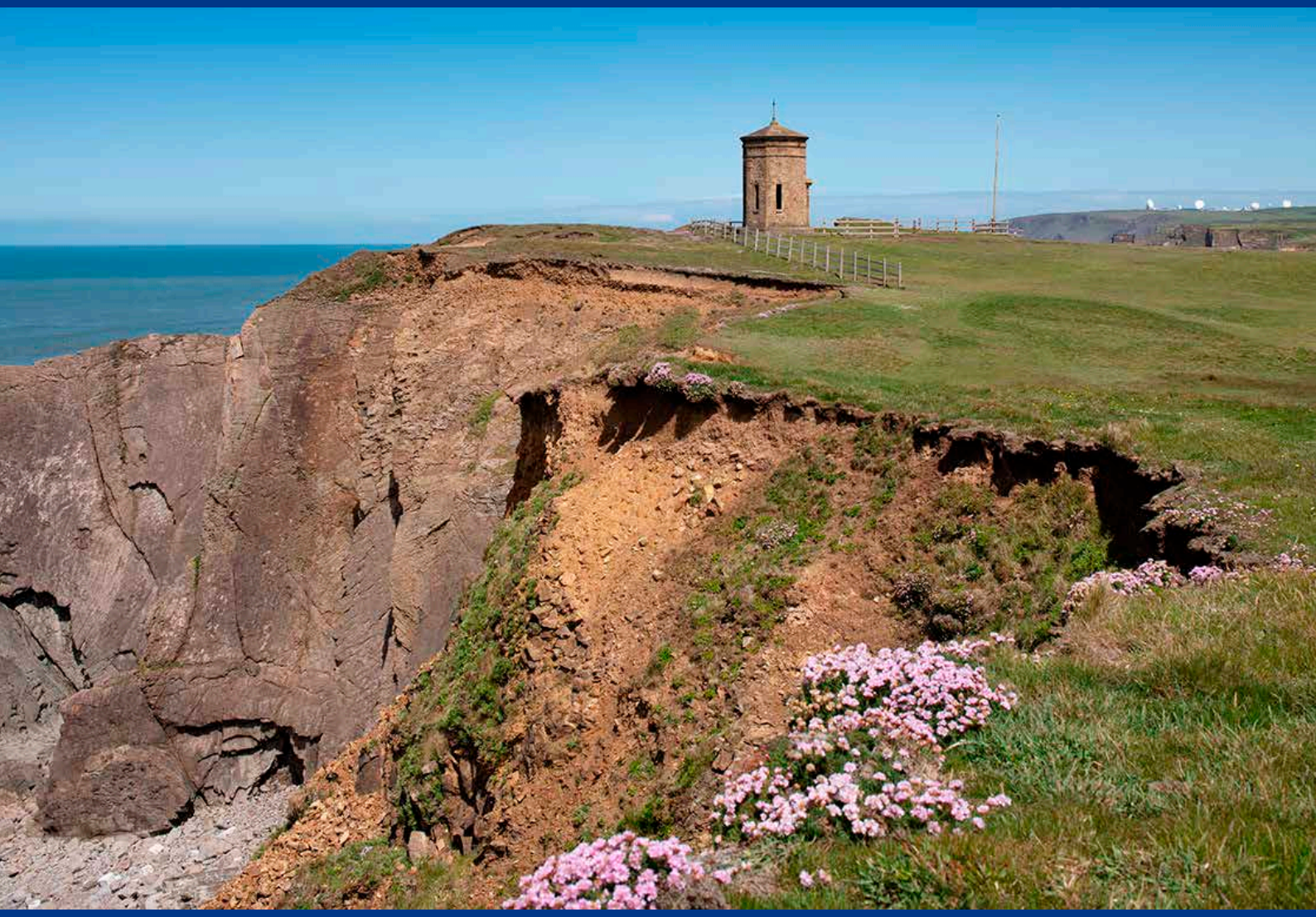
Historic England

Research Report Series 17–2022

Climate change adaptation report



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ENGLISH HERITAGE

Climate Change Adaptation Report

Historic England and English Heritage Trust

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ISSN 2059-4453 (Online)

This report has been jointly prepared by Historic England and the English Heritage Trust working in collaboration. Each organisation takes responsibility for the accuracy of its own information supplied in this report.

This report focuses on adaptation and not mitigation and therefore does not constitute a climate strategy for either Historic England or English Heritage Trust. For the most up to date information on each organisation's climate change work, including climate strategy, please visit their respective webpages.

Summary

This report has been prepared in response to the third round Adaptation Reporting Power call from Government arising from the Climate Change Act 2008. It has been prepared by Historic England and the English Heritage Trust working in collaboration; each organisation takes responsibility for the accuracy of its own information supplied in this report.

This report focuses on adaptation and not mitigation and therefore does not constitute a climate strategy for either Historic England or English Heritage Trust.

This report builds on the earlier Climate Change Adaptation Report submitted by Historic England for the second round of Adaptation Reporting Power reporting in 2016, reporting on progress against the commitments made in that report. This report includes the results of hazard mapping undertaken in collaboration with other UK heritage organisations and presents initial findings of the risks to the National Heritage List for England and the National Heritage Collection. This report also includes draft actions from the emerging Historic England Climate Strategy which was draft at the time of writing. For the most up to date information on each organisation’s climate change work, including climate strategy, please visit their respective webpages.

Contributors

Hannah Fluck, Ruth Knight

Front cover image shows the Bude Storm Tower, Cornwall, before it was moved. DP276186 © Historic England Archive.

Acknowledgements

This report has been prepared with contributions from colleagues within Historic England and the English Heritage Trust and draws on research undertaken by 3Keel Ltd. Particular thanks to Ian Morrison, Duncan McCallum, Victoria Thomson, Sharon Soutar, Lucy More, Deborah Wall, Kate Guest from Historic England; Rob Woodside from the English Heritage Trust and Josh Deru from 3Keel for their contributions and comments on earlier drafts. Katie Jenkins and Frankie McQueen from Defra provided helpful advice on the content and structure of the report.

Contents

1 Introduction

This document is prepared in response to the Adaptation Reporting Power call from the Government arising from the Climate Change Act 2008[1]. The Climate Change Act 2008 acknowledged a need for us to understand the risks presented by a changing climate and how we can adapt to minimise the impact of those risks. As well as setting out requirements for undertaking a national Climate Change Risk Assessment [2] the Climate Change Act also introduced the National Adaptation Programme[3], which sets out what Government, businesses and society are doing to better adapt to climate change. Contributions to this (adaptation reports) can be requested by the Government from certain organisations, under the Adaptation Reporting Power (ARP) established by the Act. ARP reports should contain:

- a summary of the statutory and other functions of the organisation
- an assessment of current and future risks presented by climate change to the organisation and its functions
- a programme of measures to address the risks, including policies and practices that are already being implemented and areas where further action is required.

In 2016 Historic England submitted an ARP report to the Government as part of the second round of ARP reporting[4]. This report builds on that earlier work and also includes contributions from the English Heritage Trust (EHT) in relation to developing work and collaboration around the National Heritage Collection.

The climate is already changing and these changes are already impacting upon many areas of our lives. Identifying the risks posed by a changing climate and taking action to adapt and respond to manage those risks is an essential part of climate action. For heritage organisations such as Historic England and the English Heritage Trust, this means not only understanding and responding to the impacts upon the organisations and their operations but also the impacts upon the historic environment they are tasked with protecting. However, the contribution that heritage can play in the adaptation of people and places is increasingly

1 https://www.legislation.gov.uk/ukpga/2008/27/contents [accessed 27/01/2022]

2 https://www.theccc.org.uk/publication/independent-assessment-of-uk-climate-risk/ [accessed 27/01/2022]

3 https://www.gov.uk/government/publications/climate-change-second-national-adaptation-programme-2018-to-2023 [accessed 27/01/2022]

4 https://historicengland.org.uk/research/results/reports/28-2016. Historic England 2016

being recognised[5]. The historic environment is everywhere; it is what makes places culturally distinctive, and therefore contributes strongly to the identity of the people who use those places. With care and understanding it can, and should wherever possible, retain those vital cultural roles even as we are forced to adapt to take account of the changing climate. Consequently, this report considers the impacts of the changing climate upon Historic England as an organisation, both in its management of personnel, facilities and equipment and with regard to its role as champion of England's heritage; it also considers the impacts upon heritage assets on the National Heritage List for England and heritage assets in the National Heritage Collection which are cared for by the English Heritage Trust.

5 eg see G20 Rome Declaration 2021 https://www.consilium.europa.eu/media/52732/final-final-g20-rome-declaration.pdf [accessed 27/01/2022]; Historic Environment Forum 2021 https://historicenvironmentforum.org.uk/hef-activities/archive-and-resources/heritage-responds/ [accessed 27/1/2022]; Icomos 2019 http://openarchive.icomos.org/id/eprint/2459/ [accessed 27/1/2022]; Hoseung Lee 2021, opening address to the ICOMOS/IPCC/UNESCO International Co-sponsored Meeting on Culture, Heritage and Climate Changehttps://www.ipcc.ch/event/ipcc-icomos-unesco-co-sponsored-meeting-on-culture-heritage-and-climate-science/ [accessed 27/01/2022] .

2 Summary of the organisations, their structures and responsibilities

2.1 Historic England

Historic England is the public body that helps people care for, enjoy and celebrate England's spectacular historic environment. We are the Government's statutory adviser on all matters relating to the historic environment in England. We are a non-departmental public body established under the National Heritage Act 1983 and sponsored by the Department for Digital, Culture, Media and Sport (DCMS), through whom we report to Parliament. We champion and protect England's historic places, providing expert advice to local planning authorities, developers, owners and communities to help ensure our historic environment is properly understood, enjoyed and cared for.

Together with the National Heritage Collection (managed by the English Heritage Trust) we are the Historic Building and Monuments Commission for England.

2.1.1 Structure

Structurally, Historic England is an executive non-departmental public body with powers and responsibilities that are principally set out in the National Heritage Act 1983. Key roles include contributions to the planning system; designation; record keeping; conservation advice to Government, the general public, and the heritage sector; research to support all of these activities; and grant-giving. Historic England also works closely with other Government departments, including the Department for Environment, Food and Rural Affairs (Defra) and the Department for Levelling Up, Housing and Communities (DLUHC). Work is overseen by a Chair and a board of up to sixteen Commissioners who are selected by the Government. The aims and objectives for Historic England are set out in the Corporate Plan (currently 2021-2022)[6], with the organisation's longer term vision set out in Historic England's Future Strategy (2021)[7]. Historic England licenses a charity (English Heritage Trust) to look after the majority of historic sites in Government control (the 'National Heritage Collection').

6 https://historicengland.org.uk/about/what-we-do/corporate-plan/ [accessed 27/1/2022]

7 https://historicengland.org.uk/images-books/publications/he-future-strategy-2021/he-future-strategy-2021/ [accessed 27/1/2022]

2.1.2 Staff resource and facilities

Historic England employs around 900 staff across 9 offices; a significant and growing number of this workforce are homeworkers. National offices are sited in London, Swindon and Portsmouth, with the following local offices each covering a particular geographical area: London and the South East, South West, Midlands, East of England, North East and Yorkshire, and North West. The distribution of staff and premises means Historic England has an interest in, or responsibility for, a range of building types and locations that may variously be impacted by environmental risks such as flooding, water ingress or overheating.

2.1.3 Roles and responsibilities

Planning: Historic England advises Government on law and policy developments and called-in planning applications where appropriate; it advises on marine and coastal developments; it is a statutory consultee on certain applications[8]; and it advises on national infrastructure projects.

Designation: Historic England administers and assesses applications for, and advises the Secretary of State for DCMS on, the designation of listed buildings, scheduled monuments and protected wreck sites, as well as certificates of immunity from listing; it is the decision-maker for new entries and amendments to the Register of Parks and Gardens of Special Historic Interest in England, and the Register of Historic Battlefields; and it administers the National Heritage List for England[9].

Record keeping: Historic England annually compiles the Heritage at Risk Register,[10] which is an official statistic; it holds the largest public archive for the historic environment containing over 10 million photographs, documents, plans and reports relating to the historic environment of England[11]; and it is responsible for keeping the Historic Environment Record for Greater London[12].

Conservation Advice: Historic England provides advice about dealing with historic sites facing risk; it advises Government, the general public, and the heritage sector on best practice (including through an extensive training offer); it disseminates best practice guidance; and it collaborates with and advises other organisations.

8 https://www.gov.uk/government/publications/arrangements-for-handling-heritage-applications-direction-2021 [accessed 27/1/2022]

9 https://historicengland.org.uk/advice/hpg/heritage-assets/nhle/ [accessed 27/1/2022]

10 https://historicengland.org.uk/advice/heritage-at-risk/ [accessed 27/1/2022]

11 https://historicengland.org.uk/images-books/archive/ [accessed 27/1/2022]

12 https://historicengland.org.uk/services-skills/our-planning-services/greater-london-archaeology-advisory-service/greater-london-historic-environment-record/ [accessed 27/1/2022]

Research: Historic England commissions, supports and undertakes applied research to inform the protection, enjoyment and management of the historic environment. We are a Public Sector Research Establishment and an Independent Research Organisation recognised by UKRI. We work with diverse sector and academic partners to influence research agendas, deliver research projects and maximise research impacts.

Grant-giving: Historic England administers a number of grant schemes concerned with the protection and promotion of the historic environment, including research, repair and maintenance.

2.2 The English Heritage Trust

2.2.1 Structure

The English Heritage Trust started life as an independent charity in April 2015. The Trust cares for and manages the National Heritage Collection of over 400 historic sites which have been transferred from Historic England to the charity through an eight-year Property Licence and Operating Agreement. The ownership or guardianship of these properties remains with Historic England. As a registered charity it is governed by a board of trustees who delegate day-to-day responsibility for the running of the organisation to a senior management team. The English Heritage Trust has an average monthly headcount of 2,245 employees and 3,200 volunteers.

2.2.2 Objectives

The Trust's objectives, as set out in its Articles of Association, can be summarised as:

to conserve the National Heritage Collection of over 400 unique sites, monuments and artefacts, in keeping with their status as part of England's national heritage

to bring history to life in the places where it happened by opening up the sites and monuments to public access, through exhibitions, events and educational programmes, supported through online content

through the blue plaques scheme, to advance public appreciation of the history of building and landmarks in London by showing where people of historical, artistic, scientific and religious significance lived and worked

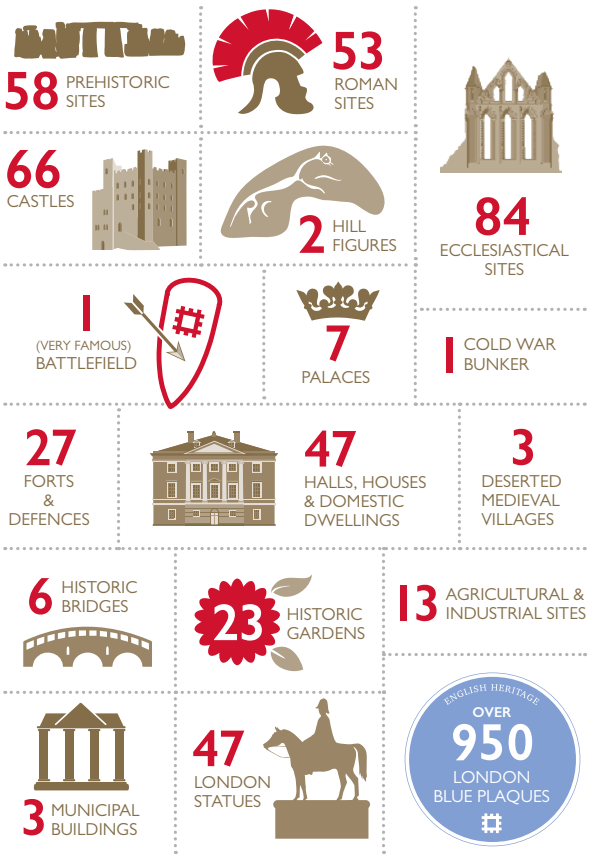
2.2.3 Collection

The National Heritage Collection is a diverse portfolio that includes World Heritage Sites, industrial monuments, castles, historic houses, abbeys, forts, stone circles and a large part of Hadrian's Wall. The collection ranges from prehistoric ruins to lavishly furnished country

houses. The English Heritage Trust also manages around 500,000 historic artefacts which are an integral part of the Collection and assist in interpreting and presenting sites to the public as well as providing a valuable research resource for heritage professionals and English Heritage Trust employees.

2.2.4 Management

The English Heritage Trust has developed an Asset Management Plan (AMP) to manage the estate according to nationally established conservation priorities. This gives the English Heritage Trust an awareness of the scale of the conservation deficit in relation to the resources available to it along with impact assessments of English Heritage Trust's ability to procure the necessary works. Work falls under four streams - Conservation Maintenance Programme to fund works to address the conservation defects on heritage assets; Annual Maintenance Programme for planned cyclical and response maintenance; Minor Planned Maintenance Programme for small repairs and the Major Planned Repair Programme for larger long-term or one-off conservation projects. The English Heritage Trust also manages the acquisition, conservation and storage of artefacts, collections and historic interiors using its own experts who specialise in the care of fine and applied art, conservation science, environmental and pest control. Pre-pandemic English Heritage Trust sites welcomed 6.2 million visitors with visitors and membership providing 60% of our income.



3 Organisation responses to climate change

This section sets out how Historic England and the English Heritage Trust are responding to climate change. Collaboration across the heritage sector is an important part of both organisations' responses to climate change and therefore a brief summary of some of the ways in which the heritage sector is collaborating in this are also included.

3.1 Historic England response to climate change

In its Future Strategy[13] and Corporate Plan[14] Historic England identifies its purpose as being "To improve people's lives by championing and protecting the historic environment" with a vision of "A heritage that is valued, celebrated and shared by everyone. A historic environment that people connect with and learn from and that we are proud to pass on to future generations." Addressing climate change mitigation and adaptation is implicit in both of these and is specifically referenced within the Future Strategy and Corporate Plan. Table 1 shows relevant sections of the Historic England Future Strategy and the Historic England Corporate Plan (2021-2022) for delivering climate action.

Research development is centred around a Research Strategy[15] and Research Agenda[16]. Within the Research Agenda climate change adaptation and the historic environment is a priority area, under the overarching theme of #adapt. It has also been a priority theme for an AHRC funded Collaborative Doctoral Programme (CDP), resulting in four-year PhD research projects on topics including coastal loss and perceptions of risk.

In order to address climate change - both mitigation and adaptation - Historic England embeds climate change thinking within its activities throughout the organisation. Historic England will publish a Climate Change Strategy for the period to 2050 this year. The Strategy will set out the actions we have prioritised and are undertaking (both short, medium and longer-term). These actions are being delivered via a Climate Change Programme and overseen by a Climate Change Programme Board that reports directly to Historic England's Executive Team. The programme provides a framework for the extensive and valuable work that is already in progress across Historic England and identifies future activity to ensure we continue to target our finite resources towards activities that deliver the most effective results in public value terms. Historic England's activity to reach organisational Net Zero carbon emissions is also managed through this programme. Of particular relevance to climate change adaptation, the

13 https://historicengland.org.uk/about/what-we-do/strategy/ [accessed 27/1/2022]

14 https://historicengland.org.uk/about/what-we-do/corporate-plan/[accessed 27/1/2022]

15 https://historicengland.org.uk/images-books/publications/research-strategy/ [accessed 27/1/2022]

16 https://historicengland.org.uk/images-books/publications/he-research-agenda/research-agenda/ [accessed 27/1/2022]

Table 1. Historic England Future Strategy and Historic England Corporate Plan (2021-2022) aims and activities of relevance to climate change. Those with direct reference to climate change indicated in bold.

Historic England Future Strategy	
'Our role as champion'	"By reaching and hearing from a wider audience, we can more effectively tackle the challenges we all face, from climate change to social and economic deprivation." (p. 4)
Thriving Places	"We will position heritage as a key part of national and local responses to climate change, through policy advocacy and promoting the re-use and adaptation of existing buildings and infrastructure" (p. 7)
Active Participation	"We'll provide free access to heritage protection and adaptation tools to encourage engagement, help to improve skills and sustain action." (p. 9)
Historic England Corporate Plan (2021-2022)	
Save historic places and enable them to thrive for future generations	• Ensure our advice and evidence results in well-informed decisions that serve people and places well • Work with people to build the skills, knowledge, confidence and motivation to fight for, and look after, their historic environment
Activity 1 - Investing in places where our expertise and resources make the most difference	1.3 Investing in heritage at risk through repair, adaptation and reuse
Activity 2 - Investing in knowledge creation, skills and organisations (including English Heritage Trust) where our help is most needed	2.1 Create necessary new knowledge, including recording prior to loss 2.2 Clarify threats, risks, harm and responses in the historic environment, including climate change 2.3 Build/develop sector capacity and capability to make the most of the historic environment 2.5 Lead innovation in heritage protection and conservation, including new techniques and materials research
Activity 3 - Developing our reputation in heritage policy and evidence to increase our influence at home and abroad	3.1 Influence the sector and provide sector leadership 3.2 Provide evidence on the state of the historic environment 3.3 Develop and make the case for heritage using tools such as Culture and Heritage Capital 3.5 Provide advice to Government on policy development and effectiveness

Activity 4 - Providing informed and audience-relevant advice to enable the care and development of the historic environment	4.2 Provide advice to owners on caring for their assets 4.3 Provide advice to planners and developers on sustainable change
Activity 5 - Working with communities to build capacity in engaging and cost-effective ways	5.1 Help heritage sector organisations to work better with communities 5.2 Build capacity (knowledge and skills) in communities
Activity 6 - Sharing techniques, tools, knowledge and expertise in innovative and inspirational ways	6.3 Use case studies for sharing our knowledge and informing new ways of working 6.4 Continually evolve ways of sharing our work and inspiring people to take action

Climate Change Programme includes priorities for action around mapping and assessing climate threats to heritage as well as a focus on the appropriate retrofit and adaptation of historic buildings to reduce their operational carbon emissions and to ensure they are more resilient to a changing climate.

3.2 The English Heritage Trust response to climate change

As a charity the English Heritage Trust is acutely aware of the impact that the changing climate is having, and will have, on the National Heritage Collection in its care. The Trust is taking action across all its work, reducing its contribution to the causes of climate change as well as working to identify the risks, vulnerability and exposure of sites to climate risks to inform work programmes, skills training and adaptation approaches. Sustainability is a priority for the organisation[17] and a new Head of Sustainability has recently joined the organisation to lead work in this area. The existing Sustainable Conservation Strategy and Sustainability Policy are currently being refreshed and strengthened to sit alongside a new Climate Action Plan which will be published this summer. This action plan will set out clear pathways for decarbonisation, sustainable operations and adaptation backed up by developing skills, training and communication.

3.3 Heritage sector collaborative responses to climate change

Historic England and the English Heritage Trust both acknowledge that tackling the climate crisis cannot be done in isolation. Collaboration is essential. As well as working with each

17 https://www.english-heritage.org.uk/about-us/our-priorities/sustainability/ [accessed 27/1/2022]

other both organisations are working with the wider sector to share knowledge and good practice. Examples of this collaboration with the wider sector include:

- Historic Environment Forum COP26 Task Group - Historic England funded the Historic Environment Forum's COP26 Task Group which was chaired by the English Heritage Trust's Estates Director and produced Heritage Responds[18], a report and interactive story maps that highlight the positive contribution heritage organisations and their partners are making to the climate change debate and the actions needed to adapt to a changing world.

- Pan-UK Climate hazards, vulnerability and adaptation working group - Historic England and the English Heritage Trust have been working with the National Trust, Historic Environment Scotland, Cadw, Northern Ireland Department for Communities, and the National Trust for Scotland to develop consistent high level climate hazard mapping for the UK. They also convened the first ever UK Climate Resilience Heritage Summit in October 2021.

- Collaborative research funded and facilitated by UKRI has enabled closer working with university based researchers on challenging topics such as managing loss, understanding vulnerability and approaches for heritage to support climate resilient places and communities.[19]

- Both Historic England and the English Heritage Trust are members of the Climate Heritage Network[20], an international network of heritage organisations working to raise the profile of climate change in cultural heritage and vice versa. Historic England's Head of Environmental Strategy is a founding steering committee member. The CHN has been instrumental in bringing together heritage organisations for the 2021 COP26 in Glasgow as well as other collaborations that have seen increased awareness of the importance of including cultural heritage in responses to climate change. The Climate Heritage Network is also an official partner in the UN Race to Resilience[21].

18 https://historicenvironmentforum.org.uk/hef-activities/archive-and-resources/heritage-responds/ [access 27/1/2022]

19 eg the UKRI Resilience Programme funded CLandage University of liverpool led project https://www.ukclimateresilience.org/projects/clandage-building-climate-resilience-through-community-landscapes-and-cultural-heritage/ and the UKRI Landscape Decision making programme funded 'Landscape Futures' University of Exeter led project.https://www.exeter.ac.uk/research/esi/research/projects/landscape-futures/ [accessed 27/1/2022]

20 https://climateheritage.org/ [accessed 27/01/2022]

21 https://racetozero.unfccc.int/race-to-resilience-launches/ [accessed 27/01/2022]

4 Assessment of current and furture risks presented by climate change

4.1 Use of climate projections

While there is overwhelming evidence that the global climate is changing, and that human activity has and continues to play a key role in this change[22], exactly what this means for our future weather is less certain. A number of models have been developed which 'project' what our climate will be like into the future from an understanding of current climate and the variables affecting it. Work by the Met Office in the UK[23] and the IPCC globally[24], as well as others, has identified trends that indicate what we might expect. The models and data that inform these projects are constantly being refined and updated; however, while the precise details might change as we gain a greater understanding of the processes, the general trends these models have identified remain valid.

The climate changes that form the basis of this adaptation report are principally based upon the UKCP18 climate projections which indicate warmer, wetter winters; hotter, drier summers; increased intensity of rainfall; rising temperatures; increased incidence of both drought and flood; and rising sea levels for the UK. For now that level of detail has been sufficient to start to identify risks for Historic England and the historic environment. **However, since Historic England's earlier Adaptation Report Historic England and the English Heritage Trust have been working together with other UK heritage organisations to map current and future climate hazards.** The early results of that work are included in this report. For the purposes of the climate hazard mapping a high emissions scenario was used (RCP8.5) and data was assessed for two time periods: a baseline period (1981-2010) and a projected future period (2060-2080).[25]

Previous work on climate change by Historic England has considered climate change as a multiplying factor with the potential to exacerbate or make more frequent certain

22 IPCC, 2021: Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [MassonDelmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press. In Press.

23 UKCP18 Science Overview. Executive Summary https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/research/ukcp/ukcp18-overview-summary.pdf [accessed 27/01/2022]

24 IPCC, 2021: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press. In Press.

25 Deru et al 2022

scenarios[26], while to a certain extent this is still the case our most recent work on climate hazards indicates that we will see new risks emerging and in places where they have not previously been experienced.

Some of the greatest climate change related risks to heritage come from people's responses to the urgent need to reduce carbon emissions, or adapt to climate driven impacts such as flooding. Actions to improve energy efficiency of buildings, for instance, that do not give consideration to the materials, construction, and use of that building may result in unintended negative consequences such as increased humidity and damp, or maladaptation such as reducing the buildings ability to cope with overheating. The extent of these risks is harder to quantify but is addressed through making the connection between climate mitigation and climate adaptation in guidance and advice on retrofit and modification of buildings.

4.2 Identifying risks for the historic environment

Identifying hazards is not the same as identifying risks. Understanding risk involves not only identifying the hazards but also vulnerability and exposure to those hazards[27]. We are making good progress in understanding relevant climate hazards[28] and we are continuing to work to understand the vulnerability and exposure of our organisation and the historic environment we care for but our understanding of climate risk is still at an early stage. **The work presented here identifies the relevant climate change drivers and their likely impacts upon heritage assets and Historic England but further action is needed to better understand climate risks to heritage.**

Identifying risks for the historic environment is complex. The third UK Climate Change Risk Assessment (CCRA3) identifies 'H11 Risks to Cultural Heritage'[29] which provides the basis for the risks described here. CCRA3 identifies that the risks to cultural heritage caused by climate change are increasing over time with an overall medium risk rising to high risk. The main current risks to cultural heritage relate to extreme weather fluctuations including increasing temperatures (heatwaves or fires), precipitation and flooding, coastal processes, and from unintended consequences of climate mitigation and adaptation measures (maladaptation)[30]. While there is a good level of awareness of the risk

26 English Heritage 2008a. Climate Change and the Historic Environment. Swindon, English Heritage; Atkins

27 Cardona et al 2012 https://www.ipcc.ch/site/assets/uploads/2018/03/SREX-Chap2_FINAL-1.pdf [accessed 27/1/2022]

28 eg Deru et al 2022

29 Kovats, S. and Brisley, R. (2021) https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA3-Chapter-5-FINAL.pdf

30 https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA3-Briefing-Cultural-Heritage.pdf [accessed 27/1/2022]

to coastal heritage, risks from other climate change impacts such as overheating, changes in precipitation, and ground stability are not so well understood. Although awareness of coastal risks to heritage may be high, knowledge of the rates of coastal processes and the scale of impact to coastal heritage over time is poorly understood.

It is worth noting that several of the risks quantified here are related to the secondary risks presented by unintended negative consequences and maladaptation. In particular, we know that retrofitting of buildings that does not consider future adaptation to hotter, drier summers can inadvertently increase the risk posed by overheating. For that reason, better understanding the way that these risks relate to each other and to activity to reduce carbon emissions is an important focus for future activity.

It is important to note that although H11 specifically addresses climate change risks to cultural heritage a number of the other risks identified within the CCRA3 are also relevant to the historic environment; a complete list and their relevance can be found in appendix 3.

The main climate changes that will impact upon Historic England's work are set out below. Refining our understanding of some of those identified in the previous adaptation report has proved challenging, however recent collaborative work developing climate hazard mapping has enabled a greater understanding of the extent of future risks to heritage in relation to overheating and humidity, ground stability, storm and coastal processes (see 4.3). A level of confidence in our current understanding of these climate change impacts is indicated as Low (where we currently have little data or a high degree of uncertainty), Medium or High (where we currently have good data and / or high certainty):

Unpredictability (low confidence): Although the precise details may be uncertain it is clear that change is already occurring and will continue to occur. Inevitably, this means a departure from the predictable seasonal weather patterns of the past. This increasing unpredictability impacts upon our ability to schedule weather-dependent work.

Increased rate and patterns of coastal change (low/medium confidence): Britain's coastline has changed continually, but the rate of this change and where its greatest impacts will be are being affected by sea-level rise, changes to coastal currents, storm patterns and other climate change related factors.

Precipitation pattern changes (medium confidence)**:** Intense pluvial events, and persistent periods of rainfall on saturated or impermeable ground, can damage buildings, flood historic areas and landscapes, affect planting in designed landscapes, disrupt fieldwork, and exacerbate erosion. With a projected increase in winter precipitation of around 33%, and increases in the frequency of intense rainfall these impacts will be felt ever more strongly.

Drought (medium confidence): At the other extreme, drought (also projected to increase in frequency and intensity) can harm plants that make up designed and historic landscapes, affect archaeological deposits, in particular waterlogged deposits, affect the stability of buildings and other structures, and also affect ground stability and exacerbate erosion.

Humidity (low/medium confidence): As the temperature rises the air is able to hold an increasing amount of water vapour which is leading to an overall rise in humidity. High humidity results in intense rainfall which can overwhelm rainwater goods, erode sites and result in surface water flooding. Collections are heavily impacted by fluctuations in humidity and an increase in mould, vegetation growth and pests can be seen across historic assets.

Temperature increase (medium confidence): In the sea, temperature increase is affecting the conditions that have hitherto preserved a rich maritime heritage. On land, it may lead to changing patterns of land use that could also present challenges for terrestrial heritage. Increasing temperatures also give rise to different flora and fauna, some of which may be harmful to elements of our heritage. This is likely to have a major impact on the plants in designed landscapes, particularly trees, affecting the appearance of our designed landscapes. New pests and diseases may attack archive materials. Buildings may also be attacked and traditional repair materials may become increasingly difficult to source.

Increasing temperatures will cause overheating of many buildings and places. Increasing temperatures also affect visitor numbers, frequency and behaviours[31] which can also exacerbate impacts such as erosion.

Increasing temperatures and reduced summer precipitation will increase risk of wildfire which will affect archaeological sites and historic buildings and structures.

Soil moisture and groundwater (low-medium confidence): Desiccation of wetlands, either as a direct result of a changing climate or as a consequence of people's response to it, can have a dramatic effect on the preservation of waterlogged archaeological and palaeo-environmental material. The drying out of certain geologies (eg clay) can affect ground stability and increase subsidence affecting historic structures and affecting archaeological sites.

Maladaptation and unintended negative consequences (medium confidence): If we seek to modify our buildings to improve energy efficiency and reduce carbon without first understanding the way the building performs - its fabric, construction, and use - we can make modifications that can either cause harm to the building and to its occupants (unintended

31 https://www.nationaltrust.org.uk/features/how-climate-change-will-affect-the-future-of-uk-tourism [accessed 27/1/2022]

negative consequences), or reduce its ability to cope with climate changes such as increased temperatures, increased humidity or increased risks of flooding (maladaptation).

4.3 Climate hazard mapping

Work is underway to create a consistent map of climate hazards for heritage across the UK[32]. Currently mapping is available for the following aggregated risks in a 5 level RAG system[33]: overheating and humidity; storm damage; slope failure; shrink swell; coastal risk. The current and future exposure of National Heritage List for England (NHLE) sites and the National Heritage Collection have been assessed against these hazards. Work is ongoing to understand the vulnerability in order to calculate risk so the assessment of risk presented here should be considered provisional. Nevertheless some important trends can be identified (see also Table 2).

Overheating and humidity: there is a considerable increase in exposure to overheating and humidity for all categories with the level or risk moving from moderate to severe for listed buildings, registered parks and gardens and the National Heritage Collection. From the hazard mapping analysis 75% of all listed buildings, 78% of registered parks and gardens and 67% of the National Heritage Collection fall within the highest-level exposure to overheating and humidity by 2060 compared to 0% for the baseline. Although exposure for scheduled monuments sees a similar increase there is less certainty about the vulnerability of scheduled monuments to overheating and humidity. This is something that requires further investigation.

Storm damage: includes changes in precipitation and wind. There is little change indicated between the baseline scenario and future scenarios. However, we know from anecdotal reports that changes in precipitation in particular are having a considerable effect on all categories of heritage, for instance increase in overtopping of guttering, flash flooding from surface water excess, and issues with localised erosion resulting from the same. Therefore, further work is needed to separate out the precipitation changes to be able to understand how that risk will change.

Slope failure: shows a significant shift to higher risk for all categories. This is most pronounced for listed buildings, scheduled monuments and the National Heritage Collection. For instance 24% of scheduled monuments, 19% of listed buildings and 17% of the National

32 Work is being undertaken with a collaboration of UK national heritage agencies (Historic England, Historic Environment Scotland, Cadw, Northern Ireland Dept for Communities, Royal Commission for Historic Buildings and Ancient Monuments for Wales, English Heritage Trust, The National Trust and The National Trust for Scotland) who are working with sustainability experts 3Keel to develop consistent mapping for climate hazards for heritage across the UK.

33 For further detail see Deru et al 2022

Table 2. Climate hazards exposure and risk for National Heritage List for England Assets and the National Heritage Collection.

Hazard	Heritage assets	Current likelihood [1] exposure (1 to 5)	Future likelihood exposure (1 to 5)	Impact [2] estimated vulnerability (1 to 5)	Current risk level exposure times vulnerability	Future risk exposure times vulnerability	Certainty (3 high; 1 low)
Overheating and humidity	Listed buildings	2	5	4	8	20	2
	Scheduled monuments	2	5	3	6	15	1
	Registered parks and gardens	2	5	4	8	20	2
	Registered battlefields	2	5	1	2	5	1
	National Heritage Collection	2	5	4	8	20	2
Storm damage	Listed buildings	2	2	4	8	8	2
	Scheduled Monuments	2	2	4	8	8	2
	Registered Parks and gardens	2	2	4	8	8	2
	Registered battlefields	2	2	3	6	6	2
	National Heritage Collection	2	2	4	8	8	2
Slope failure	Listed buildings	3	5	5	15	25	2
	Scheduled Monuments	1	4	5	5	20	2
	Registered Parks and gardens	1	3	4	4	12	2
	Registered battlefields	1	3	4	4	12	2
	National Heritage Collection	1	3	5	5	15	2

1 Likelihood scale - 1 highly unlikely, 2 unlikely, 3 possible, 4 likely, 5 almost certain

2 Impact scale - 1 minimal, 2 minor, 3, moderate, 4 major, 5 catastrophic.

Hazard	Heritage assets	Current likelihood [3] exposure (1 to 5)	Future likelihood exposure (1 to 5)	Impact [4] estimated vulnerability (1 to 5)	Current risk level exposure times vulnerability	Future risk exposure times vulnerability	Certainty (3 high; 1 low)
Shrink swell	Listed buildings	2	5	4	8	20	2
	Scheduled Monuments	1	5	3	3	15	1
	Registered Parks and gardens	2	5	2	4	10	1
	Registered battlefields	3	4	1	3	4	2
	National Heritage Collection	4	5	4	16	20	1
Coastal processes	Listed buildings	1	1	5	5	5	1
	Scheduled Monuments	1	1	5	5	5	1
	Registered Parks and gardens	1	1	5	5	5	1
	Registered battlefields	1	1	5	5	5	1
	National Heritage Collection	2	5	5	10	25	1

3 Likelihood scale - 1 highly unlikely, 2 unlikely, 3 possible, 4 likely, 5 almost certain

4 Impact scale - 1 minimal, 2 minor, 3, moderate, 4 major, 5 catastrophic.

Heritage Collection are within areas of highest level exposure to slope failure by 2060 compared to 0% for the baseline.

Shrink swell: shows a particularly high level of future risk for listed buildings, scheduled monuments and the National Heritage Collection with 36% of all listed buildings within the highest level of risk for shrink swell by 2060 compared to 0% for the baseline. However, the impact of shrink swell upon scheduled monuments, registered parks and gardens and registered battlefields is uncertain and warrants further consideration

Coastal risk: for the hazard mapping undertaken to date shows little change for categories apart from the National Heritage Collection. The reason for this is unclear but the resolution of this first phase mapping may be too coarse to identify the exposure.

4.4 Priorities for future action

Work developing the hazard mapping is ongoing with a second phase that maps over 60 separate data sets. Work has also begun on mapping coastal risk in more detail than is currently included. In both instances this work is being undertaken through collaboration with the National Trust and and the other UK heritage bodies. All of this mapping is based upon open licence and publicly available data and so the hazard mapping will be available to the wider heritage sector to support their risk management and adaptation planning. This is the first time that collaboration of this scale has occurred to address climate change impacts for heritage and is itself a good example of adaptive responses to the climate crisis.

In addition to this general work to progress the climate hazard mapping for heritage the work so far indicates the following priority areas:

- Overheating and humidity - the increase in exposure of all categories of heritage to overheating and humidity is extremely high. We need to better understand the vulnerability of different types of heritage to this hazard and identify potential adaptation responses to manage the risks. We also know there is a close connection between higher exposure to overheating and humidity and risk of maladaptation from carbon reduction responses.

- Coastal risks - the level of coastal risk from the hazard mapping to date is surprisingly low; in order to better understand the coastal risks to heritage we need to undertake hazard mapping at a finer resolution. The first phase of work to do this is currently underway with a joint project between Historic England and the National Trust. The results of that work will be added to the existing hazard mapping.

- We need to separate out climate drivers such as precipitation, the exposure to which has been hard to discern from the current hazard mapping data. The second phase of the climate hazard mapping for heritage is addressing this and further phases of work will help us increase the granularity of data and our understanding.

- We need to share the hazard mapping with the heritage sector.

5 Action on adaptation since 2016

Since Historic England's previous Adaptation Report in 2016 good progress has been made within the organisation on addressing climate change in general, and adaptation in particular. For instance:

- Developing a climate strategy and delivery programme to deliver climate mitigation and adaptation for Historic England.
- Creating a Head of Historic Buildings and Climate Change Adaptation post and associated Historic Buildings and Climate Change Adaptation team.
- Supporting the heritage sector in engaging with climate change for instance through support for the Historic Environment Forum.
- Delivering a programme of Climate Friday and Technical Tuesday webinars covering a range of climate adaptation topics for the historic environment.
- Identifying climate change response as a priority for research including IRO research bids, collaborative PhDs and Historic England commissioned research.
- Encouraging building reuse and appropriate retrofit of existing buildings stock to help reduce carbon emissions. While this work is driven by climate mitigation the retrofit of buildings can increase risks of 'maladaptation' and unintended negative consequences. Historic England has undertaken a considerable body of work to improve advice and guidance for building reuse and retrofit that is mindful of future climate adaptation and avoids maladaptation.

In the earlier ARP report Historic England committed to the following activities to facilitate adaptation to current and future climate change, the key areas of progress made under each commitment are identified below.

5.1 Maintain a 'watching brief' on climate change projections and their associated environmental impacts

Historic England has been engaged with the MET office release of UKCP18 and participated in events to help shape future UK climate projection data for wider use and relevance to the heritage sector.

Historic England has worked with other UK heritage agencies and National Trusts to develop a collaborative approach to climate hazard mapping; this work was presented at the G20 Cultural

Meeting in spring 2021 and formed the basis of the first ever UK Heritage Climate Resilience Summit in autumn 2021.

Historic England has been developing a comprehensive approach to threats that better reflects the latest climate projections.

Historic England has had input into the third UK Climate Change Risk Assessment.

Climate hazard mapping for heritage

Historic England has been working in partnership with the English Heritage Trust, The National Trust, Historic Environment Scotland, Cadw, Northern Ireland Department for Communities and the National Trust for Scotland to develop consistent, publicly available hazard mapping for heritage. This mapping is based upon the latest climate projections and has been undertaken in a way that will be easily updated as new information becomes available.

The same partnership is currently developing a more detailed and consistent approach to coastal hazard mapping for heritage.

5.2 Support measures to increase workforce resilience

Historic England has supported its staff in developing a greater understanding of climate change impacts and responses through the provision of regular webinars (eg Climate Friday and Technical Tuesday webinar series), staff briefings and communications. These have facilitated the sharing of knowledge between staff within the organisation and more widely.

Historic England is developing a ‘threat framework’ to facilitate understanding and sharing of information on threats to heritage.

Historic England has been moving towards more flexible and sustainable working arrangements over the past five years. Additionally, measures put in place in response to enforced home working during the Covid pandemic have made a significant contribution to increased workforce resilience.

The Historic England staff-led ‘Green Group’ provides informal support to staff on sustainability and climate change matters.

Introducing hybrid working and virtual meetings

In 2016 Historic England staff described how the ability for video calls and virtual conference facilities would facilitate greater flexibility and resilience for the workforce, enabling specialist staff to provide expert advice and respond to emergencies without the need to travel. At that time relatively few staff had the ability to work from locations other than their office base and therefore disruptions to travel or office access meant disruptions to work.

Since 2020 Historic England has introduced access to flexible and remote working for all staff, with video conferencing and video calling capabilities through Teams. Although introduction was in response to the COVID-19 pandemic the flexibility addressed many of the suggestions raised in the 2016 Adaptation Report.

5.3 Support measures to increase resilience in the historic environment

Historic England has been actively supporting (financially and with its own experts) heritage sector climate change networks and collaborative working. Climate change considerations figure strongly in the most recent versions of the Corporate Plan and the climate strategy and associated climate change programme bring together short term actions to help further medium and long term aims for climate adaptation.

Through its grants Historic England has supported measures to improve the resilience of heritage assets, in particular through supporting repair and maintenance.

Historic England regularly publishes guidance and research on maintenance for both owners and heritage professionals. This includes technical guidance on maintenance and repair; information on maintaining building services; maintenance plans and inspection checklists; and research on the value of maintenance. Ongoing research also looks to understand the performance of materials to conserve and repair heritage assets. It examines long-term performance and behaviour, as well as suitability and efficacy.

Heritage Responds publication and story map

Heritage Responds is the culmination of six months of collaboration by the members of the Historic Environment Forum COP26 Task Group, chaired by English Heritage Trust Estates Director Rob Woodside, and showcases how the sector is responding to Climate Change. The report includes a focus on investment in traditional low-carbon building adaptation techniques, nature-based solutions to mitigate the future impact of Climate Change, and renewed efforts to increase the lifespan of heritage assets and save the embodied carbon which might otherwise be sacrificed in demolition, new construction or poor upkeep. Alongside the report, the Historic Environment Forum in collaboration with Historic England has also launched a new Heritage Responds Climate Change Story Map, a geographical mapping of the key case studies demonstrating how the heritage sector is acting to address climate change – and how heritage is part of the solution to climate change.

5.4 Embed climate change adaptation and environmental risk management within projects and practices

Climate change risk and adaptation is included as a key consideration in the Corporate Plan and Future Strategy. The Historic England climate strategy (due for publication early 2022) sets out commitments and priorities for addressing climate risks and adaptation across the organisation in the short, medium and long term. This will facilitate greater integration into Historic England's practices and future projects.

Currently the developing Historic England Climate Change Programme addresses climate action including assessing and responding to risks; the current review of the Heritage at Risk programme includes climate change; and the development of a threat framework is underway.

With regard to the management of facilities the 'Office of the Future' project is underway and addressing the way in which Historic England works and can include consideration of climate adaptation; and Historic England have undertaken modelling to assess the impact of overheating on its offices https://historicengland.org.uk/whats-new/research/overheating-and-historic-buildings/ research that can inform better understanding of overheating and adaptation to reduce overheating of office buildings and those in historic buildings.

Repair of Wool Bridge, Dorset - Historic England

This project focused on the repair of the collapsed 16th century Wool Bridge and prevention of future damage from floods.

The Wool Bridge spans the river Frome and collapsed in 2018 following a period of intense rainfall which led to flooding. The Heritage at Risk team worked closely with the County engineers to repair the bridge and reinforce it against future flooding, adding a row of 44 four-metre sheet submerged piles to act as a wall of steel to protect the bridge from undermining by the river. These piles also support a new concrete arch and wall, which was clad in the original stonework recovered from the river. The management system put in place by the design team has since been recognised as a national model for other at-risk heritage assets. It included a desk-based assessment of the structure to establish baseline conditions, LiDAR survey of the riverbed, archaeological watching brief during the construction phase and aerial photography. The project was nominated for a civil engineering award and was awarded “ICE People’s Choice Award” 2019.

5.5 Promote the positive role the historic environment can play in informing responses to climate change and associated environmental risks

HE has undertaken a considerable body of work on the important role building reuse and retrofit can play in not only reducing carbon emissions but also improving the resilience of places and people to future climate challenges. Well informed retrofit that understands the materials, construction, use, and wider environment of a building will provide resilient homes and places for the future.

HE has undertaken research demonstrating the effectiveness of traditional building materials in recovering from flooding, often more effectively than modern materials, thereby reducing the impact on people’s lives and businesses.

Within the wider landscape HE has commissioned work to explore how heritage assets can play a positive role in informing flood management: HE commissioned work on Historic Watercourse Characterisation which has been applied to ‘Connecting the Culm’ flood management scheme in Somerset/Devon and is being further developed in the Building climate resilience through community, landscapes and cultural heritage (CLandage) AHRC-funded research project for UKRI Climate Resilience Programme (Historic England is a Co-

Investigator on AHRC-funded collaborative research led by the University of Liverpool as part of the UKRI Climate resilience programme).

Historic England has also recognised the positive role that heritage has in engaging people and shaping places, including on planning for future climate resilience and change. Examples include Historic England's continued support for the CitiZan project led by MOLA, supporting work by DCMS to develop a 'Cultural Heritage Capital' approach, and a suite of commissioned reports exploring ecosystem services and natural capital and the historic environment.

Flood resilience with traditional materials – Iron Bridge Lodge, Aldford Approach, Cheshire

Grade II Iron Bridge Lodge is located on the banks of the River Dee in Cheshire. At some point since its construction in 1894 it has seen its floor replaced with concrete, its mortar joints pointed in cement and internal walls plastered in gypsum plaster. The building is subject to regular flooding and after each flood incident the building could not be occupied for 5 months on average. Works in 2020 saw the concrete floor, cement mortar and gypsum plaster removed and replaced with traditional lime mortars, plasters and a limecrete flooring. The building has subsequently flooded, but instead of waiting 5 months the tenants only needed to move out for 5 weeks and minimal repairs had to be undertaken to recover the property.

5.6 Develop an approach for dealing with inevitable change, including loss

Historic England has worked with academic and heritage sector partners on research into how the sector might be able to constructively prepare for loss of heritage assets as a consequence of climate change. The AHRC-funded Landscape Futures research project has helped establish a network to support sector engagement with loss of heritage assets; an AHRC Collaborative Doctoral Programme PhD student with the University of Exeter is developing practical tools for managing loss of coastal heritage. Historic England has also used its grants programme to support work to undertake recording for sites that are under threat from environmental processes eg St Levan Chapel (Cornwall), and Seaford Head (Sussex).

Using research to support national heritage policy reflect some inevitable loss

UKRI-funded research led by the University of Exeter (Landscape Futures and the Challenge of Change) and an AHRC Collaborative Doctoral Programme PhD co-supervised by Historic England and University of Exeter have been investigating ways to manage transformative change and loss of heritage assets. This work will be the foundation of ongoing collaboration between the National Trust, English Heritage Trust and Historic England to develop practical frameworks to address this sensitive topic.

Repositioning of the historic Storm Tower in Bude in response to threat of loss from coastal erosion

This project focused on the relocation of a Grade II-listed coastal look-out and eye catcher, due to coastal erosion and associated threat of collapse into the sea. The Tower is now about 4m away from the cliff edge, at imminent risk of loss. Historic England are working with the local community, Town Council and Cornwall Council to relocate the Storm Tower in a position further back from the cliff edge. This will allow the Tower to continue to function as an eye-catching historic feature in the area and retain many of its values as a building of special interest. The team behind this work hope to achieve good press coverage about climate change impacts on the west coast's heritage assets and reference larger research possibilities; the conservation of a listed structure; good craft skills in reconstructing the building; the valuable contribution of heritage to local areas and the positive light that this building is seen in by the local community; and good partnership working with other public and local organisations.

5.7 Support the English Heritage Trust in addressing climate change impacts

Historic England has worked closely with the English Heritage Trust (EHT) to address climate change adaptation. HE and EHT have worked with the National Trust (and other UK heritage bodies) to develop shared climate hazard mapping for England and common approaches to assessing vulnerability and risk. Historic England's National Specialist Services have provided technical advice to the EHT to help climate adaptation responses for the National Heritage Collection.

Heritage Climate Resilience workshop October 2021

An interactive day of discussions, presentations and workshops focussing on climate risk and resilience of UK heritage ahead of COP26 hosted by Historic Environment Scotland with Historic England and English Heritage Trust as partners. Other partners included National Trust, CADW, Department for Communities in Northern Ireland and National Trust for Scotland. This event was attended by representatives from 20+ countries bringing together academics and practitioners, regulators and charitable bodies to discuss and present their efforts to explore the exposure, vulnerability and impacts of climate hazards on the historic environment.

As well as talks on risk, this event showcased the possibilities of working with climate data to develop tools with which assessments can be made on options for adaptation and thresholds for change.

6 Future commitments for adaptation

As reported in the previous section, good progress has been made against the commitments of the 2016 Climate Change Adaptation Report.

Historic England is currently finalising its climate strategy and anticipates that this will be the basis for future reporting. The draft commitments in relation to climate change mitigation, risk and adaptation are included below. **Please note that at the time of writing these are not yet fully finalised and may be subject to some change and should therefore be considered indicative.** When Historic England's climate strategy is finalised we will publish it and actively share with relevant government departments and other relevant bodies.

Historic England intends to offer support to the wider heritage sector on sustainable responses to climate change including identifying research priorities, communicating research outputs, facilitating conversations and providing targeted advice, guidance and advocacy.

Historic England and the English Heritage Trust intend to work together to encourage greater collaboration for climate change adaptation action within the heritage sector. They will work collaboratively with the wider heritage sector on climate risk and adaptation and will agree on a shared reporting mechanism in relation to the National Heritage Collection.

The following tables are an extract of the relevant actions section of the emerging Historic England climate strategy (these should be considered indicative as the strategy has yet to be published):

The following is an extract of the relevant actions section of the emerging Historic England climate strategy (these should be considered indicative as the strategy has yet to be published):

There are three strands that set the trajectory in the long term: mitigation, managing risk and adaptation.

6.1 Mitigation – Achieving Net Zero

Aim: The UK government has committed to reduce greenhouse gas emissions to zero by 2050; we will proactively remove emissions that cause climate change to achieve net zero for Historic England by 2050, and we will support other heritage organisations on their journey towards net zero. We will climate-proof all of our policies, advice, guidance and operations to play our part with the delivery of the government's Net Zero Strategy whilst at the same time ensuring our heritage continues to be protected and cherished. Removing greenhouse gas emissions and sustaining our heritage are compatible goals.

Actions:

1 During the summer of 2022 we will publish both a carbon baseline footprint and a reduction plan for Historic England that will set our trajectory for achieving carbon net zero by 2050. The plan will identify the actions we will take to identify and accurately record our carbon emissions and to remove them from our operations. We will establish annual targets for carbon reduction and report on our progress against our targets each year from 2023 onwards.

2 We will share our experience of reducing our emissions with heritage organisations that need our help to develop and deliver their own carbon reduction strategies. By 2023 we will seek to understand the particular support needs of heritage organisations so that we can tailor our help accordingly.

3 By investing in high quality research from 2022 onwards, often in partnership with others, we will continue to demonstrate how the recycling of historic buildings will play an essential part with achieving the government's Net Zero Strategy targets. We will use this evidence to help influence the development of policies and programmes designed to reduce carbon in the built environment.

4 By 2024 we will develop a 'Roadmap to Retrofit' programme for historic buildings, comprising: accessible packages of guidance, training and other support tailored to audiences, to support the appropriate retrofit of historic buildings.

5 In addition, this year we will have a particular focus on the skills challenge across the broad spectrum of construction activity to achieve the appropriate retrofit of our historic buildings, working with others to quantify the skills gap and how this might be addressed.

6.2 Risks – Understanding the threats of climate change

Aim: We will identify, understand and respond to the threats from a changing climate. We will share our insights: listening, learning and collaborating with partners to effect, enable and catalyse change and risk management.

Actions:

1 From today we are actively working closely with climate science specialists in government, universities and private practice to improve access to and understanding of future climate projections and the implications for heritage.

2 Working in partnership with others, by the end of 2022 we will map and share climate-related hazards to identify which aspects of our heritage are most vulnerable to a changing climate.

3 From 2023 onwards we will develop methodologies to quantify and monitor climate-related hazards to ensure the risks to heritage can be fully incorporated into the fourth UK Climate Change Risk Assessment report.

4 We will monitor and evaluate human responses to climate change and how they are affecting heritage.

6.3 Adapt – preparing for a changing climate

Aim: As our knowledge of climate projections and the implications for heritage improves, we will engage and equip people to take action in support of the places they care about. We will develop, innovate and adopt best practice, including emergent areas of work, responding to new insights, technical developments and changes as our work progresses. We will gather evidence and demonstrate how our historic environment can contribute to the resilience of people, places and communities.

Actions:

1 From 2023 onwards we will develop and make available an online resource of accessible guidance and case studies that showcase good practice responses to climate hazards.

2 Later this year we will publish a consultation draft Historic England Advice Note (HEAN) on Climate Change that will provide a framework for balancing the need to respond to climate change whilst sustaining our heritage.

3 Working with others, by 2025 we will seek to develop a toolkit to equip those who care for our heritage to plan for and manage decisions where loss of, or transformative change to, heritage assets is unavoidable.

4 We will constantly seek to identify adaptive practices, develop new approaches and assess their effectiveness and how they might apply to different sorts of heritage. We will provide annual summaries of new developments from 2023 onwards.

5 From today we will embed climate adaptation thinking into our operations, ensuring that all our future business decisions are mindful of future climate scenarios and their impacts.

6 This year we will review our existing Adaptation Report (submitted to Defra in 2016), and prepare and submit an updated report to government as an Adaptation Reporting Power Report.

7 We will contribute to the third National Adaptation Programme (NAP) and gather evidence on the positive role heritage can play in helping society adapt to future climate conditions.

8 We will continue to identify, document and champion the contribution of cultural heritage to climate-resilient places and communities.

9 As well as demonstrating good practice, we will also identify, document and share examples and experiences of maladaptation and climate change responses that have had unintended negative consequences to help people learn from mistakes and make good choices.

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8 Appendices

8.1 Additional Case Studies

Pilot training on adaptation at Wrest Park and Belsay Hall - English Heritage Trust

English Heritage Trust are a key partner in the European-funded international project PRO-Heritage, which is nearing completion after nearly three years. The aim of the project is to provide much-needed training for Craftspeople and anyone involved in organising work on traditional buildings on energy efficiency - effectively what can and can't be done in their use and adaptation. Training like this helps reduce the risk of 'maladaptation' and unintended negative consequences from energy efficiency alterations that are not informed by an understanding of the building. The first training events were held in January with 90 people receiving European qualifications from ECQA. Four English Heritage Trust staff are now trained to deliver the course content and the intention is for further training days to be rolled out across the year.

New Research Agenda for Sustainable Building Conservation - English Heritage Trust

English Heritage Trust and the University of Oxford are working in collaboration to develop a new research agenda to inform more sustainable approaches to historic monument and building conservation. One of the key areas of focus is the interaction and inter-dependency of nature and monuments, exploring the further application of Nature Based Solutions to build climate resilience.

Kenwood smart sensors pilot - English Heritage Trust

English Heritage Trust is working with Ecclesiastical Insurance and technology firm Shepherd to pilot state-of-the-art monitoring sensors at Kenwood House in North London. The project uses smart sensors, placed at risk points around the site, to discreetly monitor the building and environmental factors in real time, alerting the site manager and estate maintenance team to potential flooding. The system also monitors electricity across the site with the aim of reducing operating costs and providing information on the building performance.

The project was recognised at the CIR Risk Management Awards where it received the 'highly commended' award in the Risk Management Innovation of the Year category.

8.2 Relevant Historic England publications since 2016

Advice and Guidance

Climate Change and Sustainability Statement. Historic England, 2020

Energy Efficiency and Historic Buildings: Application of Part L of the Building Regulations to historic and traditionally constructed buildings. Historic England, December 2017

Energy Efficiency and Historic Buildings: How to Improve Energy Efficiency. Historic England, June 2018

Energy Efficiency and Historic Buildings: Insulating pitched roofs at rafter level. Historic England, April 2016

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Energy Efficiency and Historic Buildings: Insulating flat roofs. Historic England, April 2016

Energy Efficiency and Historic Buildings: Insulating dormer windows. Historic England, April 2016

Energy Efficiency and Historic Buildings: Open fires, chimneys and flues. Historic England, April 2016

Energy Efficiency and Historic Buildings: Insulating solid walls. Historic England, April 2016

Energy Efficiency and Historic Buildings: Insulating thatched roofs. Historic England, April 2016

Energy Efficiency and Historic Buildings: Insulating timber framed walls. Historic England, April 2016

Energy Efficiency and Historic Buildings: Insulating early cavity walls. Historic England, April 2016

Energy Efficiency and Historic Buildings: Draught-proofing windows and doors. Historic England, April 2016

Energy Efficiency and Historic Buildings: Secondary glazing for windows. Historic England, April 2016

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There's No Place Like Old Homes: Re-use and recycle to reduce carbon. Historic England, 2020. Heritage Counts 2019 report on behalf of the Historic Environment Forum.

Traditional windows their care, repair and upgrading. Historic England, February 2017

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The SPAB Research Report 2: The SPAB Building Performance Survey 2016. ArchiMetrrics Ltd. Research Department Report Series No. 102-2016

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The Value of Maintenance? Project Report. 2019. APEC Architects for Historic England. The report is based on a sample of 30 historic church buildings; however the findings can be extrapolated to other buildings.

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8.3 UK Climate Change Risk Assessment risks relevant to the historic environment and Historic England

H11 Risks to cultural heritage	The historic environment is core to what makes places culturally distinctive.
H5 Risks to building fabric	This includes risks to the fabric of our built historic environment. For instance over 20% of our homes are more than 100 years old.
H4 Risks to viability of coastal communities from sea level rise	For coastal communities at risk from sea level rise this includes their cultural heritage and historic environment.
H3 Risks to people, communities and buildings from flooding	This includes flooding risk to the historic environment within those communities.
H1 Risks to health and wellbeing from higher temperatures	Higher temperatures and risks from overheating can be exacerbated by the maladaptation of buildings. There is a risk of unintentional negative consequences as a result of not understanding the construction of our older buildings.
N4 Risks to soils from changing climatic conditions, including seasonal aridity and wetness.	Our archaeological sites are closely connected to the condition of soils. changes in extremes of wet and dry will affect the preservation of archaeological sites, in particular those with waterlogged archaeological remains.
N6 Risks to and opportunities for agricultural and forestry productivity from extreme events and changing climatic conditions (including temperature change, water scarcity, wildfire, flooding, coastal erosion, wind and saline intrusion).	Changes in land use through changes in forestry and agricultural practices can impact the historic environment. 78% of Scheduled Monuments, 100% of Registered Battlefields and 67% of Registered Parks and Gardens are on agricultural land. Currently, according to Heritage At Risk (and official statistic) 15% of Scheduled Monuments are vulnerable as a result of agricultural activities.
N8 Risks to forestry from pests, pathogens and invasive species	Those risks for forestry will also affect historic landscapes, parks and gardens.

N10 Risks to aquifers and agricultural land from sea level rise, saltwater intrusion	Saltwater intrusion may also affect buried archaeological deposits, designed landscape and planting in parks and gardens.
N11 Risks to freshwater species and habitats from changing climatic conditions and extreme events, including higher water temperatures, flooding, water scarcity and phenological shifts.	Many freshwater habitats are also part of the historic environment or heritage assets.
N14 Risks to marine species, habitats and fisheries from changing climatic conditions, including ocean acidification and higher water temperatures	These same marine changes will also affect the marine historic environment.
N17 Risks and opportunities to coastal species and habitats due to coastal flooding, erosion and climate factors	These same marine changes will also affect the marine historic environment. some of these habitats will themselves be heritage assets.
N18 Risks and opportunities from climate change to landscape character	Landscape character is the result of human activity and natural processes. They are a vital part of our Historic environment. changes to landscape character are changes to the historic environment
I4 Risks to bridges and pipelines from flooding and erosion	Many of our bridges are also heritage assets
B1 Risks to businesses from flooding	Business risks relevant to Historic England as an organisation
B2 Risks to businesses and infrastructure from coastal change	Business risks relevant to Historic England as an organisation
B5 Risks to business from reduced employee productivity due to infrastructure disruption and higher temperatures in working environments	Business risks relevant to Historic England as an organisation

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ISSN 2059-4453 (Online)