IEMA Transforming the world to sustainability

Environmental Impact Assessment Guide to: Climate Change Resilience & Adaptation

Acknowledgements

This Practitioner Guide has been developed by IEMA and EIA professionals working for organisations registered to the EIA Quality Mark scheme (www.iema.net/qmark).

The project was led by Mott MacDonald and the lead author was **Maria Pooley**. It was co-authored and edited by, **James Montgomery** (Mott MacDonald), **Phil Le Gouais** (Independent Consultant), **Kyle Welburn** (Avison Young), **Joanna Wright** (LUC) alongside **Nick Blyth** (IEMA) and **Rufus Howard** (IEMA); its development was assisted with input from/discussions with:

Alison Walker (HS2)

Anastasia Fleming (WYG)

Andrew Tinsley (TRH Assurance)

Arefa Siddiqi and Andrea Davidson (Jacobs)

Caroline Dinnage (Stantec)

Irene Serrano Gonzales (AECOM)

John Dora (John Dora Consulting)

Josh Fothergill (Fothergill Training and Consulting)

Lewis Barlow & Kirsten Leggatt (Sweco)

Paul Munday, Nikki Van Dijk, Stephanie Hands (WSP)

James Blake (Turley)

Maria Sunyer Pinya and Karoline Lende (Arup)

Contents

1. Scope of this Practitioner Note

The purpose of the Environmental Impact Assessment (EIA) process is to provide objective evidence to decision-makers during the development of a scheme, to ensure that the impacts of the scheme are understood and either mitigated or accepted as a part of wider planning and consenting process.

In the UK and European Union (EU), the EIA process is based on EU Directive 2011/92/EU (as amended by EU Directive 2014/52/EU). The EIA Directive states: *'Climate change will continue to cause damage to the environment and compromise economic development. In this regard, it is appropriate to assess the impact of projects on climate (for example greenhouse gas emissions) and their vulnerability to climate change.'*[1]

Therefore, it is important that EIA Reports (the final EIA report is called the 'Environmental Statement' in England, Wales and Northern Ireland), provide clarity on whether climate resilience has been appropriately considered in the design and development of a development scheme.

This guide provides a framework for the effective consideration of climate change resilience and adaptation in the EIA process in line with the UK Town and Country Planning (EIA) Regulations (2017) [2] – alongside the regional variations in Scotland, Wales and Northern Ireland – which (among other UK statutory instruments) transposed into UK law the EU Directive, including a new requirement to consider climate within. A fuller summary of the underlying policy documents is included in Appendix 2 – Legislative and Policy Setting.

This document is a revision of the 2015 IEMA guidance on Climate Resilience and Adaptation in EIA (2015) and reflects lessons learnt from emerging practice. It also includes case studies of EIAs which have considered climate adaptation and resilience issues.

The guide does not address methods for the assessment of greenhouse gases within EIA. For guidance in this area, practitioners should refer to IEMA's 2017 *Environment Impact Assessment Guide to Assessing Greenhouse Gas Emissions and Evaluating their Significance*.

Assessing the impacts of climate change on a scheme is fundamentally different to the assessment of impacts arising from the scheme in other EIA topics, since it focusses on the impact of an external factor (climate change) on the scheme, rather than the impact of the scheme on environmental receptors. This can lead to some difficulty in the language and style of the assessment used, which is explored further in this guidance.

Definitions of climate change, resilience, adaptation and EIA mitigation, along with other terms commonly used in this Guide are included in the Glossary.

EIA Reports[3] produced in line with this advice will:

- be proportionate in their approach and not include superfluous assessment that does not address likely material issues;
- always make reference to climate change;
- provide a concise explanation of how the project's resilience to climate change was considered;
- set out clearly how effects related to climate change have been assessed; and
- define significance of effects pragmatically, taking account of the knowledge base used in the impact assessment.

1. Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment.
2. Town and Country Planning (Environmental Impact Assessment) Regulations 2017, No. 571. Available at: http://www.legislation.gov.uk/uksi/2017/571/pdfs/uksi_20170571_en.pdf
3. Note: Statutory EIA reports are called 'Environmental Statements' in England, Wales and Northern Ireland and 'Environmental Reports' in Scotland.

2. How to use this Guidance Note

This guidance note is structured around eight key procedural steps. These steps set out what actions should be taken to integrate climate adaptation and resilience issues into the EIA process. These are broadly aligned to the statutory stages of EIA (but including pre-application and post application activities).

In addition to this, several appendices have been developed which set out additional supporting guidance on suggested roles and responsibilities, technical guidance on the use of climate projections, experience of integrating adaptation and resilience issues into the EIA process, and policy context in the UK. This guidance was previously integrated into the main text but has been separated to make the document more accessible and user friendly.

It is vital to highlight that the procedural steps and the supporting guidance are not discrete, and users must read the full document prior to applying the principles within the document.

The document is set out into the following sections:

Table 1: Document layout

Preamble	1. Scope of this Practitioner Note 2. How to use this Guidance 3. Overview and Key Principles
Procedural Guidance	1. Step 0 – Building climate resilience into the project 2. Step 1 – Scoping CC Requirements for the EIA 3. Step 2 – Defining the future (climate) baseline 4. Step 3 – Identifying and determining sensitivity of receptors 5. Step 4 – Reviewing and determining magnitude of the effect 6. Step 5 – Determination of significance 7. Step 6 – Developing additional adaptation/EIA mitigation[4] measures 8. Step 7 – Monitoring and Adaptive Management
Supporting Guidance	A1. Climate Change Risk Assessment A2. Legislative and Policy Setting A3. Case Studies A4. Identifying the future climate A5. The role of the Climate Change Adaptation and Resilience Coordinator (CCAR Coordinator) A6. Further Reading A7. Glossary and Definitions

4. Unless otherwise indicated in the text, 'mitigation' refers to the concept as accepted in EIA terminology (i.e. a measure designed to eliminate, reduce or compensate for an impact) rather than that accepted in Climate Change terms (i.e. reduction in greenhouse gas emissions).

3. Overview and Key Principles

3.1. Overview

The remainder of this guidance document sets out the considerations that should be given to climate adaptation, at key stages in the EIA process. Figure 1 shows the steps to be followed with an indication of the climate change specific actions that are likely to be required at each stage of the process. Emphasis has been placed on scoping the assessment, as this is the process whereby broad principles need to be translated into tangible plans for addressing climate adaptation issues through the EIA process.

Steps 3, 4 and 5 have been divided into two to emphasise the difference between assessing the impacts of climate change on the project (climate change resilience assessment) and assessing the impacts of climate change on the effects of the project on other environmental receptors.

Figure 1: Climate Change Adaptation and EIA [5]

Pre-Application Stage	Pre- EIA	**Step 0** Building climate resilience into the project	• Consider the resilience of the project to climate change impacts during the design stage, including early phases of design. This can be done through delivery of a climate change risk assessment, or by following the principles set out in Steps 2 - 6 below • Identify appropriate mitigation measures (to reduce the effect of impacts) and incorporate these into design as necessary • Reflect the outcome of design for resilience in the Environmental Statement under the description of the project/alternatives studied	
	Scoping	**Step 1** Scoping CC Requirements for the EIA	• Identify the scale and scope of the project, including design life • Identify the climate change projections for use in the assessment • Identify key climatic variables relevant to the project • Identify likely effects • Engage with and discuss the above with stakeholders/regulators	
	EIA Stage	**Step 2** Defining the future (climate) baseline	• Define baseline conditions under historic/existing climate conditions • Define future baseline, using selected climate change projections. This will summarise projected changes in key climate variables (e.g. increase in rainfall, increase in mean summer temperature, wind strength) • Produce summary of projected future climate changes for non-climate expert audience	
		Step 3 Identifying and determining sensitivity of receptors	**Climate Resilience** • Identify receptors within the elements of the project • Evaluate the selected receptors to identify their susceptibility and vulnerability as well as their importance	**In-Combination Climate Impacts** • Collate the receptors identified relevant to the location, nature and scale of the project and the likely effects identified as part of the EIA and to be reported within the Environmental Statement • Evaluate the selected receptors whether the susceptibility and vulnerability as well as their value/ importance changes with future climatic projections identified in Step 2

5. Screening is excluded from this flow chart as it is considered there will be limited occasions where climate change adaptation will be a decisive factor at the screening stage. However, further guidance is included in Section 3.3 below.

Pre-Application Stage	EIA Stage	**Step 4** Reviewing and determining magnitude of the effect	**Climate Resilience** • Review effects likely to arise from the project identified at Step 2 • Consider probability and consequence to determine the magnitude of the effect	**In-Combination Climate Impacts** • Collate the likely effects identified as part of the EIA and to be reported within the Environmental Statement • Consider the magnitude of the effects identified by other topics and evaluate whether the probability and/or consequence of the effect changes with future climatic projections
		Step 5 Determination of significance	**Climate Resilience** • Use the sensitivity of receptors identified at Step 3 and the magnitude of the effect identified at Step 4 alongside professional judgement to determine whether the effect is significant/the degree of effect.	**In-Combination Climate Impacts** • Assess the significance of the project effects under the existing climate baseline using standard methodologies for each relevant environmental topic • Assess the in-combination climate impact applying the significance criteria developed by the relevant environmental topics and using the outcome of the evaluation of sensitivity of receptors/magnitude of effect identified at Step 3 and Step 4 • Determine whether the significance/degree of the effect remains the same or changes with the future climate conditions
		Step 6 Developing additional adaptation/ EIA mitigation measures	• Identify additional (secondary) mitigation measures against timescale of future likely significant effects • Fixed elements for full duration need mitigation built in based on predicted climate effects (less desirable) • Project elements subject to maintenance/future change can have mitigation set for future implementation based on actual climate effects being observed (more desirable) • Prepare, if appropriate, a Climate Change Resilience and Adaptation Plan that covers the above and includes allocation of responsibilities and funding streams	
Regulator approval obtained, project implemented. Move to post-EIA work phase				
Post-EIA Stage		**Step 7** Monitoring and Adaptive Management	• Implement project mitigation measures/Climate Change Resilience and Adaptation Plan • Review and approval with stakeholders based on evidence of effects on emerging baseline	

Key Principles

In developing this guidance document, the authors noted several key principles which, while embedded in the detailed guidance that follows, are critical messages which warrant drawing out as Key Principles or 'golden rules' which practitioners are encouraged to take onboard.

1. **Climate change must be integrated into the design process** and should be evident in design decisions from the earliest stage. This is likely to require consideration well before the EIA team is mobilised. If this is not the case, the EIA leader must raise this as a significant requirement of the EIA process (UK 2017 Town and Country Planning Regulations).

2. **The EIA Report has an important role to play in documenting, for the benefit of decision-makers, how consideration of climate change and extreme weather events has been integrated into the design** (indeed this might even form the basis for 'scoping out' climate adaptation issues). This is considerably more valuable than mitigating impacts at the end of the design process.

3. **Every EIA Report should include a clear characterisation of the future climate** and at least a narrative of how this has been considered in the design process.

4. **The developer should put forward a single, sensible and unambiguous climate scenario** of how the climate is going to change, which is consistent with other statutory planning frameworks and not 'cherry picked' for the project or aspects of the project. As set out in Appendix 4, the use of the high emissions scenarios (Met Office UKCP18 RCP8.5) is generally recommended, unless the case can be made for using a different, lower emissions scenario.

5. If the risks are minimal or are addressed elsewhere (e.g. in design standards) then the scope of assessment should be proportionately reduced. **It should be OK to say that there are no significant risks; if that can be supported by evidence.** Padding out an EIA Report with superfluous assessment dilutes the value of EIA Reports where there are tangible risks that need to be managed.

6. **The EIA team must include someone with adequate knowledge of climate science (the Climate Change Adaptation and Resilience (CCAR) Coordinator).** This does not have to be a specific Climate Scientist (although larger projects may dictate that this is necessary) but they do have to be familiar with the broad climate policy context, with UKCP18 climate projections data, and be able to communicate this to other members of the team.[6]

7. **There are two key strands** to assessing climate adaptation issues within EIA, which need separate treatment: the risks of changes in the climate to the project (i.e. the resilience or conversely the vulnerability of a project to future climate changes) and the extent to which climate exacerbates or ameliorates the effects of the project on the environment (i.e. 'in-combination' effects).

    a. **Project resilience to climate change impacts needs to be assessed as a part of the design** (and is generally best reported in the analysis of alternatives). It is also better suited to a Risk Assessment type process than traditional EIA 'determination of significance';

    b. **In-Combination Assessment (where climate is exacerbating or conversely diminishing the effect of an existing impact of the project) is largely best analysed in the existing chapters** and is suited to using traditional significance criteria from the respective chapters:

8. **Reporting:** following on from point 7 above, a separate climate chapter is not a pre-requisite of good reporting, although in larger or more complex projects it may be desirable.

6. The EU Directive and UK EIA legislation requires competent expertise to be used in the EIA process. Click here for further information on competent experts in EIA.

3.2. Screening

There will be limited occasions where climate change adaptation will be a decisive factor in whether an EIA is required or not for a particular project, particularly given that current EIA regulations allow for 'proposed measures envisaged to avoid or prevent significant adverse effects on the environment' (mitigation) to be taken into account at the screening stage. However, climate change adaptation should be given appropriate consideration from the outset of the design and EIA processes to minimise the likelihood of adverse effects.

With respect to the resilience of the project to climate change, while the project's vulnerability to increased flood risk may have been taken into account at the siting and outline design stages, it is possible that potential overheating and vulnerability to extreme events may have been given only limited or no consideration. Importantly, developments are starting to be refused planning permission due to concerns about overheating, which suggests that the range of likely significant effects with respect to climate change adaptation is not always investigated appropriately at an early stage (see, for example, the Planning Inspectorate appeal decision 3198899, relating to retirement homes in Bristol (January 2019)).

With respect to 'in-combination effects', at the EIA screening stage, consideration should be given as to whether climate change could exacerbate the likely effects of an existing impact of the project to such an extent that significant effects become likely, either due to a change in the value/importance of a receptor or in the scale/geographic spread of impact, or wholly, new additional effects are likely to arise from the project which are significant. This should be undertaken with reference to the screening/significance criteria already developed for each topic area.

4. STEP 0: Building Climate Resilience into the Project

It is important that project designers incorporate climate resilience into the design of the project at an early stage. This means evaluating what resilience measures may be appropriate to include in the design, and this should take place at all stages of design development – from optioneering through to detailed design, not just as a part of the EIA process.

If it is done before the start of EIA, building climate resilience into the project can be achieved by carrying out a Climate Change Risk Assessment. Details on Climate Change Risk Assessment methodology together with examples are included in Appendix 1 – Climate Change Risk Assessment. Alternatively, practitioners may wish to follow the principles set out in Steps 2 to 6 below, with regards to identifying climate risks and formulating measures to reduce their impact.

The aim of this is to identify appropriate mitigation measures, including design features and construction materials, to provide an appropriate resilience to increased extreme weather as well as changes in average conditions. Such measures need to consider whether there are opportunities to introduce them later with more certainty, or whether they have to be allowed for in the initial design.

The design of any development takes place in stages, the number of design stages reflecting the complexity of the development itself. It is good practice to consider the effects of climate change on the development at all stages of design. If this is not done in the earliest stages, costly reversals in design (for example, potential additional land take) could arise if climate resilience is only included in the later stages of design.

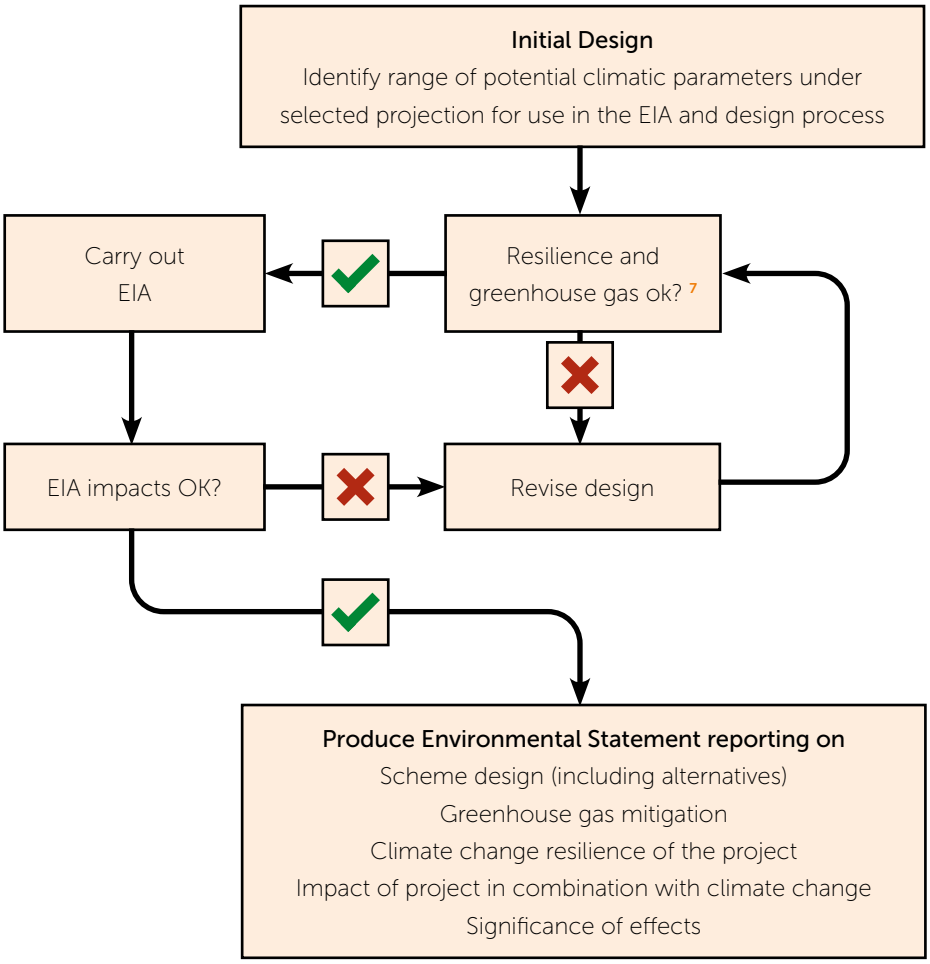
Factors to consider when assessing the risks to a project:

- its reliance on interconnected networks (be this a transport network, power supplies or telecoms for example);
- its vulnerability to the impact of weather on both normal operations and extreme weather-related disaster scenarios.

The developer should identify an acceptable risk profile for the development and the means to mitigate unacceptable risks to acceptable levels. This should include building resilience to climate impacts on the scheme.

If this has not been done before the EIA commences then it should be done during the finalisation of the design used in the EIA process, following an iterative design process (as illustrated in Figure 2).

Figure 2: Ensuring climate change is embedded in project design



If the project could be affected by climate change impacts or extreme weather events to such an extent that the project was potentially no longer viable, then the design should be changed or the project stopped.

7. Refer to separate IEMA GHG in EIA guidance

The project design team should consider resilience measures including:

- preventing the loss (total or partial) of the project or components of the project due to effects (direct or indirect) of extreme climatic events;
- understanding the risks of cascade failure impacting the functionality of the project (e.g. how dependent is the project on telecommunications being maintained 100% of the time);
- changes to operating parameters to maintain productivity/functionality under a different average climate;
- changes to capital costs to ensure project resilience under extreme and average climate conditions (e.g. accounting for average temperature impacts on bearings in a bridge over a river as well as the capacity of the bridge to permit flood flows to pass);
- any variations to maintenance regimes to account for climate change; and
- future proofing the project to build flexibility into designs, enabling future modifications, is useful where resilience measures are unlikely to be required immediately (e.g. putting in larger foundations to accommodate future increases to flood defence barriers).

The EIA team may identify climate change risks to the project which should be communicated to the design team to ensure they are aware of potential residual issues.

The outcome of this process of design for resilience needs to be properly reported in the final EIA Report or Environmental Statement under the scheme description and consideration of alternatives, or in a climate chapter if a separate climate chapter is included.

BOX 1 – ADAPTATION RESPONSES TO CLIMATE RISKS

The lifecycle of the project and the timeframes over which change might occur need to be considered in adaptation responses.

As an example, take the construction of a tunnel to accommodate a road scheme. It will be almost impossible to increase the diameter of the tunnel to allow for heating impacts under a warmer climate and so this needs to be accounted for in the initial design.

However, if the project has elements that will have to be replaced or maintained every 10 years (such as the road surface) then clearly there is an opportunity to introduce additional resilience measures as appropriate in due course. This is the basis of the adaptive management approach discussed further in Step 7.

5. STEP 1: Scoping Climate Change Adaptation into the EIA

5.1.1. The Basics – Climate Change Adaptation during Scoping

The purpose of Scoping is, where EIA is required, to determine the extent of issues to be considered in the EIA and provides a mechanism to agree this with the planning authority.[8] It provides an important opportunity to agree the extent to which climate change adaptation and resilience issues should be considered in the EIA. However, equally, there will be development proposals where climate change adaptation can be reasonably scoped out of the EIA.

In order to complete Scoping of the EIA, the following should be achieved (Step 1, Figure 1)

- agreement with key stakeholders[9] on the most appropriate climate change projection to adopt for the assessment (see Appendix 4 - Identifying the future climate) and any necessary methodological considerations to ensure climate change is appropriately considered. This may include the exclusion of explicit consideration of climate adaptation and resilience issues if it is agreed that existing design codes or standard assessment methodologies contain adequate in-built consideration of adaptation and resilience issues; [10]
- identification of the scale and scope of the project's initial design, including the duration;
- identification of climate-related parameters likely to influence the project, and anticipated changes to these climatic parameters over the lifetime of the project;
- identification of the potential impact of the project on the receiving environment, the sensitivity of this environment, and taking into account how this will be affected by a changing climate;
- engagement with key stakeholders to identify the policies and regulatory regime regarding climate change in the project area; and
- accurate recording of all the assumptions made with regard to the above points.

The incorporation of climate change into the EIA process should not change fundamental EIA processes or accepted conventions and practices. However, it will necessitate interdisciplinary consideration of CCAR parameters over the life span of the project. This should encourage developers to take account of climate change in the project design (as discussed previously), which iteratively may significantly alter key characteristics of the project design and, therefore, its impact on the environment.

Scoping of a project, taking into account climate change, should focus on general trends in climate rather than detailed, quantitative analysis. To do this will require an early decision on the climate change projection to be used in the EIA process by the project's CCAR Coordinator (see Appendix 5 - The role of the Climate Change Adaptation and Resilience Coordinator (CCAR Coordinator).

Topic leaders should use information collated by the CCAR Coordinator in combination with professional judgement and local knowledge to determine if climate change effects should be a potential consideration in their part of the EIA process. Where there is uncertainty, a precautionary approach should be applied, and risks scoped out at a later date.

8. From the Scoping section of https://www.gov.uk/guidance/environmental-impact-assessment#Preparing-an-Environmental-Statement1
9. Developer, approving authority and any key stakeholders (e.g. national climate change government department)
10. Such decisions need to be robustly and transparently documented in the Scoping Report so that they are material to any subsequent Scoping Opinion and future reliance on that Opinion.

Use of the following hierarchy will assist:

1. All Annex I[11] projects should include appropriate consideration of climate change impacts in the EIA (climate change should never be entirely scoped out).

2. Annex II projects requiring EIA for reasons other than climate change still warrant appropriate scoping of key climate change risks (it may be appropriate to scope out climate change effects for some particular technical topics that are not sensitive to climate change).

3. Where climate change is scoped into EIA then all climate change issues should be established according to legislative requirements, stakeholder and public interest and professional judgement. There may be broad categories of potential project impacts or specific areas of concern, for example those identified in policy documents such as the National Climate Change Risk Assessment or Local/ Regional Climate Change Risk Assessments. In either case, they should be assessed during the EIA for the whole project lifecycle, i.e. at the design, construction, operation and decommission/ abandonment stages.

The Scoping Report should explain how climate considerations will be included in the technical assessments being carried out within the EIA process. In setting the methodology, care is required to ensure that the method is proportional to the evidence base available to support any assessment.

It is worth noting some topics will be able to assess the impact of climate change relatively easily, for example, the methodology for assessing impacts of climate change on flood risk is well developed, whereas other topics will be challenged to develop any kind of quantitative assessment.

5.1.2. Defining the boundaries of the climate change adaptation assessment

The relevance of climate change adaptation should be analysed within spatial and temporal boundaries, which must be clearly established and communicated in the Scoping Report. The key difference from most historic and current EIAs is that the temporal scope will need to be more clearly defined at the outset as this will set how future baseline changes need to be accounted for, i.e. agree with the developer the potential project life span. This is likely to be longer than the design life embedded in the engineering design as many developments remain in situ long after the original development has fulfilled its objectives.

The EIA should consider the legacy period of the development which could be at the end of decommissioning (e.g. when an oil refinery was decommissioned) or which could extend well beyond the lifetime of the original purpose of the development (e.g. the London 2012 Olympic Park).

However, the temporal scope needs to be realistic and not assume a development will remain in situ beyond a reasonably foreseeable timescale. Consideration should be given to differentiating between elements of the project design which are 'maintenance items', and would therefore be expected to be replaced during the project life, and those elements which are 'fixed assets'.

11. i.e. Town and Country Planning (Environmental Impact Assessment) Regulations 2017, No. 571. Available at: http://www.legislation.gov.uk/uksi/2017/571/pdfs/uksi_20170571_en.pdf

It may be the case that for some major, long-term projects, the project life exceeds the range over which climate change projections are available (e.g. current UKCP18 projections provide data up to 2100 for most variables, whereas a major infrastructure project (e.g. a railway line or dam) could have a life of up to 150 years). In such cases, careful thought is needed to identify the key receptors most vulnerable to climate change and the project, and determine if additional information is needed on the climate change effects beyond 100 years. This is only likely to affect nationally important infrastructure and where there is concern about very long-term effects (i.e. timescales beyond the end of the century) relating to climate change then the developer needs to be engaging with relevant government agencies (e.g. the Met Office) for additional advice. The EIA practitioner should obtain the necessary guidance on how to accommodate such long-term climate change variations from the CCAR Coordinator in consultation with key regulators (Environment Agency, local authority, PINS or others).

5.1.3. Consultation during the scoping process

Standard consultation requirements are not affected by including CCAR in the EIA process. However, it is important that this is covered in consultations, as Local Authorities and statutory bodies will increasingly have dedicated climate change policies to comply with. In addition, they may have officers with specific responsibility for climate change who can assist in the completion of the Scoping Report.

At the same time, it is important to recognise the potential imbalance of resources between local authorities and developers in terms of available personnel. Proportionate EIA is an important part of this. It is not appropriate or proportional, nor is it good practice, to produce exceedingly lengthy EIA documentations which a local authority may be unable to consider and assess in detail.

In many cases, a Local Authority or statutory body may have already considered the implications of climate change. From their knowledge of their area they could help identify specific concerns relating to climatic resilience and the changing climate that could be affected by, or affect, the proposed development.

Unless specific studies and reports are available, EIA practitioners, local authorities and statutory bodies will need to use professional judgement, knowledge and experience in determining the issues to be considered in assessment and agreed at the scoping stage.

6. STEP 2:
Defining the Future Baseline

The future climate baseline should ideally have been identified during Step 0: Building climate resilience into the project. If this has not been carried out, it should be developed following scoping.

The current baseline is defined by historic climate conditions and the prevailing conditions at the time of the assessment. One fundamental aspect of including climate change assessment in EIA is to understand how this baseline climate will change in the coming decades.

The practitioner needs to look at recent weather patterns identifying extreme events (e.g. short-term events such as cold snaps, torrential downpours or moderately lengthy events such as drought). These short-term variations will be useful in determining how the project needs to take climate change into account in the immediate future (e.g. during construction and within the first 10 years of the project).

This is important, as it is not uncommon to describe the existing baseline using historical trends which may not properly account for climate changes which have already occurred.

However, in assessing climate change risks in the short (15 to 20 years) and longer term (>30 years), the climate change projection scenarios selected for the project will provide more useful guidance on the likely conditions that will alter the baseline.

The choice of climate scenario and time period for which climate projections data are selected is an important step in defining the future baseline, and further detail on the choice of climate scenario is set out in Appendix 4 - Identifying the future climate.

UKCP18 AND CLIMATE SCENARIOS

The UK Met Office Hadley Centre published an updated set of climate projections for the UK in 2018 (UKCP18). These superseded UKCP09, and should now be used as the best available information on UK climate projections.

UKCP18 has moved away from the use of low, medium, high emissions scenarios, and instead uses Representative Concentration Pathways (RCPs). These are named according to the concentration of greenhouse gas modelled to occur in the atmosphere in 2100. There are 4 RCPs available in the UKCP18 climate projections: 2.6, 4.5, 6.0 and 8.5, and RCP 8.5 is the most conservative, highest-impact scenario.

The practitioner needs to consider a range of factors including:

- extremes in **short-term weather** events that produce sudden shocks that can have substantial effects on some baseline receptors, such as:
  - heat waves;
  - extreme flooding and freezing conditions;
  - gales and hurricane force windstorms;
  - storm surges along coastlines.

- Extremes in **longer-term climatic** variability including:
  - variations in precipitation over one or more seasons resulting in drought or extremely wet conditions;
  - variations in average temperature which might affect receptors reliant on temperature to, for example, time when breeding cycles commence or end (which may be affected by availability of specific food sources);
  - potential changes in prevailing wind directions as the weather system over central Europe changes.

- Changes in **average climate norms** resulting in:
  - sea level rise;
  - increases in freezing/thawing;
  - changes in seasonal rainfall patterns.

Information sources: the majority of the above information is available from UKCP18; however, some data may need to be drawn from additional sources.

When engaging with EIA practitioners, it may be beneficial to develop a matrix indicating the direction of change for key climate variables (according to the latest climate projections, UKCP18). For non-climate specialists such as other topics leads (landscape, land quality, community) this provides a simple visual guide to key projected changes in climate variables. This can be developed in addition to a numeric future baseline, which is more likely to be needed by the design team when assessing the impacts of climate change to the design of the scheme, in particular where there are hard threshold values to be considered (e.g. maximum temperature values for materials integrity). An example is included in Table 2 – Example presentation of projected trends in climatic variables* below.

For longer-lasting projects (e.g. major infrastructure likely to be in place for upwards of 100 years), it is probably more useful to define several future baseline environments (current baseline and then in, for example, 50 years' time and in 100-plus years' time).

Table 2 – Example presentation of projected trends in climatic variables*

Variable	Projected change in trend at		
	10th percentile	50th percentile	90th percentile
Temperature			
Mean minimum winter temperature (ºC) Mean winter temperature (ºC) Mean summer temperature (ºC) Mean maximum summer temperature (ºC)	↑	↑	↑
Warmest day of summer (ºC)	↓		
Precipitation			
Annual mean precipitation (%)	↓	↕	
Mean winter precipitation (%)	↕	↑	
Mean summer precipitation (%)	↓	↓	↑
Wettest day in winter (%)	↕	↑	
Wettest day in summer (%)	↓	↕	
Snow			
Snow fall – winter		↓	
Snow fall – spring		↕	
Sea Level			
Sea level rise (cm)		↑	

Source: UKCP09[12] Reports & guidance. *Additional variables such as Humidity, Wind, Cloud cover, and Fog may be relevant to some schemes, in which case they should be included in the table. Similarly, if any variables, e.g. sea level rise, are not relevant, these need not be included.

12. This table was originally developed based on UKCP09 climate projections outputs; however, the projected direction of change for key climate variables in UKCP18 is the same/has not changed.

Table 3 – Example presentation of a quantitative future baseline for key climatic variables. This is data for the South East of the UK under RCP 8.5 (the highest emission scenario in UKCP18) [13]

Season	Variable	Time period*	5th percentile	Projected change at			95th percentile
				10th percentile	50th percentile	90th percentile	
Winter	Mean Temperature (ºC)	2030s	-0.1	0.1	0.9	1.8	2
		2050s	0.2	0.5	1.7	2.9	3.3
		2070s	0.4	0.9	2.5	4.2	4.8
		2090s	1	1.5	3.6	5.8	6.4
	Mean Precipitation (%)	2030s	-9	-5	8	23	27
		2050s	-10	-5	13	34	40
		2070s	-12	-5	20	49	58
		2090s	-10	-3	27	63	75
Summer	Mean Temperature (ºC)	2030s	0.1	0.4	1.3	2.4	2.6
		2050s	0.8	1.1	2.5	4	4.4
		2070s	1.2	1.8	3.9	6.1	9.5
		2090s	2.2	2.9	5.8	8.7	9.5
	Mean Precipitation (%)	2030s	-36	-30	-9	13	19
		2050s	-55	-48	-22	5	14
		2070s	-69	-61	-30	1	9
		2090s	-85	-77	-41	-3	7

*UKCP18 provides 20-year time slices, hence: 2030s (2020-2039), 2050s (2040-2059), 2070s (2060-2079) and 2090s (2080s-2099)

13. UKCP18 Key Results https://www.metoffice.gov.uk/research/collaboration/ukcp/key-results available in the linked spreadsheet [accessed 09/05/2019]

7. STEP 3: Identifying Climate Change Vulnerability and Sensitivity of Receptors

Climate resilience

Potential receptors within elements of the project relevant to the location, nature and scale of the development should be identified using the information gathered at Steps 0 – 2. These receptor groups may include:

- Buildings and infrastructure receptors (including equipment and building operations)
- Human health receptors (e.g. construction workers, occupants and site users)
- Environmental receptors (e.g. habitats and species)
- Climatic systems.

The sensitivity of the receptor/receiving environment is the degree of response of a receiver to a change and a function of its capacity to accommodate and recover from a change if it is affected.

Sensitivity is determined using quantifiable data, where available, the consideration of existing designations, relevant legislation, national and local policy and international, national, regional and local standards.

In ascribing the sensitivity of receptors in relation to potential climate change effects, the following factors must also be considered as well as the value or importance of the receptor:

- Susceptibility of the receptor (e.g. ability to be affected by a change) (the opposite of resilience); and
- Vulnerability of the receptor (e.g. potential exposure to a change).

The susceptibility of the receptor can be determined using the following scale:

- **High susceptibility** = receptor has no ability to withstand/not be substantially altered by the projected changes to the existing/prevailing climatic factors (e.g. lose much of its original function and form).
- **Moderate susceptibility** = receptor has some limited ability to withstand/not be altered by the projected changes to the existing/prevailing climatic conditions (e.g. retain elements of its original function and form).
- **Low susceptibility** = receptor has the ability to withstand/not be altered much by the projected changes to the existing/prevailing climatic factors (e.g. retain much of its original function and form).

The vulnerability of a receptor can be defined using the following scale:

- **High vulnerability** = receptor is directly dependent on existing/prevailing climatic factors and reliant on these specific existing climate conditions continuing in future (e.g. river flows and groundwater level) or only able to tolerate a very limited variation in climate conditions.
- **Moderate vulnerability** = receptor is dependent on some climatic factors but able to tolerate a range of conditions (e.g. a species which has a wide geographic range across the entire UK but is not found in southern Spain).
- **Low vulnerability** = climatic factors have little influence on the receptors (consider whether it is justifiable to assess such receptors further within the context of EIA – i.e. it is likely that such issues should have been excluded through the EIA scoping process).

A combination of susceptibility and vulnerability in addition to value/importance of the receptor should be used to reach a reasoned conclusion on sensitivity. The greater the susceptibility and/or vulnerability of the receptor, the greater the likelihood that receptor would also be of higher sensitivity. As an example, a high-value receptor that has very little resilience to changes in climatic conditions should be considered more likely to have a higher sensitivity than a high-value receptor that is very resilient to changes in climatic conditions.

Professional judgement should be applied by the CCAR Coordinator to determine sensitivity and this must be supported by evaluation and evidence.

In-Combination Climate Impacts

The receptors relevant to the location, nature and scale of the project and which have been identified as part of the EIA and reported within the Environmental Statement from other environmental topics, should be collated.

The CCAR Coordinator, working with other topic-specific competent experts in the EIA team, along with the EIA Coordinator should work together to consider the impact of the projected climate conditions on the susceptibility/vulnerability/value and/or importance of the identified sensitive receptors without the development (i.e. the future baseline) and determine whether these are changed. A reasoned judgement on whether the sensitivity of receptors will be greater or lesser with the future climate conditions must be made, supported by evaluation and evidence.

8. STEP 4: Identifying and Determining Magnitude of Effect

Climate resilience

The climate assessment undertaken during the design stage, as described in Step 0, will have identified the likely effects on the development associated with climate change resilience. These effects will then be evaluated further to identify their magnitude.

The magnitude is the degree of a change from the relevant baseline conditions which derives from the construction and operation (plus decommissioning, if relevant) of a development.

Magnitude is based on a combination of:

- probability, which would take into account the chance of the effect occurring over the relevant time period (e.g. lifespan) of the development if the risk is not mitigated; and
- consequence, which would reflect the geographical extent of the effect or the number of receptors affected (e.g. scale), the complexity of the effect, degree of harm to those affected and the duration, frequency and reversibility of effect.

A combination of probability and consequence should be used to reach a reasoned conclusion on the magnitude of the effect. It is likely that if the probability and/or consequence of the effect is high that the magnitude of the effect would also be high.

Professional judgement should be applied by the CCAR Coordinator to assign magnitude. Where professional judgement is used, this must be clearly outlined and supported by evaluation and evidence.

The magnitude assigned to the effect should also consider control mechanisms that may already be in place (e.g. due to legislation and commonly occurring standards (also termed 'Tertiary Mitigation')) which would reduce the probability or the consequence of the effect and therefore the overall magnitude.

In-Combination Climate Impacts

The likely significant environmental effects and their associated magnitude of effect identified within the other topics being assessed as part of the EIA and reported within the EIA Report or Environmental Statement should be collated.

The impact of the projected climate conditions on the magnitude of these effects without the development (i.e. the future baseline) should then be evaluated in terms of whether the probability and/or consequence of the effect changes. The judgement should then be made on whether the magnitude of the effect will be worse or improved with the future climatic baseline. This must be supported by evaluation and evidence.

9. STEP 5: Significance Assessment

Climate resilience

Once the sensitivity and magnitude have been determined, these should be combined to reach an overall judgement on the significance of the likely environmental effect. As there is no legislative definition of 'significance', the conclusion of whether an effect is significant/the level of significance is down to the CCAR Coordinator in conjunction with the EIA Coordinator. An explanation of the outcomes of the assessment should be clearly set out.

Appropriate criteria for sensitivity, magnitude and significance for the climate resilience assessment should be developed on a project-by-project basis by the CCAR Coordinator in conjunction with the EIA Coordinator, and should take into account the aims/purpose of the project. For example, a transport or road project has the purpose of providing transport options – therefore an impact which temporarily removes this should be considered significant. The criteria should take into consideration feedback from scoping and stakeholder engagement.

In-Combination Climate Impacts

The assessment of the likely significant environmental effects should be undertaken under the existing climate baseline using standard methodologies for each relevant environmental topic being assessed as part of the EIA and reported within the Environmental Statement.

The CCAR Coordinator and EIA lead, as well as the individual topic leads, also need to consider if the impacts of the development on environmental receptors are likely to be different because of the projected future climate conditions compared with the existing baseline conditions.

Consideration should also be given to whether completely new effects will arise as a result of the development during construction and/or operation with the future climate conditions.

Building on the evaluation of sensitivity undertaken at Step 3 and magnitude of the effect at Step 4, an assessment should be undertaken to identify whether the additional effects of future climate impacts alter the sensitivity and/or magnitude of the effect so that the significance/level of significance of the effects within other topics identified against baseline conditions changes.

This assessment should use the approach, methodology and significance criteria used by the other topics being assessed as part of the EIA and reported within the Environmental Statement. This process should be documented.

The uncertainty of the combined effect needs to be taken into account. If uncertainty about how a receptor will adapt to a changing climate or how the severity of environmental effect could be modified with a future climate is high, then it is recommended that a more conservative position is adopted within the evaluation in terms of sensitivity and/or magnitude of the effect.

10. Climate Change Adaptation Plan – mitigation and adaptive management **(STEPS 6 & 7)**

Once the influence that climate change may have on the project and its impacts are clear, it is necessary to capture how the project will address those issues. Some of this may be achieved by specific additional mitigation measures that can be applied to the project from the outset. However, given the uncertainty of particularly longer-term climate projections, there is also a need to identify possible future interventions that may depend on what actually happens to the climate in the future.

A key means of dealing with this kind of uncertainty is to introduce the concept of **adaptive management**[14]. Adaptive management is the process that enables uncertainty to be included in future operational decision-making. This process is not unique and is practised widely in all areas where uncertainty in the future is present.

This section identifies the principles that should be applied to both Mitigation and Adaptive Management in the context of an EIA.

14 See section 6.5.3 of 'Special Report – The State of Environmental Impact Assessment Practice in the UK' IEMA 2011 for further detail regarding adaptive management in EIA.

11. STEP 6: Developing EIA Mitigation Measures

Additional mitigation should be considered against the timescale of the project and when mitigation might be most usefully implemented. In all but exceptional circumstances (e.g. when having to design in fixed elements of a project that cause significant negative effects on current and future baseline conditions), it will not be appropriate to propose that costly and permanent mitigation be put in place if it is not going to be required for another 50 years.

Key considerations in developing mitigation should include[15]:

- favouring flexible mitigation options over options which are locked and cannot be modified in future (adaptive management);
- allowing for safety margins in developing the project design, or in mitigation designs to ensure resilience of the project or proposed mitigation to climate change;
- delaying elements of the project with high risk/ uncertainty until a later date when the risk associated with uncertainty is likely to be less;
- identifying who (which party) will be responsible for delivering the mitigation measure (e.g. designer, contractor, developer);
- when defining the EIA mitigation consideration needs to be given to the mitigation hierarchy. The following principles identify how this may apply to climate adaptation-related risks:
    - What measures are available to avoid, control or manage identified risks? (avoid, prevent or minimise);
    - Does the mitigation strengthen the project's capacity to be resilient to climate change itself? (enhance);
    - Are there risk reduction measures available? (avoid or prevent);
    - Will the mitigation improve the project's functionality under future climate conditions? (enhance);
    - Can the mitigation exploit opportunities offered by the natural environment? (minimise or enhance); or
    - Can the mitigation provide opportunities for environmental improvements that depend on the climate changing? (enhance or compensate).

Developing mitigation measures is a collaborative task, which will involve the CCAR Coordinator working with the design team (for climate resilience issues) and the environmental topic leads and EIA Coordinator (for in-combination aspects).

15. Adapted from the EU 'Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment', 2013.

12. STEP 7: Monitoring and Adaptive Management

Adaptive management is the process that enables uncertainty to be included in operational decision-making. This process is not unique and is practised widely in all areas where uncertainty in the future is present. Adaptive management enables the potential impacts from changes in the climate to be dealt with as they become more likely (see section 13). By taking an adaptive management approach, projects can introduce additional mitigation if the project's impact is starting to cause unacceptable effects on the receiving environment. This concept is not currently commonly used in EIA, but it will become increasingly important to avoid inappropriate mitigation being implemented at the wrong time in a project lifecycle.

The key steps of an adaptive management process that would be appropriate to recommend as part of an environmental management plan are:

1. Conceptualise the issues by completing the EIA and:
    a. identify the significant potential impacts and which receptors are at risk; and
    b. identify the critical areas of risk and threat.
2. Manage uncertainty (e.g. through an Environmental Management Plan that incorporates adaptive management principles) by:
    a. setting goals/objectives including threshold criteria that would require action to be taken;
    b. identifying the assumptions these goals/objectives are reliant upon;
    c. developing a monitoring plan to check the assumptions remain valid;
    d. developing a process to implement when assumptions are no longer valid; and
    e. defining roles and responsibilities and funding streams;
3. Implement the Plan:[16]
    a. implement mitigation planned for development; and
    b. monitor and analyse results.
4. Review and update the Plan:
    a. regularly collate and analyse the monitoring data;
    b. review the assumptions and the objectives;
    c. update and adapt the plan as appropriate based on results of analysis; and
    d. implement appropriate additional mitigation.
5. Report and update knowledge base:
    a. disseminate lessons learnt;
    b. roll out updated plan, inform key stakeholders of proposed changes;
    c. move back to Step 1.

Often, incorporating adaptive management into standard operations and maintenance procedures can be preferable to having a separate adaptation plan, as this ensures consideration of climate impacts and adaptation are mainstreamed into operations.

However, where climate change adaptation and/or resilience are a prominent feature in the significant effects identified in an EIA, it is recommended that a 'whole life climate change adaptation plan' be formulated that documents how to take forward the mitigation measures, following the five-step process set out above. This document should contain:

- existing policy objectives and regulatory requirements affecting proposed mitigation;
- any planning or licence conditions;
- responsibility and ownership of the Plan, including financial agreements in place, or required in future;
- timelines for mitigation implementation; and
- a procedure to ensure review and update of the Plan.

16. Longer-term management and monitoring of operational risks or risks that persist through the operational life of the scheme may be best integrated into a formal Environmental Management System.

13. Presentation in an EIA Report

IEMA's Principles on climate change adaptation & EIA[17] (published in 2010) set out the approach to be used in presenting climate change information within an EIA Report (or Environmental Statement):

- Where adaptation is considered in EIA it must be clearly presented within the EIA Report. This could be in a climate change chapter, if it is felt there is sufficient analysis and assessment of climate resilience to warrant it, however it is not necessary to always have a separate climate chapter. Alternatively, the consideration of climate change resilience can be presented in the analysis of alternatives, and the assessment of In-Combination Climate Change impacts within each individual topic chapter.

- Any modelling or detailed quantification of the effects of the changing climate in combination with the project's anticipated impacts should be presented, as relevant, within an appendix. This should be appropriately cross-referenced within the main EIA Report.

- Where other assessments of the effect of climate change on either the project or the environment are required, they should be referenced within the EIA Report. As a minimum, the EIA Report must summarise any other climate-related report's findings and make effective cross-reference to it.

Recognising the EIA Report as an important tool for informing meaningful consultation and decision-making, the climate aspects of the project (whether standalone or integrated into other chapters), must be written in a manner that makes it easy for stakeholders and other interested parties to understand the approach and findings of the EIA.

17. https://www.iema.net/event-reports/2016/04/15/taking-account-of-climate-change-in-eia/

14. Appendix 1 – Climate Change Risk Assessment

Climate change risk assessment methodology

Climate change risk assessment is a risk assessment-based methodology for identifying potential climate impacts and assessing their severity.

Carrying out a climate change risk assessment, at the simplest level, can be summarised into the following steps:

- identifying potential climate change risks to a scheme or project;
- assessing these risks (potentially prioritising to identify the most severe); and
- formulating mitigation actions to reduce the impact of the identified risks.

Any assessment of risk includes assessing the likelihood (or probability) and magnitude (or severity) of the impacts identified. This method is widespread within the climate change resilience assessments carried out by projects and cities to date.[18]

Definitions of likelihood and magnitude will vary from scheme to scheme, and should be tailored to a specific project. It is not within the scope of this guidance to prescribe a single approach to the assessment of likelihood and magnitude of climate impacts.

As general considerations, the assessment of likelihood should include consideration of available climate projections data for the project.

Assessment of the magnitude of impacts should take into account factors including:

- the acceptability of any disruption in use if the project fails;
- its capital value if it had to be replaced;
- its impact on neighbours;
- the vulnerability of the project element or receptor; and
- if there are dependencies within any interconnected network of nationally important assets on the new development.

Examples of how likelihood and magnitude have been defined in projects to date are included below:

Table 4 – Likelihood and consequence criteria used in Highways England EIA projects

Likelihood categories

Likelihood Category	Description (probability and frequency of occurrence)
Very high	The event occurs multiple times during the lifetime of the project (60 years), e.g. approximately annually, typically 60 events.
High	The event occurs several times during the lifetime of the project (60 years), e.g. approximately once every five years, typically 12 events.
Medium	The event occurs limited times during the lifetime of the project (60 years), e.g. approximately once every 15 years, typically 4 events.
Low	The event occurs during the lifetime of the project (60 years), e.g. once in 60 years.
Very low	The event may occur once during the lifetime of the project (60 years).

Table notes:

- Project lifetime is considered to include construction and operational stages.
- Project lifetime is taken to be 60 years in line with WebTAG.

Measure of consequence.

Consequence of Impact	Description
Very large adverse	National-level (or greater) disruption to strategic route(s) lasting more than 1 week.
Large adverse	National-level disruption1 to strategic route(s) lasting more than 1 day but less than 1 week **OR** Regional level disruption to strategic route(s) lasting more than 1 week.
Moderate adverse	Regional level disruption to strategic route(s) lasting more than 1 day but less than 1 week.
Minor adverse	Regional level disruption to strategic route(s) lasting less than 1 day.
Negligible	Disruption to an isolated section of a strategic route lasting less than 1 day.

18. Two examples: Public Infrastructure Engineering Vulnerability Committee (PIEVC) a climate risk assessment methodology developed in Canada by Engineers Canada, as used in the Toronto Hydro-electric system limited climate change vulnerability assessment report (Aecom & RSI, 2015). Separately, C40 Cities climate change risk assessment guidance (C40 Cities, 2018), here defines risk levels as 'likelihood x impact'.

Significance matrix

		Measure of Likelihood				
		Very low	Low	Medium	High	Very High
Measure of Consequence	Negligible	NS	NS	NS	NS	NS
	Minor	NS	NS	NS	S	S
	Moderate	NS	NS	S	S	S
	Large	NS	S	S	S	S
	Very large	NS	S	S	S	S

Table notes:
- NS = Not significant
- S = Significant

The criteria as defined by the Canadian risk assessment methodology PIEVC is summarised below.

Table 5 – PIEVC Methodology: Probability scores, Severity scores and risk matrix

PIEVC (Version 10) Probability Scores – Method B

Score	Probability	
0	<0.1%	< 1 in 1,000
1	1%	1 in 100
2	5%	1 in 20
3	10%	1 in 10
4	20%	1 in 5
5	40%	1 in 2.5
6	70%	1 in 1.4
7	> 99%	> 1 in 1.01

Source:
AECOM, RSI, 2015. Toronto Hydro-Electric System Limited. Climate Change Vulnerability Assessment. Toronto: AECOM, pp.1-92. [online] Available at: http://www.pievc.ca/sites/default/files/th_pievc_cc_assessment_final_external_june_1_2015_-_sep_14_revision_web.pdf. [Accessed 11 Nov. 2015].

PIEVC (Version 10) Severity Scores – Method E

Score	Method E
0	Negligible or Not Applicable
1	Very Low/Unlikely/Rare/Measurable Change
2	Low/Seldom/Marginal/Change in Serviceability
3	Occasional Loss of Some Capacity
4	Moderate Loss of Some Capacity
5	Likely Regular/Loss of Capacity and Loss of Some Function
6	Major/Likely/Critical Loss of Function
7	Extreme/Frequent/Continuous/Loss of Asset

Source:
Extracted from Toronto Hydro-Electric System Limited. Climate Change Vulnerability Assessment (AECOM, RSI, 2015)

PIEVC provides two models for scoring the severity of an event. Method E is the more qualitative assessment, which is suitable when there is insufficient hard data to support Method D, which is a numerical method.

PIEVC Risk Rating Matrix

Severity									
7	0	7	14	21	28	35	42	49
6	0	6	12	18	24	30	36	42
5	0	5	10	15	20	25	30	35
4	0	4	8	12	16	20	24	28
3	0	3	6	9	12	15	18	21
2	0	2	4	6	8	10	12	14
1	0	1	2	3	4	5	6	7
0	0	0	0	0	0	0	0	0
	0	1	2	3	4	5	6	7
				Probability					

Low Risk	Special Case	Medium Risk	High Risk

15. Appendix 2 – Legislative and Policy Setting

15.1. The 'EIA' Directive 2014/52/EU

Directive 2014/52/EU[19] on the assessment of the effects of certain public and private projects on the environment (hereafter referred to as 'the EIA Directive') came into force on 16th April 2014 and was transposed into UK law by the Town and Country Planning (Environmental Impact Assessment) Regulations May 2017. [20]

The revisions to the Directive do not specifically refer to climate change in Article 3 (they simply refer to climate), but the need to consider climate change specifically is confirmed through revisions to Annex IV – see below.[21]

The revisions identify the important role that EIA can play in assessing climate change, stating in preamble of the 2014 amendments to the EIA Directive [22] that:

(7) *Over the last decade, environmental issues, such as resource efficiency and sustainability, biodiversity protection, **climate change**, and risks of accidents and disasters, have become more important in policy-making. They should therefore also constitute important elements in assessment and decision-making processes.*

And

(13) ***Climate change** will continue to cause damage to the environment and compromise economic development. In this regard, it is appropriate to assess the impact of projects on climate (for example, greenhouse gas emissions) and their vulnerability to **climate change**.*

The 2014 amendments to the EIA Directive incorporate the inclusion of both climate and climate change within:

- **'Article 3**:

(1) *'The environmental impact assessment shall identify, describe and assess in an appropriate manner, in the light of each individual case, the direct and indirect significant effects of a project on the following factors:*

(a) population and human health;

(b) biodiversity, with particular attention to species and habitats protected under Directive 92/43/EEC and Directive 2009/147/EC;

*(c) land, soil, air, water and **climate;***

(d) material assets, cultural heritage and the landscape;

*(e) the **interaction**[23] between the factors referred to in points (a) to (d).*

- **Annex III: (Criteria to determine whether the projects listed in Annex II should be subject to an EIA)**
  - Where selection criteria to determine whether the projects listed in Annex II should be subject to an EIA are to include amongst other characteristics:
    - 1(f) 'the risk of major accidents and/or disasters which are relevant to the project concerned, including those caused by climate change, in accordance with scientific knowledge';
- **Annex IV: (Information to be included within the EIA Report)**
  - (4) A description of the factors specified in Article 3(1) likely to be significantly affected by the project, including climate (for example, greenhouse gas emissions, impacts relevant to adaptation).
  - (5) A description of the likely significant effects of the project on the environment resulting from, inter alia,
    - (f) The impact of the project on climate (for example, the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change.'

19. Directive 2014/52/EU amending the EIA Directive 2011/52/EU - https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32014L0052
20. http://www.legislation.gov.uk/uksi/2017/571/contents/made
21. Annex IV sets out the information to be included in an EIA Report (i.e. formerly the Environmental Statement). Paragraph 5(f) therein has specific requirements relating to climate change.
22. Ibid.
23. The reference to interactions between the 'factors' provides the facility to consider the effect that climate may have on issues considered under other factors (i.e. the influence climate stresses may have on biodiversity considerations of the project).

15.2. The UK Town and Country Planning (Environmental Impact Assessment) Regulations 2017[24]

The requirements of the 2014 amended EU EIA Directive were transposed into UK law by the UK Town and Country Planning (Environment Impact Assessment) Regulations 2017 and came into force on 16th May 2017.

The amended regulations introduce climate change as a new topic, broadening the potential scope of an EIA.

The regulations require the impact that the project will have on climate change to be assessed alongside an assessment of the project's vulnerability to climate change. The regulations state the following information must be included in the Environment Statement:

5. *A description of the likely significant effects of the development on the environment resulting from, inter alia:*

(f) the impact of the project on climate (for example, the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change;

15.3. EU Guidance

In 2013, the European Commission launched guidance documents that focussed on how to consider Biodiversity and Climate Change in EIA[25] and SEA[26] (Strategic Environmental Assessment). The EIA-focussed guidance provides useful context on the types of risks that are likely to increase in line with our changing climate, and also provides some direction on how these risks could interact with environmental factors (e.g. water, air, land, etc) listed in Article 3 of the EIA Directive.

Given the EU-wide scope of the guidance, it inevitably retains a strategic focus and only provides a broad, question-oriented approach to advising on the actual assessment of climate change in EIA. While a key reference document for practitioners working in this area, further professional judgement will be needed to fully account for climate change in many EIA processes, in line with the guidance provided below. A recording of an IEMA webinar from May 2013 – led by the European Commission and one of the Guide's principle authors – is available, and provides a useful introduction to the Commission's ambitions for EIA's consideration of climate. [27]

15.4. Wider UK Policy and Regulation

The Climate Change Act 2008 established the context for Government action and incorporated the requirement to undertake Climate Change Risk Assessments,[28] and to develop a National Adaptation Programme (NAP)[29] to address opportunities and risks from climate change. The Government commissioned the completion of the National Climate Change Risk Assessment which was reported in January 2012. The CCRA provides a useful basis for assessing the likely future environment which EIAs need to consider, and provides information on the range of impacts likely to be experienced in the following sectors: *Agriculture, Biodiversity & Ecosystem Services, Built Environment, Business, Industry and Services, Energy, Floods and Coastal Erosion, Forestry, Health, Marine & Fisheries, Transport and Water.* [30]

The Centre for Climate Change Economics and Policy produced a policy brief in March 2013 to inform the preparation of the NAP, incorporating useful guidance on the NAP and flow diagrams to consider when undertaking climate change in an appraisal (note, appraisal is different to EIA).

24. http://www.legislation.gov.uk/uksi/2017/571/schedule/2/made
25. ec.europa.eu/environment/eia/pdf/EIA Guidance.pdf
26. ec.europa.eu/environment/eia/pdf/SEA Guidance.pdf
27. http://www.iema.net/event-reports/introducing-european-commissions-eia-and-sea-guides-integrating-climate-change-and
28. Numerous reports produced as part of the national Climate Change Risk Assessment are summarized in 'UK Climate Change Risk Assessment: Government Report'. January 2012, HM Government. https://www.gov.uk/government/publications/uk-climate-change-risk-assessment-government-report
29. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/209866/pb13942-nap-20130701.pdf
30. Summary and technical scientific reports on all these sectors are available along with 'The UK Climate Change Risk Assessment 2012 Evidence Report'.

In terms of planning, the UK Government addresses climate change through the National Planning Policy Framework (NPPF). This recognises that planning plays a key role in minimising vulnerability, providing resilience and managing risks associated with climate change.[31] The NPPF does not make specific reference to EIA's role in mitigating and adapting to climate change; however, it does recognise that local planning authorities should adopt proactive strategies to mitigate and adapt to climate change.

The NAP is primarily for England but also covers reserved, excepted and non-devolved matters. The individual Devolved Administrations (Scotland, Wales and Northern Ireland) have developed their own programmes and the UK Government is working with them to share areas of common interest, to ensure a consistent approach in the shape and focus of all the programmes. Details of the specific approaches being taken in each of the Devolved Administrations are set out below.

Scotland

The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017[32] include a requirement for the same information specified in the UK Town and Country Planning (EIA) Regulations 2017 to be included in the Environmental Report (referred to as Environmental Statement in England, Wales and Northern Ireland) in relation to climate change.

The Climate Change (Scotland) Act 2009 places a duty on Scottish Ministers to set out a programme for climate change adaptation. The first Scottish Climate Change Adaptation Programme (SCCAP) was launched in 2014.[33] The SCCAP aims to build resilience of Scotland's people, environment and economy to the impacts of climate change. Progress on the programme is reported annually. The Scottish Government are in the process of developing a new five-year climate change adaptation programme.

In 2015, the Scottish Government introduced the Climate Change (Duties of Public Bodies: Reporting Requirements) (Scotland)[34] Order, which places a requirement on 'major players' in the Scottish public sector to annually report on their compliance with climate change duties. These requirements include both emissions reporting alongside climate resilience and adaptation efforts.

The Scottish Government also funds the Adaptation Scotland[35] programme which provides advice and support to the Scottish public sector, businesses and communities to ensure they are equipped for a changing climate. A new Climate Change Bill was introduced to Parliament in May 2018 by the Scottish Government.[36] It will amend the Climate Change (Scotland) Act 2009, increasing the 2050 target to 90% for all greenhouse gas emissions.

Wales

The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017 includes the requirement for the same information to be included in the Environmental Statement[37] in relation to climate change.

The Climate Change Strategy for Wales[38] sets out an adaptation framework to present a national, co-ordinated approach to ensure that Wales understands the risks and opportunities that climate change presents and is well placed to adapt in a sustainable way. The Welsh Government has also developed Sectoral Adaptation Plans across five important sectors and has put programmes in place to embed resilience measures against extreme weather events and climate change into all it delivers.[39]

31. DCLG (2012) National Planning Policy Framework (NPPF), Chapter 10. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf
32. http://www.legislation.gov.uk/ssi/2017/102/pdfs/ssi_20170102_en.pdf
33. https://www.gov.scot/publications/climate-ready-scotland-scottish-climate-change-adaptation-programme/
34. http://www.legislation.gov.uk/ssi/2015/347/contents/made
35. https://www.adaptationscotland.org.uk/
36. https://www.gov.scot/policies/climate-change/climate-change-bill/
37. https://www.legislation.gov.uk/wsi/2017/567/pdfs/wsi_20170567_mi.pdf
38. http://wales.gov.uk/topics/environmentcountryside/climatechange/publications/adaptationplan/?lang=en
39. http://gov.wales/topics/environmentcountryside/climatechange/publications/?lang=en

The Environment (Wales) Act 2016[40] provides a framework for managing natural resources in Wales in a manner which is climate change ready. The Well-being of Future Generations (Wales) Act 2015[41] aims to improve the social, economic, environmental and cultural well-being of Wales. The Act contains a number of areas which are important to climate change as this is integral to the future well-being of the country.

The Welsh Government is developing a five-year Climate Change Adaptation Plan[42] for Wales which contains actions to reduce the risks of climate change to Wales. The consultation for the Draft Climate Change Adaptation Plan ended in March 2019.

Northern Ireland

The Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2017[43] also requires the Environmental Statement to include the same information in relation to climate change as the UK Town and Country Planning (Environment Impact Assessment) Regulations 2017.

A cross-departmental Northern Ireland Adaptation Programme (NICCAP) has been developed for the period 2014-2019. Progress on the NICCAP is reported annually to the Northern Ireland Executive by the Cross-Departmental Working Group on Climate Change.[44] The Department of Agriculture, Environment and Rural Affairs (DAERA) is currently developing the next NICCAP which will cover the period 2019-2024.

15.5. Potential impact of Brexit on UK Regulations

At the time of writing, following the triggering of Article 50, the UK is in preparatory stages of an exit from the EU. Upon exiting the EU (including any transitional arrangements which may apply) it is understood that the extant UK legislation governing EIA will remain in place.

The primary consequence will be that the European Court of Justice will no longer hold jurisdiction over the application of EIA in the UK. However, we do not believe that this is material to the content of this guidance note and until such time as the UK Parliament instigates new or revised legislation for EIA, this guidance will remain current.

40. https://www.wcva.org.uk/what-we-do/the-environment-(wales)-act
41. http://futuregenerations.wales/about-us/future-generations-act/
42. https://gov.wales/climate-change-adaptation-plan-for-wales
43. https://www.legislation.gov.uk/nisr/2017/83/pdfs/nisr_20170083_en.pdf
44. http://www.doeni.gov.uk/index/protect_the_environment/climate_change/climate_change_adaptation_programme.htm

16. Appendix 3 – Case Studies

The following case studies illustrate emerging best practice in the assessment of climate change resilience and adaptation within EIA. They have been kindly provided by contributors to this guidance.

16.1. Case Study 1: Energy from Waste (EfW) facility

Turley Ltd was commissioned to carry out an EIA for this EfW facility.

1. Summary of the project: name, brief description of key aspects, sector, scale and expected lifespan of project.

Proposed 49MW Energy from Waste (EfW) facility at Protos, Cheshire, on behalf of This is Protos LLP ('TIP', a company of Peel Environmental).

EIA undertaken as part of the Section 73 Application seeking removal of a condition attached to the original planning permission requiring delivery of the first phase of a rail line and rail head prior to operation of the EfW facility. The ES was prepared subsequent to implementation of the 2017 UK EIA Regulations and as a result, climate change was scoped in (unlike the 2007 and 2016 ESs prepared previously for the project).

A 25-year lifespan was assumed for the purpose of the climate change assessment work.

2. Reporting: were the results of the assessment reported in a separate chapter or in-built to the EIA report?

The climate change adaptation assessment is reported within a separate Climate Change ES chapter (which also covers climate change mitigation issues).

3. Key challenges: Given the location of the project on the south bank of the Manchester Ship Canal, it was important to understand the potential implications of sea level rise and ensure the development was not at risk over the long term. This required consideration of climate change projections for sea level rise and existing and planned sea defences for which information is limited.

4. Accessibility of sector guidance: is there any sector guidance? If yes was it used? Provide references to guidance. If guidance exists and was not used, set out reasoning behind this.

No sector-specific guidance was identified or used by the climate change adaptation assessment (although a number of sector-specific guidance documents were identified and used for the GHG emissions/climate change mitigation assessment). The IEMA guidance on assessment of adaptation and resilience in EIA, and the guidance on mitigation, were consulted during the development of the assessment.

5. Climate scenarios and timelines considered and reasoning for this: The proposed development was anticipated to be constructed from 2019-2022, commencing operations in 2022 and operating until 2047. UKCP09 climate projections for the 2020s and 2050s time periods were selected on the basis of being commensurate to the above construction and operational phase timescales of the development proposals.

The central estimate for the high emissions scenario was used to establish likely worst-case changes to climatic conditions in the North West of England during these periods.

6. Future baseline: did you present a future baseline (summary of projected changes to climate variables in future). If yes, how/in which format did you present it? Include example for case study.

Yes, separate tables are presented on projected future baseline conditions for the construction (2020s) and operational phases (2050s). These tables present future changes projected to climatic parameters of key relevance to the proposals in the form of percentage increases/decreases (for winter, summer and annual rainfall) and increases/decreases in temperate (°C) (for winter, summer and annual temperatures).

Table 6 - Projected future baseline conditions for the construction (2020s) and operational phases (2050s)

Timeframe	2020s	2050s
Temperatures	Increase in winter mean temperature is 1.2C	Increase in winter mean temperature is 2.1C
	Increase in summer mean temperature is 1.5C	Increase in summer mean temperature is 3C
	Increase in summer mean maximum temperatures is 1.9C	Increase in summer mean maximum temperatures is 3.8C
	Increase in summer mean daily minimum temperature is 1.4C	Increase in summer mean daily minimum temperature is 2.9C
Rainfalls	Change in annual mean precipitation is 0%	Change in annual mean precipitation is 0%
	Change in winter mean precipitation is 4%	Change in winter mean precipitation is 13%
	Change in summer mean precipitation is -5%	Change in summer mean precipitation is 18%

Given the location of Protos on the south bank of the Manchester Ship Canal, UKCP09 sea level rise projections up to the year 2095 were also considered.

7. Treatment of vulnerability: method used to assess, any significant impacts identified, any significant changes made to design as a consequence of the climate vulnerability assessment.

Thresholds for 'magnitude of effect', 'sensitivity of receptor', 'significance of effect' and 'climate change resilience' determined using IEMA guidance and professional judgement. Thresholds are presented for 'negligible', 'very low', 'low', 'moderate' and 'high' levels. Thresholds were defined as follows:

- **High sensitivity** – Receptor particularly sensitive to the climate effect and potential impacts, and/or receptor includes safety critical infrastructure which if damaged could result in significant risks to people and/or property. Mitigation required to reduce the impact as a priority.
- **Negligible sensitivity** – Receptor not sensitive to the effects of climate change effects and mitigation not required.
- **High effect** – Ongoing annual impact with the potential for extreme events to cause operational or structural damage. For example, higher temperatures causing a major failure in structures or buildings with the potential for injury.
- **Negligible effect** – Minimal impact, either positive or negative and likely to be mitigated through resilience measures included through regulatory or best practice.

The FRA prepared for the previous (2016) ES had already accounted for projected effects of climate change on peak rainfall, peak river flows and sea level change and resulted in a range of mitigation measures that were implemented into the development design including minimum floor levels, minimum road levels, provision of a flood warning system and preparation of a flood plan showing evacuation procedures.

So, while no changes to development design were required as a consequence of the climate assessment, water management measures were included in Construction Environmental Management Plan (CEMP) to monitor mains water consumption and promote water efficiency during construction in response to the increased risk of drought in relation to climate change.

8. Treatment of in-combination effects or environmental effects: method used, any significant impacts identified, any key changes made to the design or to mitigation measures as a consequence.

Regarding intra-project cumulative effects, a number of potential interactions between the future effects of climate change and other ES topics are identified with the ES chapter. Where necessary, the technical team responsible for those topics were contacted to discuss these potential in-combination effects, with appropriate assessment and mitigation undertaken accordingly.

No inter-project cumulative effects are anticipated on the basis that climate change adaptation effects and impacts are specific to the development and will not result in impacts to neighbouring development.

9. Any mitigation, management or monitoring identified, including post-EIA: The key climate change adaptation mitigation measures (relating to flood risk and habitat creation & management, with measures such as consideration of climate tolerant species) are enforced via planning condition and anticipated to reduce identified effects to become not significant, and as a result no post-mitigation monitoring is required.

10. Lessons learnt: The level of policy, legislation and tertiary mitigation available, even in relation to risks such as sea level rise is extensive. Early engagement with project consultants and the design team is essential to ensuring the potential impacts of climate change are understood and mitigated as part of the design stage. Increased awareness and understanding of potential impacts in relevant disciplines can reduce the scope of assessment required significantly.

16.2. Case Study 2: Expansion of London Stansted Airport

Arup was commissioned to carry out an EIA for the proposed Stansted Airport expansion project.

1. Summary of the project: name, brief description of key aspects, sector, scale and expected lifespan of project.

Name: Transforming London Stansted Airport, 35+ planning application
Sector: Aviation
Scale and short description: New airfield infrastructure. This new infrastructure will enable Stansted Airport to make better and more efficient use of its existing single runway. The planning application seeks permission for an additional rapid access taxiway (RAT) and rapid exit taxiway (RET) to serve the existing runway, together with nine additional aircraft parking stands. STAL also seeks permission for a proposed 23% uplift to its existing annual passenger cap of 35 million passengers per annum (mppa) to 43mppa, while retaining its approved limit of 274,000 total aircraft movements per annum. Together, these physical and operational changes comprise the proposed development (also referred to as '35+ Project').

2. Reporting: were the results of the assessment reported in a separate chapter or in-built to the EIA report?

The results of both a climate change resilience assessment, and an In-Combination Climate Change Impacts assessment were presented in a chapter within the Environmental Statement.

3. Key challenges: Few precedents available of climate change assessment for airports within EIAs. Assessments required expert judgement as little guidance on qualitative assessments was available.

At the time of the project, the UK TCPA regulations had only recently been amended to include a requirement to assess climate change. A clear and comprehensive reporting was of high importance to address the new requirements.

4. Accessibility of sector guidance: is there any sector guidance? If yes was it used? Provide references to guidance. If guidance exists and was not used, set out reasoning behind this.

Table 7 - Technical guidance relevant to the development

Technical guidance	Relevance
ICAO (2016) On Board a Sustainable Future: 2016 Environmental Report.	Extreme weather risks and international airport case studies
European Commission (2013) Guidance on Integrating Climate Change and Biodiversity into EIA.	Informed development of methodologies for the assessments
EUROCONTROL (2013) Challenges of Growth 2013: Summary Report.	Climate change risks to the aviation industry up to 2050 and potential resilience measures
EUROCONTROL (2016) European Aviation Environmental Report.	Climate change risks to the aviation industry and adaptation case studies
Institute of Environmental Impact Assessment (IEMA) (2015) IEMA guide to climate change resilience and adaptation.	Describes approach to integrating CCAR assessments into the EIA process in the UK
Department for Communities and Local Government (DCLG) (2017) Planning practice guidance.	Focus on integration of adaptation and mitigation approaches in the planning process

5. Climate scenarios and timelines considered and reasoning for this:

Timelines: 2020s and 2050s, these periods cover the construction and operation stages of the proposed development and represent short- and medium-term climate change impacts

Scenarios: medium emissions and high emissions scenario at the 50% probability level. A reference range is provided in each case, using the 10% probability level medium scenario as a lower limit and the 90% probability level high scenario as an upper limit. These scenarios and probability levels were used to provide a wide range of credible projected changes including an indicative level of uncertainty.

6. Future baseline: did you present a future baseline (summary of projected changes to climate variables in future). If yes, how/in which format did you present it? Include example for case study.

Yes, the future baseline was presented in a table format. See example at the end of this document.

7. Treatment of vulnerability: method used to assess, any significant impacts identified, any significant changes made to design as a consequence of the climate vulnerability assessment.

The approach to assess CCR included:

1. analysis of relevant climate change and weather data, emissions scenarios, timescales and probability levels;
2. identification and assessment of climate hazards and disruptive weather conditions;
3. identification of potential risks from these climate hazards to the infrastructure and operations of STAL;
4. consideration of the resilience of the planning application within the context of any incorporated mitigation measures;
5. identification of need for any further resilience measures.

No significant changes were made to the design due to identified climate change impacts. Nonetheless, a series of mitigation measures to reduce climate change impacts were recommended to complement the existing embedded mitigation, related to: demand on energy supplies due to increase in temperatures, review of allowances for maximum aircraft operating temperatures, wind speeds for take-off, review and monitor the capacity of balancing ponds; and monitoring of lightning events. It was recommended that these measures should be incorporated as part of STAL's update to their climate change adaptation risk register in 2021.

8. Treatment of in-combination effects or environmental effects: method used, any significant impacts identified, any key changes made to the design or to mitigation measures as a consequence.

The method used to assess ICCI effects involved: defining a future baseline as for the climate change resilience assessment , review of guidance and topic-specific literature on climate change impacts; assessment of each environmental topic's respective significant effects and the corresponding mitigation measures identified by each topic; assessment of potential in-combination impacts and significant effects; consideration of additional mitigation measures and inclusion of allowances for future mitigation measures and monitoring.

No ICCI significant effects were identified for the construction phase; for operation, the following effects were identified:

- Increased stress on existing road and rail network in combination with increase in frequency of extreme weather events negatively impacting surface access and transport.
- Increased prevalence of hotter and drier conditions in combination with increase in vehicle and aircraft emissions may result in changes in concentrations of nitrogen oxides (NOx), fine particulate matter (PM10 and PM2.5) and ozone (O3).
- Increase in frequency of extreme weather events in combination with direct and indirect job creation during operation leading to increased stress on local infrastructure.

However, no further mitigation was required because adequate mitigation measures were already in place. The following recommendations were made for monitoring: ensuring climate change resilience plans are robust; continued monitoring of trends in weather events; and continued review of resilience measures related to interdependencies.

9. Lessons learnt:

- importance of awareness and understanding of climate change assessments within EIAs, including why they are required and how they are carried out;
- ensure any documents relating to current operations, resilience plans, etc. if available are considered early on in the assessment in the climate change resilience assessment;
- engagement with other topic experts is key for the ICCI assessment. Clearly communicate to other topic experts that the in-combination assessment requires findings from these assessment topics as an input.

Table 8 – Climate change projections data for Stansted Airport expansion Climate Assessment

Parameter and baseline (in brackets) * = baseline data unavailable		'2020s' (2010-2039)			'2050s' (2040-2069)		
		Medium emissions scenario (50% level)	High emissions scenario (50% level)	Range[45]	Medium emissions scenario (50% level)	High emissions scenario (50% level)	Range
Temperature	Mean winter daily temperature [°C] (*)	5.11	5.12	4.36-5.98	5.98	6.30	4.92-7.61
	Mean summer daily temperature [°C] (*)	17.2	17.2	16.29-18.39	18.42	18.76	16.98-20.84
	Mean daily summer maximum temperature [°C] (21.1)	22.62	22.57 [46]	21.26-24.07	24.11	24.63	22.05-27.41
	Mean daily summer minimum temperature [°C] (11.2)	12.22	12.27	11.39-12.35	13.39	13.81	11.98-15.85
	Mean daily winter maximum temperature [°C] (6.9)	8.0	8.0	7.16-8.98	8.77	9.04	7.48-10.77
	Mean daily winter minimum temperature [°C] (1.4)	2.20	2.28	1.29-3.22	3.10	3.54	1.69-5.22
Precipitation	Annual mean daily precipitation [mm/day] (1.68)	1.67	1.67	1.59-1.76	1.67	1.66	1.58-1.76
	Winter mean daily precipitation [mm/day] (1.63)	1.74	1.75	1.58-1.29	1.89	1.92	1.68-2.24
	Summer mean daily precipitation [mm/day] (1.70)	1.58	1.63[47]	1.27-1.99	1.39	1.38	1.03-1.84
Wind	Change in winter mean daily wind speed (*)	-	-	-	-	-	-
	Change in summer mean daily wind speed (*)	-	-	-	-	-	-
Relative humidity	Annual relative humidity (*)	81.55	81.58	79.89-83.11	80.42	80.08	77.95-82.35
Cloud cover	Annual cloud cover [%] (*)	0.66	0.66	0.64-0.69	0.65	0.65	0.62-0.68

45. Range is from 10% probability level at the medium emissions scenario to 90% probability level at the high emissions scenario.
46. Value for the '2020s' high emission scenario at the 50% probability level is marginally lower than value for the medium emissions scenario, but overall trend for the 2020s and 2050s is an increase.
47. Value for the '2020s' high emission scenario at the 50% probability level is marginally higher than value for the medium emissions scenario, but overall trend for the 2020s and 2050s is a decrease.

16.3. Case Study 3: HS2 Phase 1 and 2a

This case study is based on published information/ lessons learnt from HS2 (publicly available information).

1. Summary of the project: name, brief description of key aspects, sector, scale and expected lifespan of project.

- High Speed Two (HS2) is the Government's proposal for a large-scale, new, high-speed north-south railway. The proposal is being taken forward in phases: Phase One will connect London with Birmingham and the West Midlands; Phase 2a will extend the route to Crewe; and Phase 2b will extend the route to Manchester, Leeds and beyond.
- The lifespan of the project is excess of 120 years.

2.Reporting: were the results of the assessment reported in a separate chapter or in-built to the EIA report?

- The results of the assessment were presented in a separate chapter. Three distinct climate assessments were presented in Volume 3 Route-wide effects of the EIA:
  - a climate change resilience assessment;
  - an In-Combination Climate Change Impacts assessment; and
  - a greenhouse gases (GHG) assessment.
- In addition, more detailed information was presented in Volume 5 Appendices:
  - climate data and information (presented current and future baseline data);
  - results of climate change assessments; and
  - summary greenhouse gas calculation outputs.

3. Key challenges:

- Determining:
  - which climate change projection to use – as this informs the parameters to account for in the assessment and design process;
  - what the environmental baseline will be under the future projected climate – and how can it be assessed.
- Addressing longer-term uncertainty of climate projections (beyond 2050).

4. Accessibility of sector guidance:

The following guidance was consulted at the time of the development of the climate assessments:

- IEMA Guidance on Climate change resilience and adaptation in EIA (2015);
- guidance on climate change allowances to be used in flood risk assessments, produced by the Environment Agency in 2016 and set out in the National Planning Policy Framework (NPPF).

5. Climate scenarios and timelines:

- The UK Climate Projections 2009 (UKCP09) were used. At the time, these were the most recent projections available for the UK.
- Timelines of the project were used to inform the study:

Table 9 - Project timeline in relation to UKCPo9 time period

	Interim preliminary design and future	Construction	Operation (start) and maintenance	Operation (peak) and maintenance	Operation (continued) and maintenance	Design life of Proposed Scheme
Proposed Scheme activities stages	2012-2017	2017-2026	2026 onwards	2041	2041 onwards	2026-2146
UKCPo9 time period	20205 (2010-2039)	20205 (2010-2039)	20205 (2010-2039)	20505 (2040-2069)	20805 (2070-2099)	2100+ (Outside standard UKCPo9 time periods)

- In order to provide a balanced and representative approach, projections from both the Medium and High emissions scenario were taken (both at 50th percentile level), for two time periods: the 2020s (2010-2039) and the 2080s (2070-2099).

6. Future baseline: did you present a future baseline (summary of projected changes to climate variables in future)? If yes, how/in which format did you present it? Include example for case study.

- A future baseline was presented in Volume 5 Technical appendix Climate data and information (CL-001-000). This included projected changes for four variables: temperature, precipitation, relative humidity and cloud cover; with data given for two timelines the 2020s and the 2080s.

- A range of values was presented, in order to provide a representative indication of projected future changes. Hence the projections data for both the medium emissions and high emissions scenario (both at 50th percentile level) were presented.

7. Treatment of vulnerability: method used to assess, any significant impacts identified, any significant changes made to design as a consequence of the climate vulnerability assessment.

A high-level climate change resilience assessment was undertaken to identify the potential risks of climate change on the Proposed Scheme and to assess the Proposed Scheme's resilience and capacity to cope with these potential risks. The assessment considered risks posed by climate-related hazards such as extreme hot and cold weather, heavy rain, high winds and storms to the infrastructure and assets associated with the railway including tracks, tunnels, overhead line equipment, rolling stock, stations and earthworks. The likelihood and consequences of climate hazards were considered based upon the trends within the UK climate projections.

No significant effects were found for construction or operation. This is due to the range of mitigation measures which were already embedded in the design, or were to be included in the development of maintenance and monitoring procedures, or to be developed during future design stages.

Key examples of how climate change resilience was addressed include:

- the Proposed Scheme is designed to the 1 in 100 year plus climate change allowance (which is dependent on river basin and flood zone) peak river flow event. In addition, the railway infrastructure will be protected from the 1 in 1,000 year peak river flow event;
- drainage is designed to the 1 in 100 year plus climate change allowance (40% increase) peak rainfall event;
- lineside vegetation and landscape planting areas will be managed to minimise the likelihood of windborne debris blocking watercourses and drainage systems, obstructing the tracks or causing damage to overhead line equipment; and
- measures to mitigate the potential risk of increased lightning strikes to structures and systems will be addressed during further design stages.

8. Treatment of in-combination effects or environmental effects: method used, any significant impacts identified, any key changes made to the design or to mitigation measures as a consequence.

The assessment considered how climate change, in combination with the impacts of the Proposed Scheme, may affect communities, businesses and the natural, historic and built environment along the Phase 2a route.

Each environmental topic considered changes to long-term, seasonal average and extreme weather events as set out in the future baseline, in order to carry out a qualitative assessment of the combined effects of climate change and the Proposed Scheme.

One significant effect of an ICCI was found: drier and wetter conditions in future as a result of climate change were found to potentially affect the ability of 'dry' and 'wet' soils both to retain and drain moisture. This effect was relevant to both the agricultural, forestry and soils, and the landscape and visual topics considered, due to the relationships between the resilience of soils and the resilience of planted vegetation.

This effect is mitigated by the following measures:

- the creation of deeper, more moisture-retentive soil profiles to mitigate longer-term drought effects;
- the creation of better-draining soil profiles to mitigate longer-term flood effects on restored and reinstated soils where reasonably practicable; and
- permanently displaced soils to be used to reinstate soils with deeper profiles than the original where reasonably practicable (with preferably higher organic matter content);

A number of mitigation measures were also included within the design of the proposed scheme, including:

- ecological mitigation measures which will enable habitats to adapt to climate change by maintaining and enhancing ecological conditions and creating and restoring habitats to increase species' resilience to changes in climate;
- trees which will be selected from a range of latitudes and climate zones to increase species' resilience to hotter, drier and/or wetter conditions, and landscape planting palettes which will be designed to increase species' resilience and adaptability; and
- the performance of the Proposed Scheme has been assessed against a range of design floods up to and including the 1% (1 in 100) annual probability event, including the addition of the relevant future climate change allowances in line with the latest guidance from the Environment Agency.

9. Any mitigation, management or monitoring identified, including post-EIA:

Examples of ongoing climate change resilience post-EIA:

- Work during further design stages will assess the impacts of climate change on interdependencies between the Proposed Scheme and other organisations such as rail, road, power and telecoms infrastructure operators. This will use the assessments carried out for Phase One of HS2 as its basis; and
- Climate change resilience assessments will continue to take place throughout the design, construction and operation stages of the Proposed Scheme.

10. Lessons learnt:

- the effects of developing a methodology for a new assessment, in this case the ICCI assessment methodology, requires flexibility during the process of assessment;
- importance of setting of a single future baseline for topics to consider (so both climate resilience and ICCI and all topics consider the same future baseline);
- importance of presenting the future climate baseline in a manner accessible to non-climate experts, so that all environmental topics teams and design teams can access it and contribute to ICCI assessment and CCR assessment respectively; and
- importance of taking into account the full design life of the project in the climate change resilience assessment, and defining the future climate baseline accordingly. In addition, the assessment needs to be commensurate with the design stage of the project and design detail available.

17. Appendix 4 – Identifying the Future Climate

17.1. Introduction

Scientific evidence shows that our climate is changing; however, there are significant uncertainties in the 'magnitude', 'frequency' and 'spatial occurrence' either as changes to average conditions or extreme conditions. Such uncertainties generally make it difficult to assess the impacts of climate change in relation to a specific project.

An added consideration is the fact that climate change projections are based on global models simulating a range of greenhouse gas emission scenarios and look (generally) at regional responses to climate change. In comparison, almost all EIAs look at specific sites compared to regional/national-level climate change models, and the uncertainty of predicting future climate effects on such a small spatial area is potentially large. There are two aspects of uncertainty that need to be managed:

1. Which climate change scenario/s are to be included in the design (i.e. how resilient to climate change does the proposed design need to be)?
2. What will the environmental baseline be under the future projected climate and how can it be assessed?

17.2. Selecting a climate change scenario

Where climate change adaptation is included in the EIA, a key step will be to define an emissions scenario and probability to identify the range of potential future climate conditions to use in the EIA. This should be done at the scoping stage. Once a projection is identified then this must be used by all disciplines thereafter as the basis of the EIA process to ensure consistency in approach.

The recommended approach is to use a high emissions scenario, in the UK this would be RCP 8.5.[48] However, there could be situations where additional sensitivity testing is needed for very vulnerable, high-value receptors, where the impact of climate variations under other emissions scenarios may need to be considered.

Climate projections are updated periodically and it should be the responsibility of the CCAR Coordinator to ensure that the EIA is based upon the latest projections and that all the topic specialists fully understand what they are required to use in their assessments. The UK Met Office produced an updated set of climate projections in 2018, known as UKCP18. The majority of the data for these projections was published in November 2018, with the more detailed data expected for publication in late 2019. Detailed guidance on climate projections and the use of UKCP18 data is available from the UKCP18 website. [49]

UKCP18 considers the effects arising from a series of emissions scenarios which project how future climatic conditions are likely to change at a local level (i.e. at a sub-regional scale in the UK), accounting for naturally occurring climate variations.

During the EIA, it is important to understand and take account of the uncertainty associated with the selected climate projection and all outputs must reflect any assumptions made. It is also important to understand that the inertia in the climate system means that climate change over the next two or three decades (up to about 2040) is relatively insensitive to emissions. As such, a short lifespan development is not likely to be particularly sensitive to which emissions scenario is selected for the EIA.

However, after the 2040s, the projections for different emissions scenarios increasingly diverge and it will be important to have a considered approach to identifying the right emissions scenario to select where the planned operational life of a scheme goes significantly beyond 2040.

48. RCP: Representative Concentration Pathways. RCPs are the new definition used by the IPCC in their latest climate projections, and are based on the projected concentration of greenhouse gases in the atmosphere in 2100, so e.g. RCP 8.5 models a radiative forcing of 8.5 in 2100. These replace the previous Low, Medium and High scenarios. There are 4 RCPs in UKCP18 (2.6, 4.5, 6.0 and 8.5), and they do not directly map onto the Low, Medium, High scenarios used previously. However, RCP 2.6 is the lowest emissions scenario, and RCP 8.5 the highest.
49. https://www.metoffice.gov.uk/research/collaboration/ukcp

17.2.1. Criteria for choice of climate change scenario

1). Recommended best practice is to use the higher emissions scenario (RCP 8.5 in the latest UKCP18 projections) at the 50th percentile, for the 2080s timelines, unless a substantiated case can be made for not doing this (e.g. anticipated lifespan of the project is shorter than 2080s).

This provides a suitably conservative approach to climate assessment. Projects wanting to test a worse-case but feasible scenario are recommended to consider the 80th percentile values of the RCP8.5 for sensitivity testing.

WHY RCP 8.5?

In the absence of alternative guidance, or a project driver indicating the use of either multiple climate scenarios, or a lower emission scenario, this guidance recommends the use of RCP 8.5.

The reason for this is to ensure a suitably conservative approach. It is also in line with the National Policy Statement on National Networks, which states that developments should use the UKCP09 high emissions scenario at the 50% probability level.

This is the recommendation in the absence of other sector-specific guidance, or guidance from planning authorities. If either of these exist, as outlined below, they should be followed.

2). If there is sectoral guidance, this will take precedence and should be followed. For example, the Environment Agency has published specific guidance on climate change for flood risk assessments. Other sectoral guidance may be less specific, but still provide helpful guidance.

3). If no sectoral guidance exists, consult with the relevant planning authority regarding the choice of emission scenario, and appropriate timeline, taking into account expected lifespan of the development, maintenance points and any post-operational lifespan (decommissioning),

Emerging practice to date has been for higher-consequence projects to use the High emissions scenario as a precautionary approach.

Once an appropriate emission scenario is selected, it can be used to build up a holistic picture of future climate. It is recommended a summary of the range of projections under the selected scenario is produced, an example of which is shown in Table 7 below, to ensure consistency across topics in the EIA.

Probabilistic projections, such as those provided by UKCP18, give a range of possible climate change outcomes and their relative likelihoods, which typically give climate information that is considered the unlikely, likely or very likely (i.e. ranging across 10th to 90th percentiles) outcomes. We recommend the use of the 50th percentile of the RCP 8.5 climate scenario. If a different scenario or different percentile is used, the EIA report should clearly set out the justification for this.

It can often be appropriate to consider a range of potential outcomes; for example, considering the 50th percentile during the design process, and also assessing the impact of 90th percentile values as sensitivity testing for worse-case scenarios.

Table 9 – Example presentation of a quantitative future baseline for key climatic variables. This is data for the South East of the UK under RCP 8.5 (the highest emission scenario in UKCP18) [50]

Season	Variable	Time period*	5th percentile	Projected change at			95th percentile
				10th percentile	50th percentile	90th percentile	
Winter	Mean Temperature (ºC)	2030s	-0.1	0.1	0.9	1.8	2
		2050s	0.2	0.5	1.7	2.9	3.3
		2070s	0.4	0.9	2.5	4.2	4.8
		2090s	1	1.5	3.6	5.8	6.4
	Mean Precipitation (%)	2030s	-9	-5	8	23	27
		2050s	-10	-5	13	34	40
		2070s	-12	-5	20	49	58
		2090s	-10	-3	27	63	75
Summer	Mean Temperature (ºC)	2030s	0.1	0.4	1.3	2.4	2.6
		2050s	0.8	1.1	2.5	4	4.4
		2070s	1.2	1.8	3.9	6.1	9.5
		2090s	2.2	2.9	5.8	8.7	9.5
	Mean Precipitation (%)	2030s	-36	-30	-9	13	19
		2050s	-55	-48	-22	5	14
		2070s	-69	-61	-30	1	9
		2090s	-85	-77	-41	-3	7

*UKCP18 provides 20-year time slices, hence: 2030s (2020-2039), 2050s (2040-2059), 2070s (2060-2079), 2090s (2080-2099).

The source of climate projections and the range of scenarios used in the project design (and therefore the EIA process) must be clearly described in the EIA report.

50. UKCP18 Key Results https://www.metoffice.gov.uk/research/collaboration/ukcp/key-results available in the linked spreadsheet [accessed 09/05/2019]

18. Appendix 5 – The role of the Climate Change Adaptation and Resilience Coordinator (CCAR Coordinator)

18.1. Introduction

There is a great deal of scientific evidence in the public domain presenting scenarios for how the climate may change. In the UK, this takes the form of future climate projections published by the Meteorological Office through the UK Climate Projection website. [51] These projections (currently the UKCP18 climate projections) produce information that is available to practitioners, but the information is complex and needs to be used with care. Competent advice needs to be available to EIA practitioners on how to consistently interpret this data.

18.2. CCAR Coordinator

IEMA recommend that every EIA team includes access to a practitioner who is knowledgeable about future climate change scenarios and experienced in the use and interpretation of future climate projections. This person should be:

- fully conversant with the UKCP18 climate projections;
- able to provide advice on the range of climate change scenarios that could be considered;
- able to access readily available information sources such as regional climate patterns and national data sets and make recommendations to the EIA Coordinator on these projections – such data sets are provided by the Met Office and the UKCP18 climate projections, and Intergovernmental Panel on Climate Change (IPCC) reports;
- able to provide advice on the potential range of effects of climate change (e.g. how temperature will vary); and
- able to work with EIA technical specialists to ensure the information being used in the EIA does not contradict any topic-specific guidance. If there are inconsistencies in the approach recommended in different technical guidance documents in relation to climate change, then the CCAR Coordinator should provide advice on how to manage these in the EIA.

It is recommended one person within an EIA team is given the responsibility of:

- identifying what climate projection information is most relevant to the EIA;
- ensuring consistency in approach to climate change in the EIA;
- writing the background on climate change in the Environmental Report or Environmental Statement, that is appropriate to the EIA, which should refer to any relevant Strategic Environmental Assessments (SEAs), policies in the Local Plan, local and national climate change adaptation plans, other EIAs for projects in the area, and local experience and observations to inform the EIA team; and
- providing information on the broad range of topic-specific guidance available in relation to climate change (e.g. NPPF guidance on water and flood risk, or DMRB guidance on drainage design and water resources impact assessment). [52]

In this guide, this individual is referred to as the CCAR Coordinator. However, it is important to stress that this guide is not specifically advocating the involvement of a climate specialist; simply that a nominated team member has the required understanding of climate factors to perform the tasks outlined above.

51. http://ukclimateprojections.metoffice.gov.uk/22537
52. **National Planning Policy Framework**, Technical Guidance includes factors to allow for sea-level rise and rainfall changes (published by Department for Communities and Local Government, March 2012) and **DMRB Volume 11**, Section 3, Part 10 – HD45/09, Chapter 4 discusses climate change and how to allow for this in the EIA process.

19. Appendix 6 – Further Reading

Aecom & RSI (2015) *Toronto hydro-electric system limited climate change vulnerability assessment.*

Department for Communities and Local Government (2012) *Technical Guidance to the National Planning Policy Framework*.

Department of the Environment (1995) *Preparation of Environmental Statements for Planning Projects that Require Environmental Assessment: A Good Practice Guide. HMSO.*

Department of the Environment, Transport and the Regions (DETR) and the National Assembly for Wales (2000) *Environmental Impact Assessment: A Guide to the Procedures. HMSO.*

Environment Agency (2011) *Strategic Environmental Assessment and Climate Change: Guidance for Practitioners.*

European Commission (2013) *Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment.*

Highways Agency, Transport Scotland, Welsh Assembly Government and the Department for Regional Development Northern Ireland (2008) Assessment and Management of Environmental Effects. *Design Manual for Roads and Bridges, Volume 11, Section 2, Part 5. HA 205/08.*

IAIA (2012) *Climate Change in Impact Assessment – International Best Practice Principles.*

IEMA (2010) IEMA Principles Series - Climate Change Adaptation & EIA

IEMA (2011) Special Report – The State of Environmental Impact Assessment Practice in the UK

IEMA (2017) Environmental Impact Assessment Guidance to Assessing Greenhouse Gas Emissions and Evaluating their Significance

IFC (2013) *Enabling Environment for Private Sector Adaptation - An Index Assessment Framework.*

Morris, P. and Therivel, R. (2009) *Methods of Environmental Impact Assessment.*

Mott MacDonald & Global Sustainability Institute. (2015) *Climate Change and Business Survival*.

OCCIAR (2014) *Assessing the Treatment of Climate Change Impacts and Adaptation in Project-Level EAs in the Canadian Mining Sector.*

World Bank – Climate & Disaster Risk Screening Tools (http://climatescreeningtools.worldbank.org/) Accessed May 2015

Useful Sources of Future Baseline/Projections Information

Department for Business Innovation & Skills (BIS) Foresight projects http://www.bis.gov.uk/foresight

Department of Energy and Climate Change (DECC) (2010) 2050 Pathways Project. https://www.gov.uk/2050-pathways-analysis

Department for Environment, Food and Rural Affairs (Defra) (2012) UK Climate Change Risk Assessment (CCRA).

European Environment Agency overview of tools: http://www.eea.europa.eu/themes/scenarios/scenarios-and-forward-studies-eea-activities

European Environment Agency Climate Change Data Centre http://www.eea.europa.eu//themes/climate/dc

European Environment Agency PRELUDE Land Use Scenarios: http://www.eea.europa.eu/multimedia/interactive/prelude-scenarios/prelude

European Environment Agency (2010) The European Environment: State and Outlook 2010 – Synthesis.

Fast Future (2005) Baseline Scanning Project: A Research Study for Defra's Horizon Scanning and Futures Programme and Strategy and Sustainable Development Directorate.

Natural England Secure Environmental Future Project http://www.naturalengland.org.uk/ourwork/securefuture/default.aspx

Natural England (2009) England's Natural Environment in 2060 – Issues, Implications and Scenarios.

OECD (2012) Environmental Outlook to 2050: The Consequences of Inaction.

Scottish Environmental Protection Agency Climate Change Publications http://sepa.org.uk/climate_change/publications.aspx

UKCP18 UK Climate Projections https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/index

UKCP18 UK Climate Projections 2018 https://www.metoffice.gov.uk/research/collaboration/ukcp and https://www.metoffice.gov.uk/research/collaboration/ukcp/download-data

United Nations Environment Programme Global Environmental Outlook http://www.unep.org/geo/

United Nations Environment Programme (2012) GEO5 Global Environmental outlook – Environment for the Future We Want.

Task Force on Climate-Related Financial disclosures (2017). Technical Supplement: The use of scenario analysis in disclosure of climate-related risks and opportunities. https://www.fsb-tcfd.org/wp-content/uploads/2017/06/FINAL-TCFD-Technical-Supplement-062917.pdf

http://ec.europa.eu/environment/eia/review.htm

http://www.europarl.europa.eu/sides/getDoc.do?type=TA&reference=P7-TA-2014-0225&language=EN&ring=A7-2013-0277

20. Appendix 7 – Glossary and Definitions

Term	Explanation
Adaptive management	A systematic process which monitors the ongoing effectiveness of mitigatory and compensatory measures to determine if they are achieving their desired objectives and where they are not, either modifies the action, or identifies additional actions to be taken. [53]
Baseline	The environmental or social baseline for a study comprises information gathered to understand the current or future state conditions within an identified impact area prior to implementation of a project. This is the benchmark against which impacts from subsequent development can be referenced. [54]
Carbon emissions scenarios	The basis on which global climate change models are developed that take account of different levels of global carbon emissions. The scenarios are based on complex economic models but can be simply summarised as low, medium or high emissions scenarios. It is considered highly unlikely that a low carbon emission scenario is a realistic scenario on which to base assessments.
Climate	The general weather conditions prevailing over a long period of time. Climate change will see trends in the climate conditions changing (seasonal averages and extremes).
Climate change adaptation *(/Adaptation)*	The process that a receptor or project has to go through to ensure it maintains its resilience to climate change. In the case of a development project, adaptation can be embedded in the design to account for future climate conditions, or the project can introduce measures to ensure it retains it resilience (i.e. the project adapts) to future climate conditions. Environmental receptors will adapt to climate change in varying degrees depending on how vulnerable they are to climate.
CCAR Coordinator	The practitioner within an EIA team who may or may not be a 'climate expert' has a thorough grasp of climate change projections, policy and regulation and who is also conversant with the emerging climate change guidance relating to specific technical topics. It is important all EIA teams have access to a competent CCAR Coordinator.
Climate change mitigation	Measures included in a project to reduce the emissions of greenhouse gases. See below for EIA mitigation.
Climate change projection	The range of possible climate conditions projected for a range of probability that the conditions will occur for a specific carbon emissions scenario.
Climate change resilience *(Resilience)*	The resilience of something is a measure of its ability to respond to changes it experiences. If a receptor or a project has good climate change resilience, it is able to respond to the changes in climate in a way that ensures it retains much of its original function and form. A receptor or project that has poor climate change resilience will lose much of its original function or form as the climate changes.
Cumulative impact	The combined impact of a given type, from a range of different activities or sources, perhaps in conjunction with past/future development or activity. [55,56] For example, the air quality impact from one development may be of low significance but the cumulative impact from several developments with individually low significance may become collectively significant.

53. Based on: www.iema.net/assets/uploads/Special%20Reports/iema20special20report20web.pdf
54. Developed from: Therivel, R. & Wood, G., 2018. Methods of Environmental and Social Impact Assessment. 4th Edition. Taylor & Francis: New York, pp. 4-6.
55. Developed from: https://transform.iema.net/article/eia-assessing-combination-effects
56. Developed from: Therivel, R. & Wood, G., 2018. Methods of Environmental and Social Impact Assessment. 4th Edition. Taylor & Francis: New York, p706

Term	Explanation
EIA Coordinator	The practitioner with overall responsibility for ensuring the quality of the EIA satisfies current regulatory requirements and is consistent with the requirements published for EIA by IEMA. This person should be a chartered environmentalist with experience in the preparation and delivery of EIA and who will be responsible for ensuring climate change adaptation is properly accounted for in the EIA process. This practitioner has specific responsibility for advising developers of their obligations under the revised EIA Directive and the implications thereof – especially in advance of the revised EIA regulations that will be introduced in 2017.
EIA mitigation	Measures identified during the EIA process to reduce/enhance the negative/positive impacts of a project respectively. Not to be confused with climate change mitigation (see above).
Environmental Report	The name of the final statutory report in Scotland presenting the findings of the EIA. The equivalent terminology in England, Wales and Northern Ireland is Environmental Statement. Outside of Scotland, Environmental report (lower case) may refer to any document or appendix relating to the EIA process.
Environmental Statement	The name of the final statutory EIA Report submitted in England, Wales and Northern Ireland presenting the findings of the EIA.
In-combination effect	When a particular receptor is affected by impacts from the same scheme in different ways, such as by both noise and air pollution.
In-Combination Climate Impact effect (ICCI)	When a projected future climate impact (e.g. increase in temperatures) interacts with an effect identified by another topic and exacerbates its impact. For example, if the biodiversity topic identifies an effect on a habitat or species receptor due to a project/scheme, such as loss of habitat, and in addition projected future higher temperatures will increase the vulnerability of this habitat to fragmentation, this is an ICCI.
Projection	A possible outcome defined by modelling of climate variables to give a possible outcome. This is in contrast to a prediction which is a statement of probable change.
Receptor	An aspect of the natural or man-made environment which may potentially be significantly affected by a development. [57]
Significance	Significance is assessed by comparing the magnitude of an impact with a receptor's value, sensitivity, permanence or reversibility, in an assessment-specific matrix. The criteria in this matrix can be pre-set, allowing for objective impact assessment rather than subjective impact evaluation.[58]
UKCP09	UK Climate Projections 2009 is the suite of climate change projections produced by the UK Met Office Hadley centre, funded by Defra. Projections are broken down to a regional level across the UK and are shown in probabilistic form – illustrating the potential range of changes and the level of confidence in each projection. These have recently been superseded by UKCP18, but were previously in use for many years.

57. Developed from: Therivel, R. & Wood, G., 2018. Methods of Environmental and Social Impact Assessment. 4th Edition. Taylor & Francis: New York, p710
58. Developed from: Therivel, R. & Wood, G., 2018. Methods of Environmental and Social Impact Assessment. 4th Edition. Taylor & Francis: New York, p8

Term	Explanation
UKCP18	The most recent climate projections produced by the UK Met Office Hadley Centre, these represent an update from the UKCP09 projections. The new projections use Representative Concentration Pathways (RCPs) rather than the previous 'low, medium, high' emission scenarios. Most of the UKCP18 data outputs were published in late 2018. The detailed 2.2km resolution projections will be available in late 2019.
Vulnerability (to climate change)	The inverse of climate resilience, vulnerability to climate change refers to an aspect of infrastructure, operations or a project which is susceptible to impacts arising from climate change, e.g. a building may be vulnerable to overheating due to future increases in temperature if it has not been designed with consideration of higher temperatures.
Weather	Weather is what we experience on a daily basis. It is defined by the atmospheric conditions (such as temperature, wind, cloud cover, rain) prevailing at specific moments in time, or over short time periods.

IEMA Transforming the world to sustainability

MOTT MACDONALD

About IEMA

We are the worldwide alliance of environment and sustainability professionals. We believe there's a practical way to a bright future for everyone, and that our profession has a critical role to play.

Ours is an independent network of more than 15,000 people in over 100 countries, working together to make our businesses and organisations future-proof.

Belonging gives us each the knowledge, connections, recognition, support and opportunities we need to lead collective change, with IEMA's global sustainability standards as our benchmark.

By mobilising our expertise we will continue to challenge norms, influence governments, drive new kinds of enterprise, inspire communities and show how to achieve measurable change on a global scale. This is how we will realise our bold vision: transforming the world to sustainability.

Join us at iema.net

IEMA
+44 (0)1522 540069 | info@iema.net | iema.net
IEMA, City Office Park, Tritton Road, Lincoln, LN6 7AS. UK