European Investment Bank The EU bank

Environmental, Climate and Social Guideline on Hydropower Development

Contents

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List of Acronyms

CAPEX – Capital Expenditure

CIA – Cumulative Impact Assessment

CIS – Common Implementation Strategy

EIA – Environmental Impact Assessment

EIB - European Investment Bank

EFR – Environmental Flow Release

EFTA – European Free Trade Association

E(S)IA – Environmental (and Social) Impact Assessment

ESMS – Environmental and Social Management System

EU – European Union

FI – Financial Intermediary

GHG – Greenhouse Gases

HMWB – Heavily Modified Water Body

ICOLD – International Commission on Large Dams

IWRM – Integrated Water Resources Management

NGO – Non-Governmental Organisation

POE – Panel of Experts

RBMP – River Basin Management Plan

SEA – Strategic Environmental Assessment

UNECE – United Nations Economic Commission for Europe

UNESCO – United Nations Educational, Scientific and Cultural Organisation

WFD – Water Framework Directive

1. Introduction

i. Preamble

Hydropower is currently the largest source of renewable power worldwide[1], and therefore an important contributor to low-carbon "clean development". However, the development of hydropower has been extensively criticised over many years because of its potential negative environmental and social impacts. The impacts of hydropower projects are often cumulative over large parts of river basins, affecting sensitivities such as biodiversity sites and other water uses; outside the European Union and candidate countries, issues such as resettlement, social problems resulting from population influx, and disturbance of critical habitats are more likely to occur.

This guideline sets out the EIB's Environmental, Climate and Social requirements for investments in hydropower projects, establishing sector-specific standards and criteria which promoters must meet. It also summarises best practice recommendations to integrate social, biodiversity, natural resources management and climate considerations into hydropower projects. It is written for use by hydropower promoters, who should take the requirements and recommendations into account from the early stages of the Project Development Cycle, preferably during the pre-feasibility stage. The guideline will also serve as a reference for other stakeholders with interests in hydropower projects.

The term "hydropower project" is used to refer to rehabilitated, refurbished or new hydropower facilities comprising *inter alia*, and where relevant, dam and reservoir, water intake and transmission structures, power plant, all civil works, and electrical and electro-mechanical equipment from water collection points until the delivery point to the grid, as well as any associated infrastructure.

EIB (and where appropriate its financial intermediaries) will treat potential hydropower investments on a case-by-case basis, assessing the features of the project and information on the biophysical and socioeconomic context within which the project would be constructed, rehabilitated or refurbished, and subsequently when it is operational and, if appropriate, ultimately decommissioned. EIB will promote best practice mitigation of environmental and social impacts and risks. It supports the EU approach to sustainability in compliance with EU legislation and EIB's *Environmental and Social Standards*, whilst also drawing on wider international best practice as appropriate.

ii. Applicability of Guideline

This guideline is applicable to all types of small and large hydropower projects,[2] including run of the river, storage, pumped storage and diversion. It also applies to associated infrastructure which may include any of the following.

- Access roads (temporary and permanent).
- Construction workshops, offices and laydown areas.
- Permanent offices and staff accommodation.
- Security posts and fencing.
- Coffer dams and diversion channel(s) to divert water flows during construction.
- Quarries and borrow pits.

[1] Renewable Energy Policy Network for the 21st Century (REN21): *Renewables 2017 Global Status Report* http://www.ren21.net/gsr-2017/

[2] See Box 1 regarding definitions of hydropower project scale.

- Accommodation for construction workforce (construction camp).
- Transmission lines.

The guideline is applicable to all financial products provided by EIB to promoters in the hydropower sector, including on-lending to financial intermediaries who will ensure that EIB's *Environmental and Social Standards* and the requirements in this guideline are applied fully.

Box 1 Benchmarks for Hydropower Project Scale

There are a number of different ways used to classify the scale of a hydropower project depending upon the particular context or purpose of the classification. One simple and commonly used approach is to classify a scheme based upon its installed capacity (in megawatts). However, in some circumstances more specific definitions have been adopted as follows.

- In the context of dam safety planning, the International Commission on Large Dams (ICOLD) definition of a large dam is used, as greater than 15 metres in height, or between 5 and 15 metres with a reservoir greater than 3 million cubic metres in volume.
- In the context of storage schemes, a large reservoir is taken to be one with a capacity in excess of 10 million cubic metres (the threshold used for Annex I dam storage projects under the EU EIA Directive).
- In the context of potential environmental impacts, a significant Degree of Regulation (DOR) in the river system is taken as greater than 5%, where DOR is defined as the ratio between the total artificial storage capacity (including any upstream reservoirs) and the average annual flow volume at the project site.[1]

It is recognised that the above benchmarks are only indicative, and that other factors (e.g. surface area) can be equally or more important in assessing the effects of a scheme. This is discussed where relevant within the document.

[1] Threshold developed by TNC to represent conditions whereby significant environmental (and associated ecosystem services) impacts generally start to occur (The Power of Rivers: Finding a balance between energy and conservation in hydropower development, TNC, 2015)

The EIB provides financing to financial intermediaries (FIs) in the form of loans, equity and debt participations, and guarantees. Any hydropower project appraisal carried out by a financial intermediary will be subject to approval by EIB in accordance with the requirements set out in this guideline and the EIB's *Environmental and Social Standards*.

EIB will require that FIs provide answers to the questions listed in Box 2 for all potential investments in hydropower projects at the very start of consideration of the loan (pre-allocation). FIs will liaise with final beneficiary clients to develop responses. This information will be used to differentiate between: (a) projects for which appraisal may be delegated to the FI and validated by EIB according to the procedures agreed between EIB and intermediary; and (b) "sensitive" projects for which environmental and social appraisal shall be the responsibility of EIB.

Box 2 Hydropower-specific Questions for Intermediaries

- Does the project involve any physical resettlement or, if outside the EU/EFTA/candidate countries, either physical or economic resettlement?
- Is there a Water Framework Directive-compliant River Basin Management Plan, or equivalent, for the river where the project will be implemented? Is the project shown in the plan, or planned to be included in the next revision?
- Is the project site situated within or in close proximity (within 20 km) of any Natura 2000 areas (or outside EU and candidate countries, those defined under the Emerald Network[1] or other area designated nationally or

internationally for nature protection purposes) and/or are there any such areas downstream of the project site within the same river basin?

- Does the project either:
  - Create additional storage volume in excess of 10 million cubic metres? [2]
  - Introduce a Degree of Regulation (DOR) into the river system greater than 5%, where DOR is defined as the ratio between the total artificial storage capacity (including any upstream reservoirs) and the average annual flow volume at the project site? [4]

[1] Sites of Special Conservation Interest in the Emerald Network (see https://www.coe.int/en/web/bern-convention/emerald-viewer)
[2] Threshold used for Annex I dam storage projects under the EU EIA Directive
[4] Threshold developed by TNC to represent conditions whereby significant environmental (and associated ecosystem services) impacts generally start to occur (*The Power of Rivers: Finding a balance between energy and conservation in hydropower development*, TNC, 2015)

If it is deemed that environmental and social appraisal of the project shall fall under EIB's direct responsibility, this may entail appointment of an appropriately qualified consultant with sole duty of care to EIB staff, and may also require establishment of an independent panel of environmental and social experts. Otherwise, the involvement of an environmental and social consultant and/or an independent panel of environmental and social experts will be at the FI's discretion, taking account of its responsibility to comply with EIB's Environmental and Social Standards, the requirements set out in this guideline, and all other applicable requirements.

Detailed technical aspects of hydropower project design, construction and operation are not within this guideline's scope as they are covered elsewhere in guidance provided by professional associations and design standards; where appropriate these are referenced in this document, and details are provided in the "*Key References*" section at the end of the document.

iii. Policy Environment

EIB's lending strategy and objectives are underpinned by the EU's fundamental principles of sustainable development, in particular the protection and enhancement of biodiversity, actions to counter climate change and promotion of human rights. The EIB advocates the promotion of multi-purpose schemes that provide sustainable benefits to the communities they serve. Site selection for hydropower projects can benefit from the early assessment of key potential impacts and risks, including eutrophication, greenhouse gases, cultural heritage and resettlement.

EIB implements the EU approach to environmental and social issues, and its sustainability policies and principles are defined as requirements in the ten EIB *Environmental and Social Standards*[3] which are applicable to all EIB financial products, as is EU legislation (see below); these requirements are supplemented and supported by the hydropower-specific requirements and recommendations in this guideline.

1. Assessment and Management of Environmental and Social Impacts and Risks
2. Pollution Prevention and Abatement
3. Biodiversity and Ecosystems
4. Climate-related Standards
5. Cultural Heritage
6. Involuntary Resettlement
7. Rights and Interests of Vulnerable Groups
8. Labour Standards
9. Occupational and Public Health, Safety and Security
10. Stakeholder Engagement

[3] See the *EIB Environmental and Social Handbook,* http://www.eib.org/attachments/strategies/environmental_and_social_practices_handbook_en.pdf

The EU policy framework is primarily defined by the most relevant EU Directives. These include the following.

- *SEA Directive 2001/42/EC.*
- *EIA Directive 2011/92/EU as amended by 2014/52/EU.*
- *Water Framework Directive 2000/60/EC (see Box 3).*
- *Habitats Directive 92/43/EC.*
- *Birds Directive 2009/147/EC.*

The EIA directive is enshrined within EIB Standard 1 and will (as with all EU legislation) apply within the EU member states and candidate countries.[4] The principles of EU legislation will be followed in other countries. Implementation of these directives is supported by a number of EU guidance documents, including several relating to the EIA Directive[5] and the Habitats Directive, and the following guidance which has specific relevance to hydropower projects.[6]

- *WFD CIS Guidance Document 36: Exemptions to the environmental objectives according to WFD Article 4(7) (2017).*
- *Climate Change and Major Projects: Outline of the climate change related requirements and guidance for major projects in the 2014-2020 programming period (EC DG CLIMA, 2016).*
- *WFD CIS Guidance Document 31: Ecological flows in the implementation of the Water Framework Directive (2015).*
- *WFD CIS Guidance Document 20: Exemptions to the environmental objectives (2009).*

Box 3 Hydropower and the Water Framework Directive

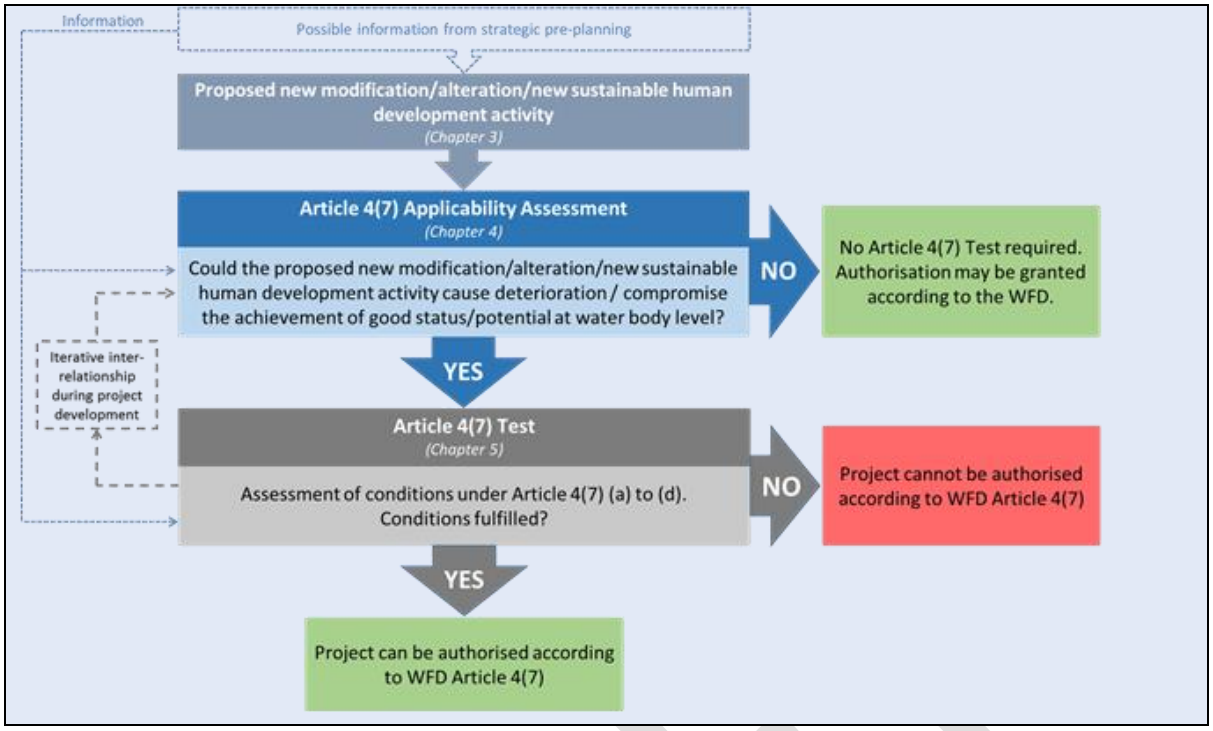
The EU Water Framework Directive (2000/60/EC) requires that hydropower projects support the achievement of good status in any affected water bodies (or good potential in HMWBs), and that no deterioration in status occurs unless an Article 4(7) exemption process has been met.

Under WFD Article 4(7), exemptions from achieving good status or potential for a water body can be applied by member states for new modifications and new sustainable human development activities. This can relate to new projects (e.g. new hydropower schemes) or to modifications to existing schemes. Article 4(7) requires that the reasons for modification or alterations leading to deterioration of status are set out and explained in the member states' RBMPs. It is generally assumed that a new hydropower plant will lead to a deterioration of good status and the procedure of Article 4(7) is generally followed.

In order to apply Article 4(7), a certain process has been agreed in the WFD Common Implementation Strategy.

a) All practicable steps are taken to mitigate the adverse impact on the status of the body of water;
b) The reasons for those modifications or alterations are specifically set out and explained in the river basin management plan required under Article 13 and the objectives are reviewed every six years;
c) The reasons for those modifications or alterations are of overriding public interest and/or the benefits to the environment and to society of achieving the WFD objectives are outweighed by the benefits of the new modifications or alterations to human health, to the maintenance of human safety or to sustainable development, and
d) The beneficial objectives served by those modifications or alterations of the water body cannot for reasons of technical feasibility or disproportionate cost be achieved by other means, which are a significantly better environmental option.

[4] The EIA Directive requires assessment of hydropower projects: Annex 1 includes "dams and other installations designed for the holding back or permanent storage of water, where a new or additional amount of water held back or stored exceeds 10 million cubic metres"; Annex II includes: "dams and other installations designed to hold water or store it on a long-term basis (projects not included in Annex I)"; and "Installations for hydroelectric energy production".
[5] http://ec.europa.eu/environment/eia/eia-support.htm
[6] In addition to the EU guidance listed here, a *Guidance Document on the Requirements of Hydropower in Relation to Natura 2000* is currently being prepared by EC DG ENV. The guide is expected to be published in early 2018.



Other documents providing valuable examples of international best practice in sustainable development of hydropower are identified as appropriate in this guideline and listed under "*Key References*".

2. Environmental Issues and Impacts

The most significant potential environmental impacts and risks associated with hydropower projects are as follows.

- Loss or degradation of threatened, endangered or endemic species due to inundation or fragmentation of natural habitats, or interruption of migratory fish and other species.
- Loss or degradation of ecological (riverine, riparian and floodplain) habitats and associated livelihoods, or disruption of other water users due to the fundamental alteration of hydrological, morphological or water quality conditions downstream of the hydropower scheme.
- Reservoir water quality impairment and sedimentation, and associated issues such as eutrophication and proliferation of aquatic weeds, or accumulation of upstream pollutants (potentially including priority substances under EU Directive 2008/105/EC on Environmental Quality Standards).

The following summarises EIB's various requirements for the design and operation of hydropower projects in relation to the above issues. A central theme running through these requirements is the fulfilment of, or (for projects outside of the EU) alignment with the objectives of the EU WFD. In summary, these are to support the achievement of good status (ecological and chemical for surface water) in any project affected water bodies, and to ensure that no deterioration in status occurs unless an Article 4(7) exemption process has been met as described earlier in Box 3.

i. Natural Habitat and Biodiversity Degradation and Loss

Hydropower projects can potentially lead to the loss or degradation of natural ecosystems due to habitat fragmentation and isolation (e.g. of aquatic habitats in river reaches upstream and downstream of single or multiple impoundments in a system), or due to the fundamental alteration of downstream hydrological, morphological or water quality conditions (see below).

Storage-based hydropower projects can also lead to the permanent flooding of natural habitats due to inundation, especially where reservoirs are located in relatively inaccessible areas in upper watersheds. Even in the case of small, run-of-river hydropower projects where habitat loss may not be evident at the site level, there is potential for significant natural habitat loss or degradation at a cumulative scale since these types of projects are often found clustered within a single river basin or region.

EIB Requirements/Recommendations Natural Habitat and Biodiversity Degradation and Loss	Required	Recom-mended
1. All hydropower projects financed by EIB **must meet the Environmental and Social Standards, and more specifically *Environmental and Social Standard 3: Biodiversity and Ecosystems***. Opportunities for ecological restoration and enhancement should also be considered wherever possible in accordance with WFD objectives, for example with respect to hydropower rehabilitation projects.	✓	
2. For projects located in EU member states or candidate countries (depending on their transition agreements) that are likely to have a significant effect on one or more Natura 2000 sites (with the area of influence determined under condition 5 below), **an Appropriate Assessment must be included in the overall assessment in accordance with Article 6(3) of the Habitats Directive**.	✓	
3. For projects located outside the EU, and where EIB is not the lead investment partner, common approaches to **biodiversity conservation and management must be applied based upon good international practice** where this meets the requirements of EIB's own standards.	✓	
4. Notwithstanding the above, **EIB will not finance any projects that will have a potential measurable adverse impact on any UNESCO World Heritage Site.**	✓	
5. In all of the above cases, of key importance for hydropower projects is that **the assessment of potentially affected habitat must consider not just the footprint of the reservoir or project infrastructure (powerhouses, roads, transmission lines etc.), but also downstream flow and/or water quality effects**.	✓	
6. **Mitigation must follow the hierarchy principle**, whereby avoidance, minimisation and restoration measures are applied in that order of preference, with compensatory (e.g. offset) measures considered as a last resort. The single most effective mitigation measure for hydropower projects is the avoidance of biodiversity related impacts through careful and effective site selection at the strategic planning stage (see page 16).	✓	

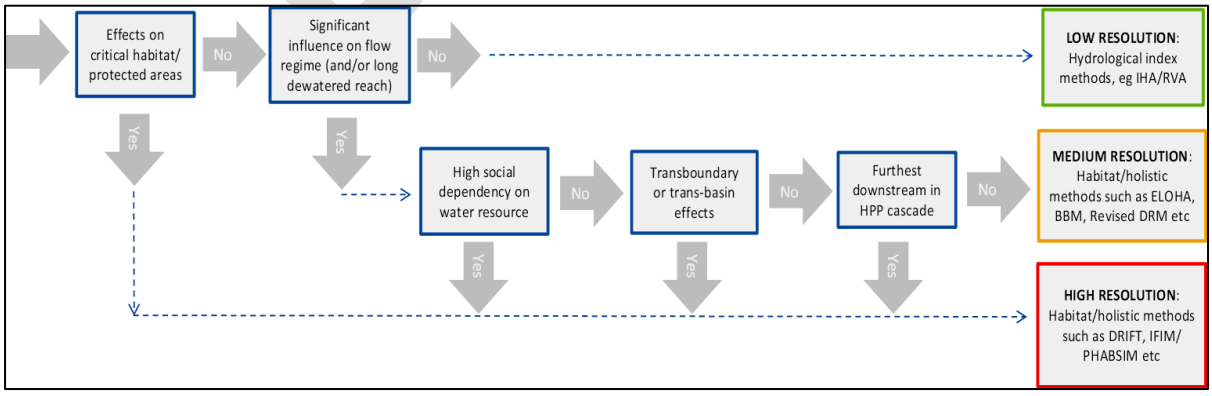
ii. Downstream Hydrology and Limnology (including Environmental Flows)

The impoundment and/or diversion of a river for hydropower generation can have a profound impact on the hydrology and limnology of the downstream river system, and thereby on its ecological status and any associated livelihoods. It can lead to changes in the magnitude and timing of flows, the quality and temperature of the water, and the sediment transport dynamics and associated morphology of downstream river, floodplain and estuarine systems.

Storage-based hydropower projects can have a particular impact on a river's natural flow equilibrium owing to the fact that reservoir releases are often made in response to patterns of power demand rather than natural hydrological cycles, sometimes with significant day-to-day, or even hour-to-hour, fluctuations in flow called 'hydropeaking'.

EIB Requirements/Recommendations Downstream Hydrology and Limnology	Required	Recom-mended
7. All hydropower projects financed by **EIB must assess and make provision for an appropriate downstream environmental flow release (EFR) and any additional mitigation measures that may be required (at a minimum these would normally include measures for fish passage) in order to maintain the current status of freshwater and estuarine ecosystems and support existing socio-economic uses of the water resource**. These measures must meet national legislative requirements, but in many cases will require additional features such as varying flow releases at different times of year in response to seasonal habitat requirements, or the periodic release of flood pulses (freshets) to promote downstream sediment or nutrient transport.	✓	
8. Any proposed mitigation measures to **adapt the EFR must be properly costed within the project design**, which may require flexibility to incorporate future adjustments as part of an adaptive EFR strategy.	✓	
9. The method used to determine the EFR should at a minimum be consistent with national standards or approaches, but **must be appropriate to the scale and complexity of the project and risks involved (e.g. presence of protected areas, critical habitats, high water-use intensity)**. A process for deciding on the appropriate resolution of assessment method to be used is presented in Figure 1, and further details can be found in Section 7.2 of CIS Guidance Document No. 31. [7]	✓	
10. In cases where low resolution methods apply outside of the EU, **the applied method must be comparable in approach to those used by EU member states.**	✓	
11. For projects located in EU member states or candidate countries (depending on their transition agreements), **the above EFR must support the achievement of good status in the affected water bodies (or good potential in the case of HMWBs) as defined in the RBMPs prepared under the WFD, and ensure that no deterioration in status occurs** (unless explicitly approved under the Article 4(7) process – see Box 3). The EFR must also ensure compliance with any additional standards or objectives for water bodies that form part of a Natura 2000 Network.	✓	
12. For projects located elsewhere, in addition to meeting the requirements under 7 above, **the EFR must support any defined water quantity or quality objectives or conservation plans or priorities that apply to the water body** (e.g. as part of an RBMP, IWRM Plan, or similar). In situations where the current status of downstream ecosystems is not defined, this will need to be determined in accordance with the selected EFR method in 9 above (i.e. higher resolution methods will require more extensive ecological baseline survey).	✓	
13. The EFR regime **must include a continuous programme of monitoring (including both flow and biological indicators), evaluation, and adjustment -** commonly referred to as adaptive management - so that it can be periodically reviewed and where necessary modified in response to increased understanding or changes in downstream ecosystem or socio-economic conditions.	✓	

Figure 1: Selection of Appropriate Environmental Flow Assessment Method (adapted from *Brown, C. 2016*)



[7] European Commission DG ENV, 2015. WFD CIS Guidance Document 31: Ecological flows in the implementation of the Water Framework Directive

iii. Reservoir Water Quality and Sedimentation, including Eutrophication

The decomposition of vegetation on inundated land creates a nutrient-rich environment that can stimulate the growth of algal blooms and aquatic weeds such as water hyacinth in the reservoir. If eutrophication occurs this can impair water quality and affect fisheries, both in the reservoir and downstream, primarily by reducing dissolved oxygen levels in the deeper reservoir layers and releasing this water through the turbines. Some algae can also form toxic blooms on the reservoir surface. Furthermore, the proliferation of aquatic weeds and reservoir releases can clog or damage hydraulic structures (e.g. from the passage of anaerobic waters through the turbines) and impede navigation.

Land-use practices upstream can have a significant impact on water quality and sedimentation in the reservoir, in particular where these change as a result of economic development. For example, reservoir eutrophication can be stimulated by an influx of nutrients due to uncontrolled agricultural runoff or poorly treated municipal or industrial wastewater effluents. Polluted inflows and/or the inundation of contaminated soils can also lead to the potential bio-accumulation of toxic pollutants such as mercury in the reservoir and its bottom sediments. Poor agricultural and forestry management practices can also exacerbate soil erosion leading to enhanced sedimentation rates in the reservoir and a reduced life-span of the dam, which can be further exacerbated by increased water abstractions upstream and reduced water availability under climate change (see also "*Climate Resilience and GHG Emissions*" section below).

EIB Requirements/Recommendations Reservoir Water Quality and Sedimentation, including Eutrophication	**Required**	**Recom-mended**
14. All storage-based hydropower projects that introduce a significant Degree of Regulation (DOR) in the river system (see Box 1) **must include an assessment of the eutrophication potential of the reservoir, either as a standalone assessment or as part of the E(S)IA, and mitigation measures incorporated into the project design where the risk of eutrophic conditions is assessed as significant**. The assessment should consider existing and potential future nutrient inflows from the upstream catchment (e.g. in relation to agricultural runoff). Mitigation measures may include vegetation clearance prior to inundation, nutrient flushing and/or upper watershed management measures.	✓	
15. In cases of large reservoirs with potentially long water residence times (of the order of several months or more), i.e. where there is a significant risk of seasonal thermal stratification, it is **recommended that a detailed reservoir water quality assessment is carried out** using hydrodynamic (rather than empirical) modelling approaches to assess and mitigate the risks of eutrophication and/or accumulation of pollutants.		✓
16. All storage-based hydropower projects with large reservoirs **must include an assessment of existing and potential future reservoir sedimentation**, with ongoing monitoring of sediment influx throughout the reservoir life (see also 54).	✓	
17. It is **recommended that an ongoing programme of reservoir water quality monitoring is undertaken post-construction**, focussing on any water quality parameters that are identified as significant during the E(S)IA process. For projects in the EU/candidate countries, this would include the monitoring of performance against any water quality objectives established for the new reservoir as part of the WFD Article 4(7) process or otherwise (see Box 3). The programme may also include periodic fish tissue sampling to monitor the potential bio-accumulation of pollutants in the reservoir.		✓

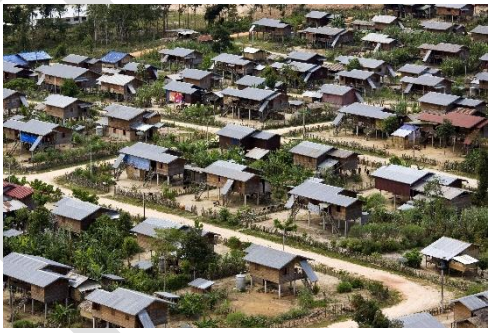
3. Social Issues and Impacts

The most significant potential social impacts and risks associated with hydropower projects are as follows.

- Physical and economic displacement of people, including loss or restriction of access to property, assets, resources and social networks.
- Temporary or permanent changes in employment patterns, livelihoods and other activities.
- Loss of, or damage to, cultural heritage.
- Matters related to occupational and public health, safety and security.
- Disruption of ecosystem services, including *inter alia* those caused by alteration to water flows and by changes in microclimate which may affect agricultural productivity.

The following text summarises EIB's various requirements and recommendations for development of hydropower projects in relation to the above issues. Other impacts within the above subject areas (e.g. labour standards, human rights) are not considered in this guideline because they are not specific to hydropower projects. For these broader, non-hydropower specific social and socio-economic impacts, promoters will be expected to follow all relevant requirements of the EIB *Environmental and Social Standards* listed on page 4.

i. Physical and Economic Displacement and Loss of Access



Development of a hydropower project may physically displace people, or lead to loss of assets and disruption of livelihoods (this circumstance is termed economic displacement). While in some cases the impact may be relatively small or even negligible, for hydropower projects with a large reservoir that permanently flood substantial areas significant displacement may occur. Flooding may displace people from homes, commercial or industrial properties, agricultural land, and areas used for other purposes. Additionally, periodic or permanent changes to water flows and/or creation of new water bodies may disrupt access to important economic and cultural assets, resources and social networks for affected communities over considerable areas; creation of exclusion zones for safety or operational reasons can have a similar effect.

Hydropower can raise issues of land tenure covering ownership and access rights for both water and land, with implications for current and future demands such as agriculture, drinking water supplies, fishing and ecosystem health. Hydropower projects are often built in remote areas with stagnant economies, with few new opportunities and with poor transportation and communications systems, making income restoration more difficult. Sometimes, these remote areas are inhabited by indigenous people or ethnic minorities that are culturally and economically tied to the land, and the loss of this relationship exacerbates the negative impacts of construction.

Small, run-of-river hydropower projects may, if they are clustered within a single river basin or region, cause displacement impacts comparable to those from individual larger projects.

Restriction of access to water and other resources, particularly in developing countries, may have a disproportionate impact on women and children who are frequently households' main collectors of water, and of other important resources such as firewood and non-timber forest products.

Nonetheless, hydropower projects also have a potential to mitigate some of the mentioned adverse impacts by serving as sources of residential or commercial electricity for resettlement areas, as sources of employment, or as sources of revenue earmarked for development activities in affected communities.

EIB Requirements/Recommendations Physical and Economic Displacement and Loss of Access	Required	Recom-mended
18. For any resettlement that is required to remedy displacement and loss of access caused by a hydropower project, **promoters must fulfil the requirements of the Bank's *Environmental and Social Standard 6: Involuntary Resettlement*.**	✓	
19. Promoters **are recommended to consult the World Bank's *Involuntary Resettlement Sourcebook (2004), Chapter 15 – Dams and Resettlement: Building Good Practice.***		✓
20. Promoters **must demonstrate that a robust and realistic identification and assessment has been carried out to delineate the full area of influence where impacts relating to displacement and loss of access could occur**.	✓	
21. Promoters **must identify all communities and/or other groups that might be affected, and undertake informed and meaningful stakeholder consultation with them** from the early stage of the project development and preferably during pre-feasibility stage, throughout the area affected.	✓	
22. Stakeholder consultation **must collect information to assess impacts and identify how users – including groups such as women, and vulnerable groups such as the elderly and those with different abilities - will be affected**, and use this information to develop and implement robust mitigation in all areas where impacts will be experienced. With respect to women who may be vulnerable, promoters are recommended to take account of *The EIB Group Strategy on Gender Equality and Women's Economic Empowerment.* [8]	✓	
23. Where impacts on collective ownership and access rights are identified (particularly where these affect indigenous or forest communities), promoters are **recommended to follow the FAO's *Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests in the Context of National Food Security* (known as "VGGT", 2012)**, which promote responsible governance of tenure of land, fisheries and forests, with respect to all forms of tenure: public, private, communal, indigenous, customary, and informal.		✓

ii. Economic Development, Employment and Livelihoods

The area in which a hydropower project is being developed may expect to experience increased economic activity during construction (including during rehabilitation and refurbishment projects). These may result from direct and indirect employment, provision of goods or services to the project, and stimulation of the wider local economy via the "multiplier effect". However, once the construction phase is complete, operational hydropower projects typically require a small number of highly skilled staff, and the requirements for goods and other services are mostly highly technical: this is likely to curtail revenue flows into the local economy, and thus potentially cause reduced economic activity. In some cases, particularly in less developed countries, the highly skilled profile of the operational staff required may disadvantage women, and also vulnerable groups which are less likely to have had the education and training opportunities to develop these skills.

Loss of productive land and disruption of access to assets and resources may have an impact on economic and other activities (including leisure) over a considerable area upstream and downstream of a hydropower project.

[8] http://www.eib.org/attachments/strategies/eib_group_strategy_on_gender_equality_en.pdf

EIB Requirements/Recommendations Economic Development, Employment and Livelihoods	Required	Recom-mended
24. **The promoter must meet the requirements of *Environmental and Social Standard 10: Stakeholder Engagement***.	✓	
25. **The promoter must develop and implement a Community Development Plan that yields immediate, and ongoing, benefits,** where this is appropriate and feasible: a template for this type of plan is included in Strategic Community Investment: A Good Practice Handbook for Companies Doing Business in Emerging Markets (IFC, 2010). [9]	✓	
26. **The promoter must carry out a robust and realistic identification and assessment of the full area where economic impacts could occur: both upstream and downstream, and potentially outside the catchment;** and use this information to develop appropriate mitigation.	✓	
27. The promoter is **recommended to encourage the participation of local companies and individuals in the project construction and operation**, notably through appropriate job and contract opportunities advertisement. The promoter shall not allow any local content requirements (either de jure or de facto) or any discrimination based on nationality that are in breach of the Bank's Guide to Procurement.		✓
28. The promoter **is recommended to support an appropriate and timely education programme relevant to the project implementation**.		
29. The promoter **is recommended to use an appropriate construction contract template that comprises adequate social provisions.**		✓
30. The promoter is **recommended to implement employment and supply chain opportunities that demonstrate the inclusion of specific parts of the community**, such as women and potentially vulnerable groups, within the measures implemented. These measures should take account of *The EIB Group Strategy on Gender Equality and Women's Economic Empowerment*.		✓ ✓

iii. Cultural Heritage

In common with other infrastructure projects, hydropower developments have the potential to disturb both tangible and intangible cultural heritage (these terms are defined in *Environmental and Social Standard 5: Cultural Heritage*). For new hydropower projects, the risks to cultural heritage are increased as the likelihood of affecting previously undisturbed areas is greater; it will be greatest in the case of new storage projects where the disturbed area will be considerably larger as a result of creation of a reservoir which could flood areas of tens or sometimes hundreds of square kilometres. Stakeholder consultation, in particular with local communities, expert ground surveys, and use of other interpretive methods such as remote sensing will be valuable methods that could determine whether extensive affected areas might contain significant cultural heritage resources.

Water-based intangible cultural heritage values recognised by local communities could *inter alia* include sacred features or locations, such as areas believed to be inhabited by water spirits.

EIB Requirements/Recommendations Cultural Heritage	Required	Recom-mended
31. **Promoters must meet the requirements of *Environmental and Social Standard 5: Cultural Heritage* and relevant national legislation relating to cultural heritage**.	✓	
32. **Promoters must demonstrate that a robust and realistic identification and assessment has been carried out to delineate the full area of influence**, both upstream and downstream, where impacts relating to cultural heritage could occur. This should be achieved through surveys, consultation with communities and/or other groups that might be affected and/or have knowledge of cultural heritage resources, and other methods as appropriate (see 34).	✓ ✓	

[9] http://www.ifc.org/wps/wcm/connect/f1c0538048865842b50ef76a6515bb18/12014complete-web.pdf?MOD=AJPERES&CACHEID=f1c0538048865842b50ef76a6515bb18: see *Tool 1: Template for Preparing a Community Investment Strategy* (p. 115).

EIB Requirements/Recommendations Cultural Heritage	Required	Recom-mended
33. **EIB will not finance any projects that will have a potential measurable adverse impact on any UNESCO World Heritage Site.**		✓
34. Promoters **are recommended to carry out cultural heritage surveys and studies as part of site selection and identification of alternatives** so that feasible measures to avoid cultural heritage sensitivities can be incorporated at the earliest stages, and not to leave consideration of cultural heritage until the subsequent E(S)IA and development of mitigation.		
35. Promoters are **recommended to make use of best practice interpretative and predictive techniques**, including remote sensing interpretation and statistical analysis.		✓
36. **Cultural heritage mitigation procedures** (e.g. a "chance finds" procedure) **must be developed** (including consultation with key stakeholders such as government agencies responsible for cultural heritage, and with local communities): **and they must encompass all areas where hydropower project development activities will take place**. Therefore, in the case of storage reservoirs the areas must include sites where *inter alia* vegetation clearance, slope stabilisation and other activities including development of associated facilities will occur..	✓	

iv. Public Health, Safety and Security

Hydropower projects could create health, safety and security risks for communities. Water quality and condition could either present a direct human health risk (e.g. as a consequence of contamination or other factors causing poor water quality – see page 8), or create water conditions that could harbour disease vectors such as rats (leptospirosis) or mosquitoes (malaria; also Zika virus, dengue fever and chikungunya). Poor water quality, vector-borne or water-borne diseases may increase vulnerability in surrounding communities, during construction and through the operational phase of a project unless regular monitoring, and where appropriate vector and disease control measures, are implemented.

Downstream communities may be at risk from planned and unplanned water releases and significant fluctuations of water level.

Static, slow- and fast-moving water bodies may all present safety risks to members of the public. Development of hydropower projects can increase the likelihood of conflict, particularly in fragile environments: see "*Strategic and Basin-wide Issues*" section below.

EIB Requirements/Recommendations Public Health, Safety and Security	Required	Recom-mended
37. **All EIB-financed hydropower projects must meet the requirements specified in *Environmental and Social Standard 9: Occupational and Public Health, Safety and Security*.**	✓	
38. If technical studies and the E(S)IA indicate that risks exist, **a project risk assessment and emergency preparedness plan must be prepared to address potential impacts on downstream communities and resources** in the event of both planned and unplanned water releases.	✓	
39. **Where identified as being required by the project risk assessment and emergency preparedness plan, early warning systems must be installed** to ensure that downstream communities are informed in advance of major water fluctuations (e.g. those associated with periodic reservoir flushing), and any unplanned release scenarios (such as those caused by operator error or equipment failure).	✓	
40. **Downstream communities must be trained in evacuation and/or other procedures and a programme of periodic test drills established** (see also "*Dam Safety*" section below).	✓	
41. Where it is deemed necessary, **the scope of the risk assessment must include identification of areas where interaction between members of the public and a project component could pose a safety or operational risk**. Exclusion zones should be established around such areas, where appropriate.	✓	
42. **Life-saving equipment, warning signage and other measures must be installed at locations identified in the risk assessment and the emergency preparedness plan** (for example, at locations on a reservoir margin where public access cannot be controlled; and in areas close to fast-flowing water released through a tailrace, if an exclusion zone is not feasible).	✓	
43. Initial and ongoing (i.e. throughout operations) public health education campaigns should be considered, to promote safe water use and safe behaviour around water.		✓

EIB Requirements/Recommendations Public Health, Safety and Security	Required	Recom-mended
44. The **promoter must establish an ongoing programme of monitoring and engagement with downstream communities** both during construction and operation, to provide early identification of potential contamination of domestic water supplies due to poor water quality from sources such as spills and high sediment loads during construction, and releases of poor quality water from the reservoir during operation.	✓	

v. Ecosystem services

The services provided by ecosystems play a vital role in human well-being, and any hydropower development will have the potential to impact important ecosystem services and the communities that depend upon them. Some ecosystem services that could be affected by a hydropower development are easily recognized (e.g. fresh water; fish used for leisure, commercial or subsistence purposes) but others are less obvious and may require detailed study to understand their importance, such as erosion control, protection from natural disasters and regulation of air, water, and soil quality. A reduction or loss of any of these services and the benefits they provide can have socio-economic consequences that may not be immediately apparent.

EIB Requirements/Recommendations Ecosystem services	Required	Recom-mended
45. **An analysis of ecosystem services and dependencies and an assessment and mitigation of impacts on ecosystem services must be carried out** as set out in *Environmental and Social Standard 3: Biodiversity and Ecosystems*.	✓	
46. The promoter **must ensure that ecosystems services review is included in the terms of reference for E(S)IA of all hydropower projects**. The terms of reference will specify that **if the review indicates it is required, an ecosystem services baseline must be prepared, priority services identified, and mitigation measures developed** for impacts on those services. **Associated facilities must be considered in the assessment**.	✓	
47. P**romoters must demonstrate that a robust and realistic identification and assessment has been carried out to delineate the full area of influence within which ecosystem services could be affected**, both upstream and downstream. This should be achieved through surveys, and consultation with communities and/or any other groups that might have dependencies on priority ecosystem services.	✓	

4. Climate Resilience and GHG Emissions

Hydropower projects generally have a very long design-life, sometimes well in excess of 50 years when future rehabilitation is taken into account. As such, there are important climate-related considerations that need to be factored into their design, planning and operation in order to make them resilient to long-term climate changes and to limit their vulnerability to extreme weather events. Broadly, these are as follows.

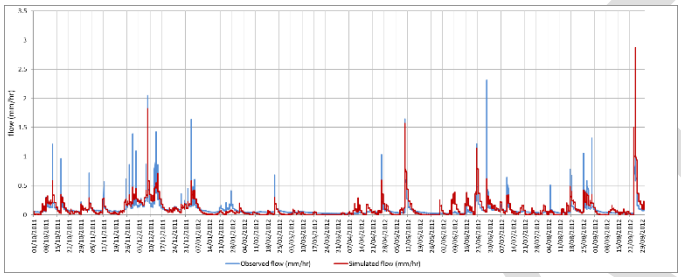
- Climate change projections need to be incorporated into the hydrological assessment of resource potential for hydropower project planning and design, and hence the size and configuration of the hydraulic infrastructure.
- Potential physical risks associated with climate change (e.g. relating to enhanced flooding, erosion and sedimentation etc.) need to be factored into reservoir and dam planning, design and management (including safety planning).

- Potential system-wide climate risks (e.g. relating to powerline and/or access road damage, communications/IT failures etc.) and consequent impacts on site access (e.g. for emergency workers) and energy end-consumers need to be addressed, for example through extreme weather management planning and demand management measures for end-users.
- The calculation (and minimisation) of GHG emissions from hydropower projects needs to consider methane emissions from the reservoir.

The following sections summarise EIB's requirements for the design and operation of hydropower projects in relation to the above issues.

i. Factoring Climate Change into Hydrological Assessment

Long-term changes in average seasonal temperature and/or rainfall conditions in a catchment could have a significant effect on the timing and magnitude of river flows, and hence on hydropower generation potential and project infrastructure design. These effects are likely to be particularly significant in catchments where snowmelt provides a significant contribution to seasonal flows, or where there is limited water storage within the scheme to even out future changing patterns of runoff between seasons.



The majority of hydropower schemes have in the past been designed on the basis of the hydrological analysis of historical flow records, which can lead to power-energy modelling that does not provide representative projections for energy output. In addition to directly affecting the long-term financial viability of a scheme, in the nearer term this is likely to impact on other water uses, for example ecological flows or in the case of multi-purpose schemes, irrigation water supply, as the available stored water is prioritised for power generation needs.

EIB Requirements/Recommendations Factoring Climate Change into Hydrological Assessment	Required	Recom-mended
48. All hydropower projects financed by EIB **must meet EIB Environmental and Social Standard 4: Climate Related Standards.**	✓	
49. A climate risk and vulnerability assessment (CRVA) **must be carried out as part of the project feasibility study, either as a standalone assessment or as part of the E(S)IA** which should include the integration of likely climate change scenarios into the hydrological analysis for the scheme. The results should then be applied to the power generation model to assess its sustainable long-term energy yield for design purposes. This would not only apply to new hydropower developments, but should also be applied retrospectively to existing schemes that are being rehabilitated or refurbished.	✓	
50. It is **recommended** that the above CRVA includes the development of a representative hydrological model of the catchment. The model should be run for a suitable range of future climate scenarios to estimate changes in the net runoff from the catchment based upon input climate data and physical catchment characteristics.		✓
51. **Long-term hydrological monitoring of inflows to the hydropower scheme must be undertaken** and made publically available, in order to facilitate the periodic review of hydrological design conditions and assumptions.	✓	

ii. Assessing Potential Physical Risks

There are a range of potential risks to any infrastructure project that stem from the changes in physical conditions that may occur in a catchment as a result of climate change, e.g enhanced flooding or

erosion. However, there are a number of key considerations for hydropower projects, and in particular those that include large dams or impoundments, as follows.

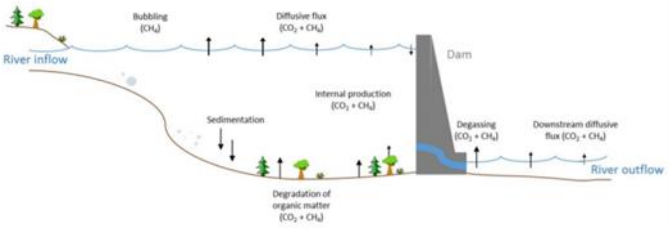
- Potential safety concerns for the dam or impoundment relating to enhanced flood runoff from the upstream catchment and inadequate spillway design. This may be characterised by a gradual increase in extreme flood frequency over time as a result of changing patterns of precipitation, or a sudden extreme flood event induced by (for example) an upstream glacial lake outburst.
- Potential safety concerns relating to the overtopping of embankments from enhanced wind-run affects, or large landslips into the reservoir caused by conditions such as more intense rainfall or freeze/thaw events.
- Enhanced sediment runoff from the upper catchment leading *inter alia* to accelerated reservoir siltation (and loss of capacity) and turbine damage.
- Long-term temperature changes, and potential consequences for reservoir water quality and eutrophication.

EIB Requirements/Recommendations Assessing Potential Physical Risks	Required	Recom-mended
52. The abovementioned climate risk and vulnerability assessment (CRVA) **must include an assessment and mitigation of any potential physical risks to project infrastructure arising from, inter alia, enhanced flooding or erosion in the upper catchment due to climate change**. Mitigation measures may include the re-design of spillway capacities including maintaining spare capacity, changing the dam construction type (e.g. to allow overtopping), and lowering maximum reservoir operation levels (to increase freeboard in response to future flood conditions).	✓	
53. It is also **recommended that the above CRVA includes an assessment of the wider system risks to road infrastructure, communications/IT equipment, powerlines etc., with consequent impacts on emergency response functions and power end-users**. Mitigation measures could include the preparation of an extreme weather management plan, demand-side measures etc.		✓
54. For dams that have a significant Degree of Regulation (DOR) in the river system a **long-term monitoring of sediment inflows must be undertaken** in order to facilitate the periodic review of associated engineering design considerations and assumptions.	✓	

iii. Reducing Reservoir GHG Emissions

Environmental and Social Standard 4: Climate Related Standards requires that a carbon footprint assessment is carried out and reported for projects that emit more than 100kt CO_2eq/yr in absolute terms, or lead to an emissions variation (positive or negative) of more than 20kt CO_2eq/yr.

Carbon Cycle in Reservoir *(Source: The GHG Reservoir Tool, G-res, Technical Documentation, IHA, 2017)*



Whilst a small-scale hydropower scheme would never achieve this level of absolute emissions, it is possible that a large-scale scheme would do so when reservoir methane emissions (including from spillway and turbine flows) are taken into account. Large, shallow tropical reservoirs can be a particularly significant source of these emissions in this respect. Moreover, both small and large-scale schemes alike would be anticipated to reduce net GHG emissions (compared to non-renewable alternatives) by more than 20kt CO_2eq/yr, so would require a carbon footprint assessment.

5. Strategic and Basin-Wide Issues

This section focuses on the broader, strategic or river basin level impacts that may result from the development of a hydropower project. These include the following.

- Potentially significant cumulative impacts (e.g. on habitat loss and fragmentation, flow regulation and sediment and nutrient transport) from a series of hydropower developments within a single river basin or region, and associated weaknesses in the analysis of strategic and project-level alternatives.
- Potential transboundary impacts both from and to hydropower projects, e.g. from changes in upstream land-use and/or water-use, inundated areas, or from changes to downstream patterns of flow or sediment and nutrient transport, which in fragile environments may create or increase the potential for conflict between water users and/or communities.
- The potential impact of weak governance structures on the planning and implementation of hydropower projects leading to poor performance or delays, e.g. from ineffective stakeholder engagement and buy-in (e.g. due to lack of community benefit sharing), through to ineffective environmental and social performance management etc.

EIB's various requirements for the design and operation of hydropower projects in relation to the above issues are summarised here.

i. Cumulative Basin-Level Impacts

These impacts are usually defined as those occurring on a valuable ecosystem resource as a result of the incremental effects of the project of concern and any other past, existing, and reasonably foreseeable future anthropogenic activities. They can occur from the combined effects of different components of a single hydropower project (e.g. reservoir, powerhouse and associated facilities), or from a series of hydropower projects planned for the same river, or from other intended projects that would use and affect the same resources.

Some of the most significant cumulative impacts that can occur in relation to hydropower are the result of multiple installations, sometimes in a cascade arrangement, on a single river, or in several tributaries within a river basin. These impacts can include direct natural habitat loss from the accumulated project footprints, aquatic habitat fragmentation due to the isolation of river reaches and habitats between impoundments/ barriers, or degradation of ecosystem services due to the fundamental alteration of hydrological conditions and sediment and nutrient transport along the length of a river to its estuary.

Prior to approving a loan EIB will expect the promoter to address the topic of decommissioning as part of the design stage, setting out the processes and timescales under which it is anticipated that detailed decommissioning plans are prepared, and how decommissioning will be financed. In addition, decommissioning should be evaluated as an alternative option when rehabilitation of an existing hydropower project is considered, and the promoter should present a robust justification for the option selected. Similarly, proposals for a new, greenfield hydropower project in river basins where old hydropower projects exist shall be justified by the promoter against the alternative of rehabilitating or refurbishing those existing hydropower plant(s).

EIB Requirements/Recommendations Cumulative Basin-Level Impacts	**Required**	**Recom-mended**
55. EIB **will only consider financing hydropower projects where an appropriate Cumulative Impact Assessment or equivalent study has been undertaken that identifies and addresses any significant regional or basin-level environmental and social impacts**, preferably at the	✓	

EIB Requirements/Recommendations Cumulative Basin-Level Impacts	Required	Recom-mended
strategic planning stage (see below). Such a study must consider all of the planned infrastructure developments in the basin, for example as part of a hydropower cascade.		
56. In the case of EU member states and candidate countries (depending on their transition agreements) the **project must be included within the relevant River Basin Management Plan under the EU WFD (or set for inclusion in the next iteration of the plan) and in so doing subject to economic analysis in accordance with WFD CIS Guidance Document No. 1** [10] and where necessary to an Article 4(7) process (see Box 3)**.** The project should also have been subject to a Strategic Environmental Assessment (SEA) under the EU SEA Directive as part of the RBMP and/or a regional energy plan or programme, and the results and conclusions of this SEA carried forward into the project design process as appropriate.	✓	
57. For projects located outside of the EU, **alignment with the EU Water Framework Directive principles must be demonstrated through the implementation of a strategic study (Cumulative Impact Assessment, Strategic Environmental Assessment, Integrated Water Resources Management Plan or similar) that includes proper consideration and mitigation of any significant impacts on river flows, quality and morphology at the basin-scale in order to protect ecological flows and water users**. It would also need to incorporate a consultation process that includes the full range of basin stakeholders (it may also in some circumstances include transboundary consultation, as discussed below).	✓	
58. In line with the requirements of Standard 1 (and the EIA Directive) for analysis of alternatives, within the E(S)IA the promoter **must: a) evaluate decommissioning as an alternative option when rehabilitation of an existing hydropower project is considered**, and present a robust justification for the option selected; and **b) justify proposals for a new, greenfield hydropower project** in river basins where old hydropower projects exist against the alternative of rehabilitating or refurbishing those existing hydropower plant(s).	✓	
59. It is **recommended that strategic studies are conducted at the earliest possible stage during project planning such that the optimal balance between financial return and environmental and social costs can be achieved between different hydropower options in a river basin or region**. Strategic and system-wide planning tools are emerging to support this integrated assessment and scheme optimisation process to be carried out (e.g. TNC's Hydropower By Design approach[11]). The aforementioned *CIS Guidance Document No. 1* also provides detailed guidance on economic analysis in support of integrated water resources planning.		✓

ii. Potential Transboundary Impacts

International boundaries are often demarcated by large rivers, and as such a reservoir footprint may extend across a border. Similarly, the headwaters of a reservoir may be seasonally dependent, for example extending further upstream during the flood season, and therefore may impinge on an international boundary on a transient basis. Whilst these impacts are usually fairly self-evident, the potential downstream impacts from a hydropower scheme – on seasonal patterns of river flow, sediment and nutrient transport - may extend for several tens of kilometres downstream, and can easily cross international boundaries.

In addition to the potential transboundary impacts *from* a hydropower project, there are also a range of potentially very significant impacts *on* a project relating to changes in upstream land and/or water use. Aside from a decrease in water resource potential through increased upstream abstractions, these can include enhanced sediment runoff and/or pollution from deforestation, land degradation or other economic development activities. Potential transboundary conflict might result from reductions in water availability or water quality, and competing water uses.

[10] European Commission DG ENV, 2003. WFD CIS Guidance Document 1: Economics and the Environment – The Implementation Challenge of the Water Framework Directive

[11] The Nature Conservancy (TNC) & Inter-American Development Bank, Nov 2013. The New Frontier of Hydropower Sustainability: Planning at the System Scale

EIB Requirements/Recommendations Potential Transboundary Impacts	Required	Recom-mended
60. In accordance with Standard 1, all projects financed by the EIB **must identify and address any transboundary impacts as applicable** as part of the E(S)IA process. In assessing whether transboundary impacts may occur from a hydropower development, **the E(S)IA process must include a robust assessment of the potential area of influence of the project,** including the potential downstream influence on flows, sediment and nutrient transport.	✓	
61. Regardless of whether parties are signatories, the above assessment and associated consultation process **must be consistent with the principles of the UNECE Convention on EIA in a Transboundary Context** (the 'ESPOO Convention'). These include that all appropriate and effective measures are taken to prevent, reduce and control significant adverse transboundary impacts, and that best efforts are made to undertake an effective and early process of stakeholder identification and engagement with affected transboundary parties using a conflict sensitive approach. This would include the preparation of a cadastre of downstream water users.	✓	

iii. Governance and Community Support

Hydropower projects (particularly larger ones) will be major components in energy and infrastructure planning, and as such are likely to be of regional or national importance. Like all major projects, effective governance arrangements will be critically important to project success, but in the case of hydropower projects this importance is heightened further by several factors, including the following.

- The long construction and operational life of hydropower projects: good governance principles and structures must be able to withstand changes of political regime, reassessment of strategic priorities, and the exit of funders.
- Many hydropower projects are designed for multiple-use, e.g. they include water supply, irrigation or flood control. This introduces challenges in providing benefits for several groups of end users (see Box 4).

Box 4 Key Principles of Benefit Sharing in Hydropower Projects

Evolving good practice in benefit sharing for hydropower and other dam projects[1] aims to counter the tendency for affected communities to be net losers, and those benefiting most to be groups such as the residents of energy-hungry urban centres that may be hundreds of kilometres away, or across an international boundary.

Good practice benefit sharing requires that robust and transparent governance and stakeholder engagement processes are used throughout the project: a) to understand affected communities' (and others') perceptions, needs and concerns: and b) to track and therefore be able to respond to how these evolve over time to avoid conflict between water users (for power generation) and affected communities. These communities are in many cases (particularly in a developing country context) least able to articulate their needs and concerns so that they can be fully incorporated into decision-making.

[1] See, for example, examples of developing country case studies in Skinner, Niasse and Haas, 2009, and World Bank, June 2012.

The range and potential complexity of impacts arising from hydropower projects, and the extensive area over which they can have an effect, requires measures including those described in the box above, underpinned by effective coordination between all stakeholders to avoid conflict between the demands of power generation and the interest of local communities. In fragile environments, development of a hydropower project might exacerbate conflict as a result of issues such as downstream and

transboundary impacts, and competition over resources (e.g. use of water to generate energy versus other uses).

EIB Requirements/Recommendations Governance and Community Support	Required	Recom-mended
62. **All hydropower projects must meet the requirements of EIB *Environmental and Social Standard 10: Stakeholder Engagement*: identification and effective engagement with a diverse variety of institutions and representational groups must be undertaken throughout**, starting from the project design process. Communities that are directly impacted will be a priority focus for engagement.	✓	
63. P**romoters must identify and evaluate opportunities to implement equitable benefit sharing based on robust and transparent governance and stakeholder engagement processes**, developing mechanisms to identify affected communities' needs and concerns, to track them, and enable effective responses to how they evolve over time to avoid conflict between those benefiting from energy generated and directly affected communities. The above engagement process will be continued throughout the life of the project, providing relevant information (including summaries of monitoring, and conclusions reached about monitoring data) to affected communities and other stakeholders in a transparent manner.	✓	
64. It is recommended that promoters analyse and understand ongoing and potential conflicts that might be exacerbated by a hydropower project, and which have the potential be a risk to the security and sustainability of the project itself. If a conflict risk exists such that mitigation is required, the promoter **must apply a conflict sensitive approach**, i.e. i) to mitigate risks to the project; ii) to do no harm; and iii) to do good if possible in terms of contributing to peace.	✓	

6. Reservoir and Dam Safety Issues

This section provides a brief overview of some of the main reservoir and dam safety issues and measures that need to be addressed in order to safeguard the health of workers and affected communities during the planning, construction and operation of a hydropower project that is financed by EIB. The guidance does not replace or preclude the need to implement detailed dam safety studies: it is only meant to briefly illustrate the hydropower-specific issues that need to be addressed. It also does not elaborate on methods, codes or safety standards to be applied, since these are covered by more detailed guidance produced by organisations such as ICOLD.

i. Risks Associated with Infrastructure Failure

There are clearly very significant risks to downstream health and property arising from the potential flooding that would occur following structural failure and/or overtopping at a dam, or at an associated structure such as a spillway, powerhouse or tailrace. This failure may be induced by inadequate planning for natural hazards such as extreme floods, landslips, glacial lake outbursts or earthquakes, by inadequate design, construction or operation practices, or by a combination of any or all of these factors. Moreover, the aforementioned 'natural' hazards may themselves be induced or enhanced by the dam project itself, e.g. due to reservoir induced seismicity or bank instability caused by fluctuating reservoir water levels. Also, in the case of upstream flooding, erosion and reservoir sedimentation, these processes are likely to alter their characteristics over time due to changes in land-use and/or climate change (as discussed earlier).

EIB Requirements/Recommendations Risks Associated with Infrastructure Failure	Required	Recom-mended
65. **A technically robust assessment of the natural hazards and technological risks to the safety of a hydropower project must be prepared during the project design process**. For large dams, this will require expertise across an array of disciplines, including hydrology (e.g. for spillway design flood calculation and breach analysis) and engineering safety competencies such as geotechnical, structural, electrical and mechanical design.	✓ ✓	

EIB Requirements/Recommendations Risks Associated with Infrastructure Failure	Required	Recom-mended
66. For large dams (see Box 1 for definition), **the risk assessment must include the computational modelling of the downstream effects of potential dam breach scenarios**, and the resulting flood extent maps should be shared with the relevant authority in charge of civil protection and emergencies, as well as local authorities. This modelling is also recommended for other types of dams.	✓	
67. For all large dams (see Box 1 for definition), **the involvement of an independent Dam Safety Review Panel (DSRP) (or equivalent in an EU member state) is compulsory** and recommended for other dams. The panel has the responsibility to review the design, construction and commissioning and operation of the dam and reservoir. This modelling is recommended for all dams.	✓	
68. The mitigation of dam safety risks **must include effective emergency planning and response measures**. Safety procedures will be project specific and would need to be approved by the above panel, but would normally include measures such as the installation of signage, exclusion zones, public communication protocols/early warning systems, emergency preparedness and response training, and periodic dam safety inspections (to include infrastructure condition). Detailed guidance on dam safety procedures is published *inter alia* by the International Commission on Large Dams (ICOLD).	✓	
69. Whilst it would normally be the responsibility of the relevant civil protection authorities to plan and implement most of these measures, in countries where these authorities either do not exist, or have limited capacity or resources, **the dam operator is required to identify and support as appropriate suitable and sustainable implementation arrangements.** This may include long-term training and capacity building for local authorities.		

ii. Risks Associated with Dam Operation

The operation of a hydropower scheme can lead to rapid variations in downstream flows and associated water levels and velocities, for example as a result of routine hydropeaking operations (whereby flood releases are made in response to power requirements at specific times of day), or due to periodic equipment maintenance or reservoir sediment flushing etc. The assessment and mitigation of any resulting impacts on downstream river users (e.g. community water users or recreational users such as anglers or rafters) should form part of the E(S)IA. From a specific public health and safety perspective, these impacts could include the risk of drowning if the water level rise is too rapid or unannounced.

EIB Requirements/Recommendations Risks Associated with Dam Operation	Required	Recom-mended
70. For hydropower projects that involve significant hydropeaking operations, **a quantitative assessment of the potential downstream propagation of flood waves and hydraulic behaviour of the river in relation to the types and behavioural patterns of river users must be carried out**, either as part of the E(S)IA or as a standalone study. There are wide variety of hydraulic models that are available for this purpose - selection of an appropriate method should be made by a qualified water engineer or hydrologist.	✓	
71. **Where potentially significant effects on river users are identified, mitigation measures must be developed**. Measures to be considered should include adjustments to dam operations (e.g. speed, sequencing or timing of gate openings), the introduction of signage and exclusion zones, published operational timetables, public awareness campaigns and real-time flood warning systems for downstream river users (e.g. phone or text message alerts, audible alarms).	✓	

7. Monitoring Requirements

EIB will treat each possible hydropower investment on a case-by-case basis. As a result, the monitoring requirements for each will vary, as will their contribution to the overall assessment of investment performance, which will be set within the framework of the requirements set out in EIB *Environmental and Social Standard 1: Assessment and Management of Environmental and Social Impacts and Risks*.

In order for EIB to have a comprehensive overview of the potential impacts of a hydropower project and the effectiveness of mitigation measures, EIB will require monitoring information from a variety of sources, including the following.

- The regular reporting by the promoter on performance of the project's ESMS, including organisational capacity and resourcing needs and how these are being addressed.
- Periodic reporting to regulatory authorities by the promoter/contractors under the applicable permitting regimes for construction and operation, and reports by the authorities on performance with respect to the relevant regulations and any conditions permit imposed.
- Self-monitoring reports prepared for submission to EIB by the promoter and/or intermediary.
- Promoter's reports on contractor management.
- Summaries of stakeholder engagement in general, and specifically on the operation of the project grievance mechanism.
- Media articles and documentation on NGO interest in/comment on the project.

This guidance has emphasised the spatial extent and diverse nature of the potential impacts from hydropower projects; EIB will therefore require that all relevant topics and the entire area of influence of a project are considered in setting out its monitoring requirements/conditions. These will include requirements relating to a range of 'generic' environmental and social topics, e.g. construction management, stakeholder engagement and grievance processes, and RAP implementation. However, there will be some monitoring requirements that are specific to EIB's financing of hydropower projects, as follows.

EIB Requirements/Recommendations Monitoring Requirements	Required	Recom-mended
72. **The Environmental Flow Release (EFR) regime established for the hydropower project must include a continuous programme of downstream monitoring** (including both flow and biological indicators as appropriate), evaluation, and adjustment during operation - commonly referred to as 'adaptive management' - so that it can be periodically reviewed and where necessary modified in response to increased understanding or changes in downstream ecosystem or socio-economic conditions.	✓	
73. All hydropower projects **must include the long-term hydrological monitoring of inflows to the scheme in order to facilitate the periodic review of hydrological design conditions and assumptions** (including with respect to future climate change resilience). This information would also feed into the adaptive EFR strategy described above. The monitoring may be undertaken directly, or the data collected from a national or river basin authority gauging station if present.	✓	
74. For hydropower projects that have potentially significant environmental and social impacts the EIB **recommends the establishment of an independent panel of environmental and social experts**[12].	✓	
75. All hydropower projects **must include the implementation of an Environmental and Social Steering Committee** that includes representatives of the local community to provide monitoring oversight and advice on the implementation of community based actions defined within the ESMS and the Community Development Plan.	✓	
76. All storage-based hydropower projects with large reservoirs **must include the long-term monitoring of sediment inflows and reservoir sedimentation rates** in order to facilitate the periodic review of associated engineering design considerations and assumptions, including	✓	

[12] Bank Information Centre, 2011 Best Practices for Panels of Experts

EIB Requirements/Recommendations Monitoring Requirements	Required	Recom-mended
with respect to flushing regimes. It is also recommended that regular inspection of shoreline stability is carried out to monitor and control erosion.	✓	
77. All potentially 'carbon-intensive' storage-based hydropower projects (e.g. those with large reservoirs and/or emissions greater than 20kt CO_2eq/yr) **must carry out direct monitoring and reporting of reservoir CO2 emissions during operation**. This is primarily to verify project design assumptions and (where possible) facilitate interventions to improve GHG performance in future. It will also enhance the general body of knowledge for future project design.		✓
78. For hydropower projects that involve significant hydropeaking operations, in addition to the EFR monitoring described above, it is **recommended that periodic stakeholder engagement surveys and grievance monitoring should be undertaken with affected downstream communities**, to include users groups such as those with established fishing rights (commercial and recreational), riparian farmers, and other recreational users such as canoeists. The purpose of this engagement will be to ascertain the effectiveness of operational flood warning systems, EFR strategies etc., and to refine these processes as necessary.		

8. Key References

EIB Documents and Standards

- Statement of Environmental and Social Principles and Standards, 2009
- Environmental and Social Handbook, Version 9.0, December 2013
- Methodologies for the Assessment of Project GHG Emissions and Emission Variations, Version 10.1, April 2014
- Energy Lending Criteria: Screening and Assessment Criteria for Energy Projects, July 2013
- EIB water sector lending orientation: strengthening water security, December 2017
- The EIB Group Strategy on Gender Equality and Women's Economic Empowerment, December 2016.

Other Documents

- European Commission DG ENV, 2003. WFD CIS Guidance Document 1: Economics and the Environment – The Implementation Challenge of the Water Framework Directive .
- European Commission DG ENV, 2009: WFD CIS Guidance Document 20: Exemptions to the Environmental Objectives.
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- Inter-American Development Bank (IDB) & The Nature Conservancy (TNC), 2013: The New Frontier of Hydropower Sustainability: Planning at the System Scale.
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- World Bank, 2012: A Guide for Local Benefit Sharing in Hydropower Projects. World Bank Social Development Working Papers, Paper No. 128.