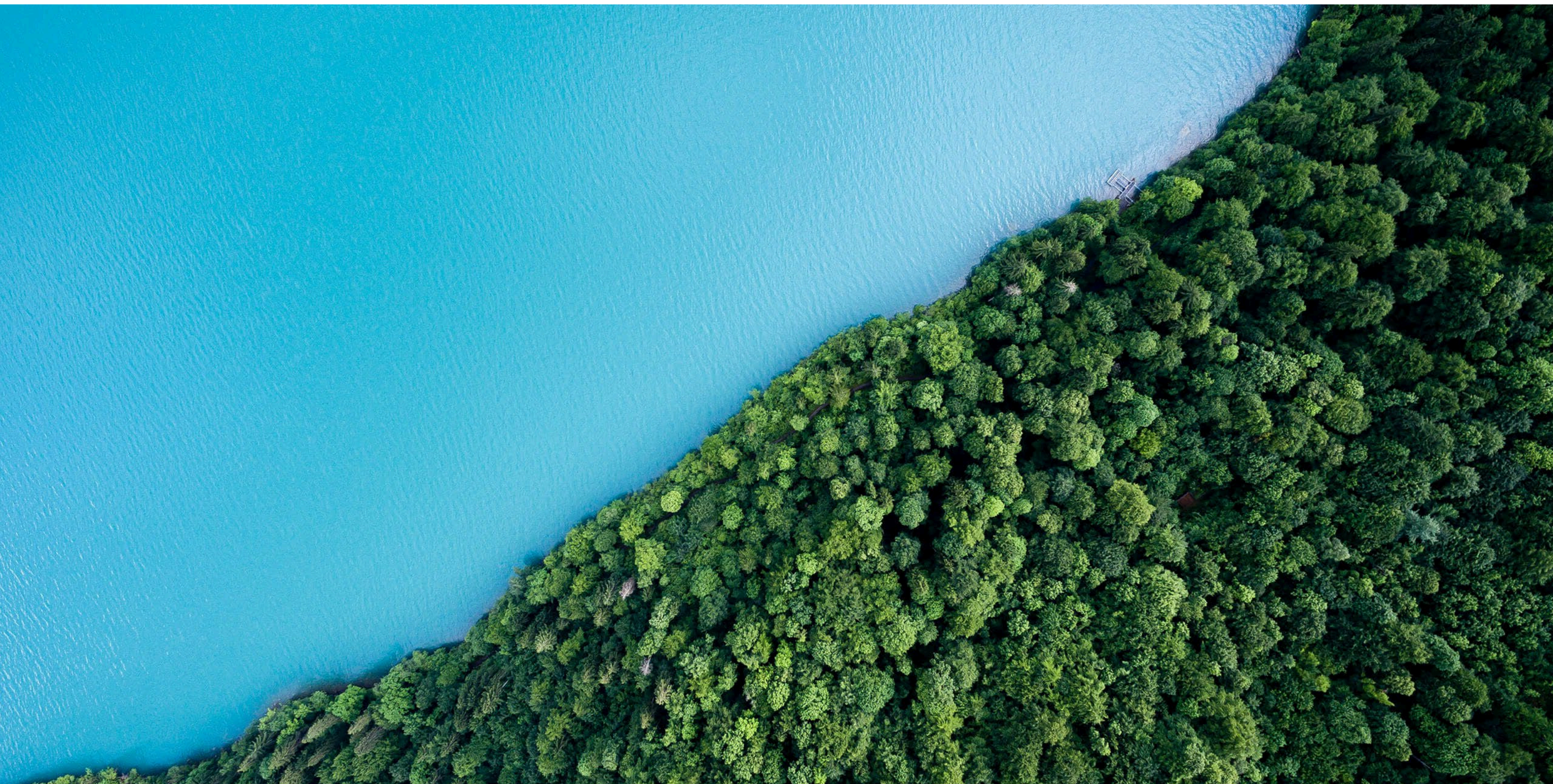
The Basics of Climate Change Adaptation, Vulnerability and Risk Assessment

June 2017



JASPERS Guidance Note

The Basics of Climate Change Adaptation Vulnerability and Risk Assessment

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Joint Assistance to Support Projects in European Regions

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Introduction

Climate Change Adaptation Vulnerability and Risk Assessment is the process of managing climate adaptation considerations throughout the development of a project, it involves identifying which climate hazards the project is vulnerable to, assessing the level of risk and considering adaptation measures to reduce that risk to an acceptable level.

The purpose of this document is to provide advice about what the basic principles of such an assessment are, especially in relation to project development, and what is expected in good practice. Project development refers to the process of developing infrastructure projects (transport, water, waste, energy, knowledge economy, etc.) from concept to implementation.

This document does not seek to set out a specific methodology which must be followed precisely for each project. Having established the basics, people utilising this information will then need to consider what is additionally appropriate in each particular project context; a range of approaches can be applicable.

This JASPERS guidance is largely based on the information provided in the European Commission DG Climate Action Non-paper *Guidelines for Project Managers: Making vulnerable investments climate resilient* and summarised in the publication *Climate Change and Major Projects*. In addition, this JASPERS guidance is consistent with the advice from the European Financing Institutions Working Group on Adaptation to Climate Change (EUFIWACC) on *Integrating Climate Change Information and Adaptation in Project Development*.

Climate Change Mitigation *vs* Climate Change Adaptation

There are two main components in dealing with climate change: mitigation and adaptation. Mitigation is about dealing with the causes of climate change, by reducing greenhouse gas emissions (GHGs). Adaptation is about dealing with the inevitable consequences of climate change and attempting to lower the risks and improve resilience. Whilst there is a clear EU and international commitment to reduce emissions, climate change is inevitable and it is therefore essential that we adapt.

Vulnerability and Risk Assessment focuses on the adaptation side and aims to integrate the consideration of climate adaptation into the project development cycle.

Climate Influenced Projects *vs* Climate Adaptation Projects

It can be useful to consider projects as falling into two categories:

- **Climate-influenced projects** – those assets and infrastructure projects whose success may be affected if climate change is ignored, for example a highway project prone to landslides;

- **Climate adaptation projects** – where the main aim is to reduce vulnerability to climate hazards, such as a flood management scheme.

Vulnerability and Risk Assessment can and should be undertaken for both types of projects. All major infrastructure projects, regardless of the sector, may be vulnerable to climate change (climate influenced projects) and may need to adapt to a changing climate, therefore the process is applicable to all projects, cross-sector. Climate adaptation projects focus on achieving adaptation; however, this does not mean that Climate Adaptation Vulnerability and Risk

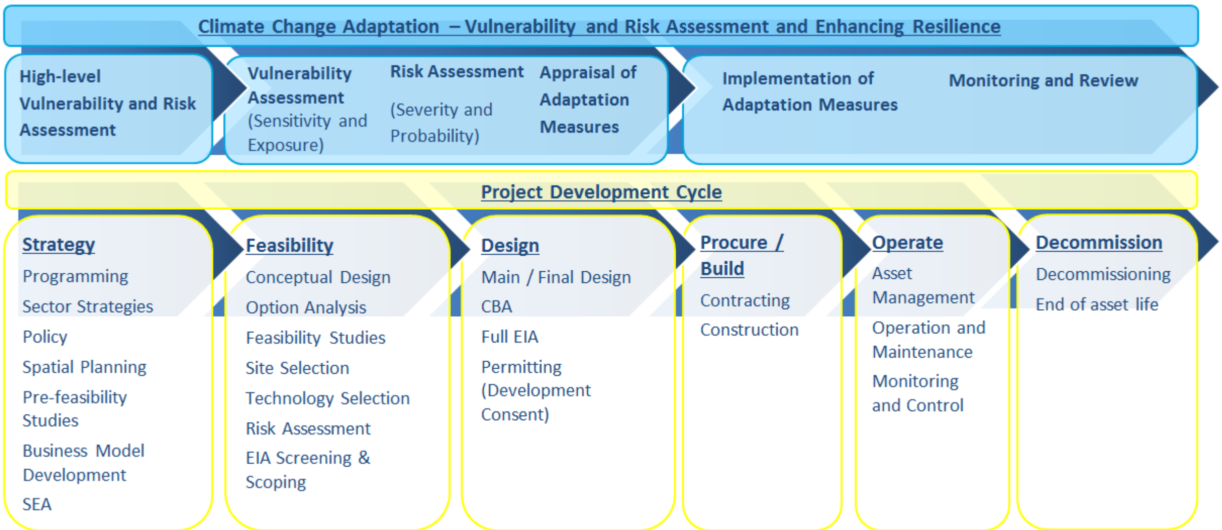
Assessment is not needed. On the contrary it means that the process is even more important in order to ensure success of the project and avoid maladaptation.

Basic Requirements of Climate Adaptation Vulnerability and Risk Assessment

Climate Adaptation and the Project Development Process

The diagram below shows the typical phases of project development and how climate adaptation is relevant to all project phases.

Figure 1: Integrating Climate Change Adaptation into the Project Development Process



While the project development process is usually depicted as a linear process, the reality is not so straight forward. Projects do not necessarily transition smoothly from phase to phase, and may become stalled at a certain phase, or may be sent back to earlier stages. This is true also of the Climate Adaptation Vulnerability and Risk Assessment process; some phases may be undertaken in more detail than others or may need reiteration. It is important that the Climate Adaptation Vulnerability and Risk Assessment process is integrated into the existing process development processes, which may include, inter alia, pre-feasibility and feasibility studies, audits, technical assessments, risk assessments, or environmental and social due diligence.

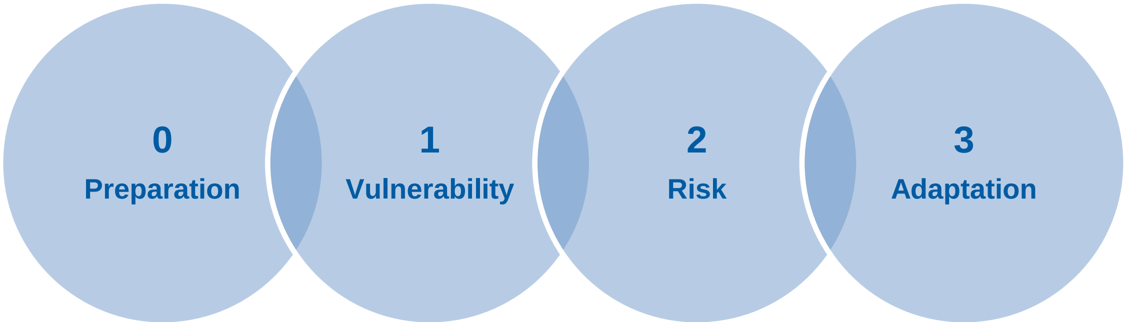
Pre-Project Context – The Strategic Context

Before entering into the traditional project development stages (Feasibility, Option Analysis, Design, Procure and Build, Operate, Decommission), much work will have already been undertaken at the Strategic stage. This is where bigger decisions will have been made about what is being developed and why. This information should come from a strategy and/or plan, where climate change considerations have already been taken into account through a high-level vulnerability and risk assessment. At the project level, it is important to know this information and to understand how the decisions were taken.

Tasks at the Project Level

Climate Adaptation Vulnerability and Risk Assessment is the process of managing climate adaptation considerations in developing a project and improving the resilience of the project; it is not to be considered a product or a report. In relation to project development, the process starts from the pre-feasibility / inception stage and should be integrated into all subsequent stages of project development, including feasibility studies, option analysis and design. The results of the assessment should be used to inform decision making as the project develops.

The process can be broken down into three main tasks (These could also be thought of as stages, steps or building blocks in the assessment process), plus the pre-assessment preparatory stage of setting the correct boundaries for the assessment:



Task 0: Preparation	aims to set the foundations for the assessment and ensure that it is adequately scoped;
Task 1: Vulnerability	considers which climate hazards the project is most vulnerable to as a result of its components and location;
Task 2: Risk	considers the probability and severity of climate risks affecting the project;
Task 3: Adaptation	Intends to identify and appraise adaptation options and integrate the most suitable measures into the project, with the aim of increasing the project's resilience and adapting to climate change.

Task 0: Preparation

0 1 2 3

The aim of this task is to set the foundations for the assessment, understanding the background of the project, how the methodology will be undertaken and who should be involved. Establishing this information at the outset will mean that the assessment is adequately scoped and fit for purpose.

Sub-task 0.1: Project Context

What is the project?

First it is important to have a good understanding of the proposed project and its objective, including all ancillary activities necessary to support the project's development and operation.

To understand how the project may be at risk of current climate variability and future climate change, it is important to understand the project and all its various dimensions. Projects generally involve multiple ancillary activities and different components and they form a part of a larger system of infrastructure. An impact of climate change on any one of those activities or components may have a debilitating effect on the success of the project. It is therefore also essential to understand the importance of the project within the overall context and determine the purpose of the project and how critical this infrastructure is. It is also important to know the proposed life span of the project and/or its components.

Depending on the complexity of the project it may be useful to break down this project description into discrete, manageable, parts such as the following in order to define possible impacts of climate change on each of these parts:

- The physical infrastructure itself (**Assets**);
- How the infrastructure will work, including operations and maintenance (**Processes**);
- Anything the project may be dependent on to function correctly, for example energy supply, water use, transport links, others (**Inputs**);
- The purpose of the project and what it delivers (**Outputs**);
- How the project fits into a larger system of infrastructure or planning network (**Interdependencies**).

Sub-task 0.2: Methodology

How is the assessment undertaken?

The methodology applied in the assessment needs to be explained in detail and in a logical and clear manner so that it is understandable how the assessment will be (or has been) executed and what are the limits of its reliability.

The approach can be quantitative; using scoring matrices for the assessment of vulnerability and risks, or qualitative; taking a more descriptive approach to the assessment.

The methodology description should explain at what project development stage this Vulnerability and Risk Assessment was undertaken; whether the assessment and consideration of climate adaptation has been undertaken throughout the development of the project or has been applied in a more audit like fashion at the end of the design (this may be the case for the more mature projects).

This description of methodology should explain the sources of information used in the assessment. Specifically, the assessment requires consideration of current and future relevant climate risks which needs to be based on robust and authoritative forecasts and predictions, including climate scenarios. Sources and references should be given (Annex I provides some examples of such data sources).

It is also important to establish if there are any applicable national laws and/or international guidelines and standards that need to be observed in the undertaking of the assessment.

Sub-task 0.3: Stakeholders

Who is involved?

Clarify the responsibilities and roles of all involved in or associated with the Vulnerability and Risk Assessment, including relationships to the other specialist studies being undertaken (e.g. EIA, SEA, CBA, etc.).

It is important to identify who should do the assessment, who should lead the process and who else should be involved. The assessment should be undertaken by people involved in the project with knowledge of the projects components, the local area and the historical experience. It should be undertaken by a team of different specialists with varying view-points, not in isolation. This assessment process should be led by a dedicated team member; often one of the existing team members will be the most suitable, for example the project engineer. For specific issues it may be necessary to hire dedicated consultants with expertise in climate change adaptation to inform the process.

In addition to those undertaking the assessment it is important to involve other stakeholders through consultation and joint discussions. It is useful to have a clear stakeholder engagement plan and to identify key points in the assessment process when these stakeholders should be involved. Such a plan should identify who should be involved (e.g. authorities and technical institutes, construction and operational departments, local residents, etc.), when (e.g. during vulnerability screening, during risk assessment, for identification and assessment of adaptation options, all stages, etc.) and how (through workshops, public forums, interviews, etc.). This is essential in order to fully understand the local and historic background of the project and to ensure that the ongoing management of the project takes climate change into consideration.

Task 1: Vulnerability Assessment

0 1 2 3

The aim of this task is to understand which climate hazards the project may be vulnerable to, and to screen hazards in or out of the more detailed risk assessment.

Vulnerability of a project is a combination of two aspects: 1) how sensitive the project's components are to climate hazards (sensitivity) and, 2) the probability of these hazards occurring at the project location now and in the future (exposure). These two aspects can be assessed in detail separately or considered in combination. The order of these two sub-tasks depends on when in the project development cycle the assessment is undertaken, in reality they will often be done in parallel. If the location of the project is already known then some site specific climate hazards can already be ruled in or out of exposure, whilst if the technology of the project is already selected some of the specific climate hazards can be considered relevant or not in terms of the sensitivity analysis.

Sensitivity ✖ Exposure = Vulnerability

When considering a changing climate, the key changes are seen in the following climatic factors (these are also referred to as primary climate drivers):

- **Temperature** – changes in average temperatures and the frequency and magnitude of extreme temperatures;
- **Precipitation** (rain, snow, etc.) – changes in average precipitation and the frequency and magnitude of extreme precipitation events;
- **Sea level** – change in relative sea level;
- **Wind speeds** – changes in average wind speeds and maximum wind speeds;
- **Humidity** – changes in the amount of water vapour in the atmosphere;
- **Solar radiation** – changes in the energy from the sun.

Changes in these factors result in a diverse set of climate hazards that may impact on a project. Examples of potential climate hazards that are recommended to be considered in a vulnerability assessment are listed in Table 2. This is an extensive but not exhaustive list. Determining whether the hazards are relevant to the project is dependent on "sensitivity" and "exposure".

Table 2: Examples of Potential Climate Hazards to Consider

Climate Hazard	Description
Average air temperature increase	Increases in average temperatures over time
Extreme temperature occurrences (including heat waves)	Changes in the frequency and intensity of periods of high temperatures, including heat waves (periods of extremely high maximum and minimum temperatures)
Average rainfall change	Trends over time of either more or less precipitation (rain, snow, hail, etc.)
Extreme rainfall events	Changes in the frequency and intensity of periods of intense precipitation
Water availability	The relative abundance or lack of water

Climate Hazard	Description
Water temperature	Changes in the temperature of surface and ground water
Flooding (coastal and fluvial)	Flooding from the sea or from rivers
Seawater temperature	Changes in the average sea surface water temperature
Relative sea level rise	Caused by a combination of increased sea temperatures (expanding the volume of water) and melting ice sheets and glaciers
Storm surges	An abnormal rise of seawater generated by a storm, over and above the predicted astronomical tides
Saline intrusion	Movement of salt water into freshwater aquifers, which can lead to contamination of drinking water sources and other consequences
Ocean salinity	Changes in the concentrations of salt in seawater
Ocean pH	Acidification of the oceans
Coastal erosion	The wearing away of land and the removal of beach or dune sediments by wave action, tidal currents, wave currents, drainage or high winds
Soil erosion	The process of removal and transport of soil and rock by weathering, mass wasting, and the action of streams, glaciers, waves, winds and underground water
Ground instability/ landslides/ avalanche	Ground instability: movement of the ground; Landslide: A mass of material that has slipped downhill by gravity, often assisted by water when the material is saturated; Avalanche: a rapid flow of snow down a sloping surface
Soil salinity	Changes in the salt content in the soil
Average wind speed	Changes in average wind speeds over time
Maximum wind speed	Increases in the maximum force of gusts of wind
Storms (tracks & intensity)	Changes in the location of storms, their frequency and intensity
Humidity	Changes in the amount of water vapour in the atmosphere
Droughts	Prolonged periods of abnormally low rainfall, leading to shortages of water
Dust Storms	A storm of strong winds and dust-filled air
Wild fire	Unwanted, unplanned and damaging fires such as forest fires and fires of shrub and grasslands
Air quality	Increased concentrations of pollutants locally, including incidents such as smog
Urban heat island effect	Cities or metropolitan areas which are significantly warmer than the surrounding rural area, caused by higher absorption of solar energy by materials in the urban area, such as asphalt
Growing season length	Changes in the seasons during which certain flora species grow, either longer or shorter
Solar radiation	The energy emitted by the sun from a nuclear fusion reaction that creates electromagnetic energy
Cold spells	Prolonged periods of extremely cold temperatures
Freeze-thaw damage	Repeated freezing and thawing may cause stress damage to structure such as concrete
Melting permafrost	Melting of previously permanently frozen soil

Sub-task 1.1: Sensitivity

Project specific factors

Different types of projects are susceptible to different climate hazards. Based on the information gathered in task 0.1 about the project context, it is possible to understand how the project functions, how critical the project is within its wider network or system, and therefore which hazards are most relevant and why. For example, a maritime port may be highly sensitive to sea level rise, whilst the cooling for a thermal power plant may be highly sensitive to river droughts.

Given the wide range of project types, the onus is on technical engineers and other specialists to identify the climate hazards that could be important or relevant.

If the project description has described the project in terms of various components this sensitivity analysis should be performed per project component. The analysis can be relatively basic (identifying whether the project is sensitive or not to each hazard) or more detailed (for example the analysis could identify hazards with high, medium, low or no sensitivity).

The analysis of sensitivity does not take into account any considerations about the site of the project; it is purely based on the project specific factors, irrelevant of the location, e.g. what the project is and how it works. If the sensitivity analysis is performed early in the project development process, it can help to support the option analysis process regarding the site location. By understanding the sensitivities of the project the most appropriate location can then be identified.

Sub-task 1.2: Exposure

Location specific factors

This part of the assessment looks at how the location of the project is likely to be exposed to specific climate hazards both now and in the future.

The analysis of exposure to climate hazards should consider both the current climate variability and future climate change.

For current climate variability this can be determined by considering the available data for the recent history of the project location (or locations of project alternatives) and where there have been incidences of hazards such as flooding, drought, high temperatures or coastal erosion, etc.

With regard to future climate change, the assessment should take into consideration available relevant and reliable projections and forecasts, covering the proposed physical life span of the project and/or its components. References and sources need to be provided (Annex I provides some examples of such data sources).

Data from, at least, the national level should be used. For most projects, the more local and specific the data is, the more accurate and relevant the assessment will be. Additionally, some information will need to be site-specific, such as the incidence of flooding and landslides when considering site options.

Sub-task 1.3: Vulnerability

The vulnerability assessment combines the sensitivity and exposure analysis to determine which climate hazards are relevant for the project as a result of the project type and its location.

If the sensitivity and exposure assessments were undertaken in a more detailed manner, identifying high, medium and no sensitivities and exposures, then the resulting vulnerability assessment will be more informative, providing a ranking of the levels of vulnerability for each hazard. The more detailed the assessment is, the more useful the results will be in informing decision making at the various project development phases.

The vulnerability assessment can also be considered as a risk screening stage, as it aims to identify which are the most relevant hazards to which the project is vulnerable. Those are the hazards which are then assessed in further detail at the risk assessment stage.

NOTE:

If the vulnerability assessment concludes that the project is not vulnerable to any climate hazards, and that conclusion has been duly justified, there may be no need to undertake further risk assessment.

Task 2: Risk Assessment

The aim of this task is to consider the likelihood and severity of each risk affecting the success of the project.

The vulnerability assessment identified the hazards that the project may be vulnerable to. These hazards are then assessed in more detail to understand the level of risk they pose to the project, its objectives and its components.

The level of detail, which the risk assessment goes into, depends on the scale of the project (in terms of the type, its size and relative importance), and the project development stage at which the assessment is undertaken. For example, early in the project cycle the assessment is likely to be more high-level than a risk assessment undertaken at the later stages.

In order to understand the risks in more detail, it is important to understand the probability of the risk occurring (how likely it is to happen) and the severity of the impact if it did occur (the consequence of the risk).

Probability ✖ Severity 〓 Risk

Sub-task 2.1: Probability

Likelihood of impact

This part of the risk assessment looks at how likely the identified climate hazards are to occur within a given timescale, e.g. the lifetime of the project.

It is important that the methodology (as described in sub-task 0.2) sets out what sort of scale will be used to assess probability and that this is explained clearly. The same scale should be used throughout the assessment. This scale can cover 3 levels of likelihood (for example: Unlikely, Possible, Likely) or 5 levels (for example: Rare, Unlikely, Possible, Likely, Almost Certain) or otherwise. For example the scale used in the risk assessment of the CBA Guide could be used for consistency with the wider risk assessment exercise.[a] The scale needs to be explained and each category needs to have a description about what that means (for example what is understood by "likely").

For some climate risks there can be considerable uncertainty about the likelihood of their occurrence. In such circumstances the assessment team should use their best judgement, based on currently available data, statistics and knowledge, and in consultation with relevant stakeholders (as described in Sub-task 0.3). This should include references to national, regional and/or local climate data and projections.

An additional consideration should be given to how the likelihood of the climate risks may change over time. For instance, increases in average temperatures caused by climate change may significantly raise the likelihood of certain climate risks during the lifespan of a project.

A general example of a probability scale with five levels of probability is provided in Table 3.

[a] See http://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/cba_guide.pdf. Section 2.9.1 (p.70) includes scales for probability, severity and resulting risk level.

Table 3: Example Scale for Assessing the Probability of Hazards affecting the project

	1	2	3	4	5
	Rare	Unlikely	Possible	Likely	Almost Certain
Meaning:	Highly unlikely to occur	Given current practices and procedures, this incident is unlikely to occur	Incident has occurred in a similar country / setting	Incident is likely to occur	Incident is very likely to occur, possibly several times
OR					
Meaning:	5% chance of occurring	20% chance of occurring	50% chance of occurring	80% chance of occurring	95% chance of occurring

Sub-task 2.2: Severity

Magnitude of impact

This part of the risk assessment looks at what would happen if the identified climate hazard did occur, what would be the consequences. This should be assessed on a scale of severity per hazard. This is also referred to as magnitude.

Again, it is important that the methodology sets out the scale for assessing severity and that this is explained clearly. This scale can cover 3 levels of severity (for example: low, medium, high) or 5 levels (for example: insignificant, minor, moderate, major, catastrophic) or otherwise. The scale needs to be explained in relation to the project. Each category needs to have a description about what that means for the project (for example: what "Catastrophic" means). The consequences should be considered in terms of the physical assets and its operations, health and safety, environmental impacts, social impacts, financial implications, and reputational risk. The assessment needs to consider the adaptive capacity of the project and the system in which it operates, e.g. how well the project can cope with the impact and how much risk it can tolerate. It also needs to consider how fundamental this infrastructure is to the wider network or system and whether there would be additional wider scale impacts and cascading effects.

A general example of a severity scale with five levels of severity is provided in Table 4.

Table 4: Example Scale for Assessing the Severity of Consequence

	1	2	3	4	5
	Insignificant	Minor	Moderate	Major	Catastrophic
Meaning:	Minimal impact that can be mitigated through normal activity.	An event which effects the normal project operation, resulting in localised impacts of a temporary nature.	A serious event requiring additional actions to manage, resulting in moderate impacts.	A critical event requiring extraordinary action, resulting in significant, widespread or long term impacts.	Disaster with the potential to lead to shut down or collapse of the asset / network, causing significant harm and widespread long term impacts.

Sub-task 2.3: Risk

Having assessed the severity and probability of each hazard occurring, the significance level of each potential risk can be determined through a combination of the two factors. The risks can be plotted on a risk matrix to identify the most significant risks and those where future action is needed in terms of adaptation measures. Table 5 presents an example of how such a risk matrix may look based on the example probably and severity scales in Table 3 and Table 4 respectively.

Table 5: Example Risk Matrix

	Probability	Rare	Unlikely	Probable	Likely	Almost Certain
Severity		1	2	3	4	5
Insignificant	1	1	2	3	4	5
Minor	2	2	4	6	8	10
Moderate	3	3	6	9	12	15
Major	4	4	8	12	16	20
Catastrophic	5	5	10	15	20	25

Negligible Risk
Low Risk
Medium Risk
High Risk
Extreme Risk

Whilst Table 5 presents an example of a risk matrix, the judgement as to what is an acceptable level of risk, what is significant and what not, is the responsibility of the expert team undertaking the assessment, specific to the circumstances of the project. Whatever categorisations are used, these need to be defendable, clearly defined and described in a clear and logical manner. For example, it may be considered that a catastrophic event, even if it is rare or unlikely, still represents an extreme risk to the project as the consequences are so severe.

It may be beneficial to agree on a national and/or sector basis some standardisation in the consideration of significance of risks, in order to have consistency in the approaches used between similar projects or in similar locations.

It is recommended to integrate the climate change adaptation risk assessment into the overall risk assessment for the project, so that this can be addressed holistically and not as a stand-alone assessment. Also it is recommended to start the risk assessment process at the earliest opportunity in project planning, as if risks are identified earlier, they can be more easily and cost effectively managed and/or avoided.

NOTE:

If the risk assessment concludes that there are no significant risks to the project from climate change, and that conclusion has been duly justified, there may be no need to undertake further assessment or to identify adaptation measures.

Task 3: Adaptation

0 1 2 3

Sub-task 3.1: Identification and Appraisal of Adaptation Options

If the risk assessment concludes that there are significant risks to the project from climate change, these risks need to be managed and reduced to an acceptable level. For each significant risk identified, various adaptation measures should be proposed and assessed.

Such measures can include:

- Structural measures – a physical change to the design of the project or its location;
- Non-structural measures – also known as soft measures, these include operational and maintenance measures plus relevant monitoring. They are more about how the infrastructure is managed in the long-term;
- Risk management – assessing whether the risks can be accepted and managed.

Different adaptation options should be assessed to determine the right measure or mix of measures which can be implemented to reduce the risk to an acceptable level.

The determination of “acceptable level” is dependent on the expert team undertaking the assessment and the risk that the project promoter is prepared to accept. For example there may be elements of the project which are considered to be non-essential infrastructure where the costs of adaptation measures outweigh the benefits of avoiding the risks and the best option could be to allow the non-essential infrastructure to fail under certain circumstances. This is a form of risk management.

Given that there is a lot of uncertainty in future forecasts for climate change hazards, the key is to identify adaptation solutions which will perform well in the current situation, as well as in the future scenarios. Such measures are often termed low or no regret options.

It may also be appropriate to consider flexible/adaptive measures such as monitoring the situation and only implementing physical measures when the situation reaches a critical threshold. This option may be particularly relevant when climate forecasts show high levels of uncertainty. This solution is appropriate as long as the thresholds or trigger points are clearly defined and the future proposed measures can be proven to address the risks sufficiently.

Sub-task 3.2: Integration of Adaptation Measures

The preferred measures need to be integrated into the planning and design of the project. It is important to demonstrate that they are not just suggested recommendations but that they will actually be included in the final project design and operation. Clear responsibilities for their implementation should be assigned and, whenever possible, the costs of these measures should be identified.

It is important to avoid maladaptation. Maladaptation is when the measure turns out to be more harmful than helpful, causing negative secondary cascading effects, or measures which are ineffective. For example flood protection measures which may protect one particular site but result in increased flooding elsewhere and create long term changes in the flow regime. It is therefore important to think about the whole system within which the project exists.

Sub-task 3.3: Residual Risk Assessment

The adaptation measures need to be proven to reduce the risk to an acceptable level. Therefore the level of risk needs to be reassessed for the project including its adaptation measures. It is important to note that there will always be some level of underlying residual risk, but that this should not be excessive or significant.

The same process of risk assessment, as outlined in Task 2 should be applied to assess the residual risk after implementation of adaptation measures. For a given probability of occurrence of an identified climate hazard, the adaptation measures are expected to reduce the severity of the related impact.

If climate adaptation considerations have been integrated into the full project development cycle from the early concept stages through to detailed design then it may not be possible to identify specific measures, as the project development should have avoided risks inherently or built in adaptation measures as part of the overall design. In which case, the tasks of Risk Assessment, Identification, Appraisal and Integration of Adaptation Options, and Residual Risk Assessment (Tasks 2 and 3), would be undertaken simultaneously. However, if the assessment is undertaken at the later stages of project development, in a more audit-like approach, then the measures will be more evident as “add-on” measures aiming to adapt an already developed project.

In either case the assessment should be concluded when it can be proven that the level of risk is at an acceptable level.

Sub-task 3.4: Ongoing Monitoring

As a follow-up to the assessment and as good management practice, ongoing monitoring should be undertaken throughout the operational lifetime of the project. Such monitoring is required for two reasons:

- Monitoring of the projects operation, its overall success and the success of the specific adaptation measures. To understand how accurate the assessment was and to inform future assessments and projects.
- Monitoring of the identified climate hazards and potential impacts to the project, to identify whether specific trigger points or thresholds are likely to be reached, indicating the need for additional adaptation measures to be implemented.

Conclusions and Summary

This document aims to provide an overview of the basic principles of the Climate Change Adaptation Vulnerability and Risk Assessment process. It does not seek to provide a specific methodology or step-by-step instructions for how to undertake such assessments.

In general the basic principle is that project developers should identify which climate hazards the project is vulnerable to (Task 1), assess the level of risk (Task 2) and integrate adaptation measures to reduce that risk to an acceptable level (Task 3). The assessment should be a process which is started as early as possible, is integrated into the normal project development cycle and not prepared only as a stand-alone assessment.

The assessments should be based on sound data and forecasts which cover current climate variability and future climate change.

The information provided by developers should demonstrate a clear and logical approach to incorporating climate change adaptation considerations into the normal project development cycle.

Annex I: Example Information Sources

European / International Level

A certain level of general information can be obtained from International and European sources, such as:

European Climate Adaptation Platform (Climate-ADAPT)
http://climate-adapt.eea.europa.eu/

European Commission Joint Research Centre
https://ec.europa.eu/jrc/en/research-topic/climate-change

European Environment Agency
https://www.eea.europa.eu/themes/climate-change-adaptation

Copernicus Climate Change Service (C3S)
https://climate.copernicus.eu

World Bank: Climate Change Knowledge Portal
http://sdwebx.worldbank.org/climateportal/

The Nature Conservancy: Climate Wizard
http://www.climatewizard.org/

Intergovernmental Panel on Climate Change: Data Distribution Centre
http://www.ipcc-data.org/

Member State Level

The primary source of information for project specific assessments should be the relevant authorities at National and/or Regional level – such as environmental authorities, hydro-meteorological institutes, etc.

Information can be obtained from the National Risk Assessments, the National and/or Regional Adaptation Strategies and related Action Plans which are either finalised or under preparation for each Member State. Many of these Risk Assessments, Strategies and Plans have identified key sensitivities by sector which can be used to inform high-level vulnerability assessments.

Additional information for each country can be found on the European Climate Adaptation Platform: Climate-ADAPT http://climate-adapt.eea.europa.eu/.

Each Member State prepares National Communications to the UNFCCC (United Nations Framework Convention on Climate Change), the most recent version of which is the 6th National Communications (at the time of writing this note). These reports cover both Mitigation and Adaptation aspects in terms of what each country is doing to implement the Convention. They can be found here:
http://unfccc.int/national_reports/annex_i_natcom/submitted_natcom/items/7742.php.
This information is often very high level, having been prepared for whole countries.

For more site specific and local information the relevant authorities should be consulted.

Annex II: References to Further Guidance and Industry Standards on Climate Resilience

European Commission DG Climate Action – Non-paper Guidelines for Project Managers: Making vulnerable investments climate resilient
https://ec.europa.eu/clima/sites/clima/files/adaptation/what/docs/non_paper_guidelines_project_managers_en.pdf

European Commission DG Climate Action – 2016 Publication – Climate Change and Major Projects
https://ec.europa.eu/clima/sites/clima/files/docs/major_projects_en.pdf

European Financing Institutions Working Group on Adaptation to Climate Change (EUFIWACC) – Paper on Integrating Climate Change Information and Adaptation in Project Development
https://ec.europa.eu/clima/sites/clima/files/docs/integrating_climate_change_en.pdf

European Commission DG Regional and Urban Policy – 2014 Guide to Cost-Benefit Analysis of Investment Projects
http://ec.europa.eu/regional_policy/sources/docgener/studies/pdf/cba_guide.pdf

European Commission DG Environment – 2013 Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment
http://ec.europa.eu/environment/eia/pdf/EIA%20Guidance.pdf

European Committee for Standardization (CEN) and European Committee for Electro-technical Standardization (CENELEC)
http://www.cencenelec.eu/standards/sectors/climatechange/pages/default.aspx

International Organisation for Standardisation (ISO)
http://www.iso.org/iso/home/news_index/iso-in-action/climate_change.htm

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