April 2022.
5. The Blacksmiths Arms, Naburn York, YO19 4PN – approved 12th September 2016. Renewed on 12th September 2022.
6. The Grey Horse Public House, Main Street, Elvington, York, YO41 4AA – approved 11th July 2022.
7. The Deramore Arms Public House, Main Street, Heslington, York, YO10 5EA. – approved 13th March 2017. Renewed on 12th October 2023.
8. The Royal Oak Public House, 1 Main Street, Copmanthorpe, York, YO23 3ST. – approved 11th July 2022.
9. The Blue Bell Public House, 53 Fossgate, York, YO1 9TF. – approved 17th October 2017. Renewed on 19th September 2024.
10. New Earswick Swimming Pool, Hawthorne Terrace, New Earswick, YO32 4TZ. - approved 12th March 2018, renewed 12th December 2024
11. Strensall Library, 19 The Village, Strensall, York, YO32 5XS. – approved 9th April 2018. Renewed 12th October 2023.
12. The Garrison Church of St Wilfrid, St Wilfrid's Road, Strensall, York, YO32 5SJ. – approved 17th September 2018. Renewed 12th October 2023.
13. Hurst Hall Community Centre, Border Road, Strensall Camp, York, B757RL. – approved 15th July 2019. Renewed 19th September 2024.
14. The Ship Inn Public House, Hauling Lane, Acaster Malbis, York, YO23 2UH. – approved 19th December 2022.

15. The Rose and Crown Public House, Main Street, Askham Richard, York, YO23 3PT. – approved 10th July 2023.
16. Vernon House, Vernon Close, Bishopthorpe, York, YO23 2RH. – approved 10th July 2023.
17. The Fox Public House, Stockton on Forest, York, YO32 9UW – approved 5th August 2025
18. The Lord Nelson Public House, 9 Main Street. Nether Poppleton , York, YO26 6HS. – approved 16th September 2019, renewed 30th July 2026
19. The Blacksmiths Arms Public House, Shipton Road, Skelton, York, YO30 1YJ. – approved 16th September 2019, renewed 30th July 2026
20. Cross keys Public House, Common Lane, Dunnington, York, YO19 5NG. – approved 30th July 2026
21. The Victoria Vaults, 47-49 Nunnery Lane, York, YO23 1AB, approved 11th August 2026