



Rogun Alert Coalition

Rogun Hydro vs Biodiversity

**Review of the Updated Environmental and Social Impact
Assessment (ESIA) for the Rogun Hydropower Plant Project for
Compliance with the IFIs' Biodiversity Standards**

Editors:

Eugene Simonov, Rivers without Boundaries

Andrey Ralev, CEE Bankwatch

November 2025

Rogun Hydro vs Biodiversity

Review of the Updated Environmental and Social Impact Assessment (ESIA) for the Rogun Hydropower Project for Compliance with Biodiversity Standards

Contents

SUMMARY	3
1. Introduction	7
2. Contents of the Rogun ESIA	8
2.1 Key Biodiversity Impacts Identified in the ESIA.....	8
2.2. Transboundary and Cumulative Impacts	9
2.3. Proposed Mitigation Measures	10
3. Gaps in fulfilling the 2014 ESIA obligations and the Terms of Reference for 2023 ESIA.....	12
4. Detailed Analysis of the Rogun HPP ESIA (2025)	14
4.1. Fulfillment of the ESS6 Objectives:.....	14
4.2. Biased Approach: Terrestrial vs. Freshwater Biodiversity.....	16
4.3. Free-flowing Vakhsh River – Denied the Natural Habitat Status.....	19
4.4. Flaws in delineation of the Area of Influence (AOI)	24
4.5. Refusal to assess the impacts on the World Heritage site and other ecosystems below Vakhsh Hydropower Cascade.....	27
4.6. Baseline Data Insufficient and Unreliable	32
4.7. Improper Identification of Natural, Modified and Critical Habitat.	34
4.8. Uneven analysis of direct, indirect, and cumulative project-related impacts	36
4.9. Selective use of mitigation hierarchy	38
5. Concluding Remarks and Recommendations	40
Selected sources:	46

SUMMARY

The review assesses the ESIA's compliance with international biodiversity standards, with a primary focus on the World Bank's Environmental and Social Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (ESS6). This consolidated document synthesizes the detailed analyses, and presents a comprehensive assessment of the ESIA's contents, weaknesses, and critical gaps¹.

The provided ESIA documentation, led by the main report (ESIA Vol. 1), presents a structured but ultimately fragmented and narrowly focused approach to biodiversity assessment and management under ESS6. The main report (ESIA Vol. 1) complemented by the cumulative impact analysis (TCIA Vol. 1) serves as the central document, outlining the project, its baseline, and impact assessments, while the annexes (baseline biodiversity data-BBD, Critical-Habitats Analysis-CHA,) and management plans provide supporting analyses and planned actions. The Biodiversity Management Plan does not contain any credible mitigation measures for aquatic biodiversity. The “no net loss plan” (NNLP) is represented by a general framework, while detailed planning is delayed to future “Phase-2”. While the documentation is extensive, the collective analysis reveals significant inconsistencies and a selective application of ESS6 principles.

Comparative analysis reveals a potential inconsistency in the depth of assessment between terrestrial and freshwater ecosystems. The terrestrial analysis, culminating in the NNLP, is more detailed and partly quantitative regarding habitat loss and potential compensation. In contrast, the assessment of the main Vakhsh river channel and its aquatic ecosystems relies heavily on the questionable argument of a pre-existing modified baseline, leading to a less rigorous application of the mitigation hierarchy for impacts occurring within the river itself.

The major shortcomings include:

- **Narrow and Inconsistent Application of ESS6:** *The ESS6 framework is applied almost exclusively to two terrestrial habitat types occupying less than 2% of the inundation zone. The Vakhsh River itself, a vast aquatic ecosystem to be fundamentally altered, is explicitly not classified as a Natural Habitat and is thus excluded from the comprehensive mitigation and offsetting requirements of ESS6. This represents a critical inconsistency in the application of the standard. The habitat assessment relies heavily on broad categories (e.g., "pasture/degraded grassland") that obscure the value of smaller important habitats and does not meet basic requirements of the ESS6 or the EIB's standards. Many endangered and endemic species which may trigger critical habitat threshold and in any case require mitigation measures are discarded from proper assessment based on insufficient and inaccurate information (e.g. Amu Darya trout, Turkestan catfish, Eurasian Otter, Egyptian Vulture, etc.)*

¹ For inquiries regarding the contents of this paper, please, contact Eugene Simonov, at esimonovster@gmail.com

As a result, the impacts on at least 6000 hectares of natural habitats to be degraded by reservoir inundation are not included into the NNL framework. Suggested mitigation measures are insufficient and inefficient.

- **Dismissal of Ecological Impacts Based on Non-Ecological Arguments:** *The TCIA and ESIA Vol. 1 repeatedly assert that the project will have no negative downstream impacts on biodiversity below the Vakhsh hydropower cascade. This conclusion is based on a vague political commitment to adhere to existing water allocation agreements, which is not supported by any feasibility analysis. Consequently, the ESIA does not document the baseline conditions of the most valuable ecosystems of the Lower Vakhsh (e.g. Tigrovaya Balka World Heritage site) and fails to assess potential biodiversity impacts from different possible water regulation regimes and periods of climatic and hydrological extremes. Such an argument ignores the profound ecological consequences of water and sediment flow, and water temperature altered by the large hydropower cascade in which the Rogun HPP will become the main regulator, extending the recurring impacts by at least 60 years. This is inconsistent with the precautionary and science-based approach required by ESS6. Similar politicized arguments are used to dismiss a need to assess impacts of reservoir filling on the Ramsar wetlands of the Amu Darya Delta.*
- **Fragmented Impact Accounting:** *Not only downstream impacts are omitted. Impacts from associated facilities (resettlement sites, quarries, new roads) are acknowledged, but their biodiversity footprint is not quantified or integrated into the core biodiversity impact assessment or the compensation framework of the NNLP. The impact assessment focuses on direct impacts of inundation and road construction, but largely omits indirect and cumulative impacts in areas surrounding the future reservoir. These omissions are significant gaps under ESS6, which requires assessment of all project-related impacts.*

This ESIA applies the requirements of ESS6 to a small, pre-selected subset of impacts while failing to apply its principles consistently across the full scope of the project's ecological footprint. The result is an assessment that underestimates the project's true biodiversity risk and fails to propose adequate mitigation for its most significant impacts, particularly on the freshwater ecosystems.

*In particular, the **following steps are recommended** to bring the ESIA in compliance with the ESS6:*

Re-evaluate the Area of Influence (AOI): *Revise the AOI for biodiversity assessments to be ecologically meaningful and receptor-specific. The downstream aquatic AOI for operation period must extend to at least the Panj confluence, while for filling period it must include Amu Darya Delta wetlands. Terrestrial and freshwater AOIs must be based on the ecology of indicator species (e.g., home ranges) rather than arbitrary buffers.*

Strengthen Baseline Data: *Conduct detailed baseline biodiversity study of the ecosystems of Lower Vakhsh River with specific attention to World Heritage site and endangered aquatic fauna. Conduct and integrate full biodiversity baseline and impact*

assessments for all resettlement areas, quarries, and material extraction sites. For the whole Aol commission supplementary, targeted, multi-season baseline surveys to fill data gaps, particularly for bats, otter, invertebrates, fish populations (quantitative data), and river-dependent species. These surveys must aim to establish population baselines, not just presence/absence. Carry out targeted surveys for the Central Asian Otter, Amu Darya Trout (*Salmo oxianus*), Turkestan Catfish, and endangered raptors to determine if they trigger Critical Habitat or Priority Biodiversity Feature thresholds.

Refine Habitat Mapping and Classification: Conduct a finer-scale habitat mapping exercise that identifies, maps, and assesses specific habitat sub-types of ecological importance (e.g., different grassland communities, riparian scrub, gorges, cliffs, ravines). Re-classify the Vakhsh River within the main impoundment zone and most of its floodplain as a Natural Habitat under ESS6, recognizing that the project will fundamentally and permanently alter its primary ecological functions and composition.

Conduct Comprehensive Downstream Impact Studies: Assess impacts of the 16-year reservoir filling period on the Amu Darya Delta including the Ramsar wetlands. Perform a dedicated study on the impacts on biodiversity of altered flow, thermal regimes, and sediment starvation on the Lower Vakhsh River aquatic life and floodplain ecosystems, considering different operation regimes of the Rogun HPP, recurring nature and cumulative temporal impacts during its 100-year service. Conduct World Heritage Impact Assessment as required by the World Heritage Convention rules and present its draft results to UNESCO for review.

Strengthen the Mitigation Hierarchy Framework: Provide a transparent and robust justification that explicitly demonstrates how biodiversity impacts were considered in project design (e.g., dam height). Systematically document the application of the "avoid-minimize-restore-offset" hierarchy for all identified impacts, especially for freshwater ecosystems, to demonstrate that all preceding steps have been exhausted before accepting an impact as a residual one.

Improve Legal Agreements to Avoid Impacts. Assess effectiveness and long-term viability of existing water-sharing agreements and institutions to design and adopt additional improved legal and monitoring mechanisms to safeguard biodiversity during Rogun reservoir filling and hydropower cascade operation.

Manage Reservoir Filling: Develop a specific plan to minimize ecological shock to the Amu Darya Delta during the 16-year filling period, ensuring strict adherence to environmental flow requirements for downstream wetlands.

Expand the No Net Loss Plan: Based on the re-classification, develop a specific compensation strategy within the NNLP for the irreversible loss of over 170 km of lotic (riverine) habitat and its associated biodiversity, pursuing a "like-for-like or better" offset.

Include Technical Minimization Measures: Installation of fish-friendly turbines and/or behavioral barriers, design of multi-level outlets in Rogun dam for mimicking natural thermal regimes essential for aquatic life cycles. Application of robust collision risk modelling for new power lines and implement undergrounding or bird diverters in high-risk zones for migratory birds and raptors.

Develop a Robust Environmental Flow (E-flow) Regime based on the biological requirements of aquatic species and floodplain ecosystems of areas downstream of Vakhsh Cascade and prioritize release of artificial floods for Tigrovaya Balka. Incorporate the e-flow requirements into Operation Rules for Rogun HPP/Vakhsh Cascade and Management plan for the World Heritage.

Implement "Like-for-Like or Better" Offsets: To compensate for the fragmentation and loss of the Vakhsh River, designate and legally protect the Panj River (and adjacent Upper Amu Darya reaches) as a "free-flowing river," protecting it in perpetuity from future damming or diversion.

Restore Ecosystem Services for Communities: Implement restoration programs at resettlement sites to compensate for the loss of access to natural resources (pastures, water, wild plants). Develop and implement ecosystem conservation and restoration plan for the Upper Vakhsh subbasin to improve natural ecosystem resilience.

Integrate Findings Across Documents: Ensure that findings, impacts, and commitments are consistent and fully integrated across all volumes of the ESIA, ESMP, CHA, NNLP, BMP and TCIA to form a single, coherent assessment.

Without such adjustments the Rogun HPP Project implementation will cause wide-scale irreversible harm to regional biodiversity, will not fulfill "no net loss" requirements of the World Bank's Environmental and Social Framework (ESF) and will contribute to deterioration of globally important natural ecosystems, including those inscribed on the World Heritage and Ramsar lists.

1. Introduction

This report presents the findings of an independent expert review of the Updated Environmental and Social Impact Assessment (ESIA), Volume I, and its associated supplementary documentation for the Rogun Hydropower Project (HPP) in Tajikistan. The World Bank is the lead among 12 international finance institutions supporting the project. The analysis was undertaken to assess the Project's compliance with international biodiversity standards, primarily focusing on the World Bank's Environmental and Social Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources (ESS6), which is identified as an applicable standard for the Project (ESIA Vol. I, p. 436)².

This review has considered the following key documents provided:³

- **Rogun Hydropower project – Updated Environmental and Social Impact Assessment – Volume I** (hereinafter "ESIA Vol. 1"), which also includes Chapter Transboundary **Cumulative Impact Assessment** (hereinafter "TCIA")
- **ESIA Volume 2, Annex on Baseline Data. Part 9. Biodiversity.** (hereinafter "BBD")
- **ESIA Volume 2, Annex 15-1: Critical Habitat Assessment** (hereinafter "CHA")
- **ESIA Volume 3: Environmental and Social Management Plan: ESMP** (hereinafter "ESMP")
- **ESIA Volume 3: No Net Loss Plan/Framework** (hereinafter "NNLP")
- **ESIA Volume 3: Biodiversity Management Plan (BMP).**

The objective of this report is to evaluate the adequacy of the biodiversity baseline, the rigor of the impact assessment, and the robustness of the proposed mitigation and management measures. It concludes with a series of comments and recommendations on how to achieve compliance and ensure the long-term protection of biodiversity values. We intended to review the following key components of the ESIA in relation to biodiversity, with a special focus on freshwater ecosystems and species:

- The adequacy of the legislative and standards framework and assessment of baseline conditions.

² The ESIA also stipulates that according to EIB requirements the EU Habitats and Birds Directives also contain applicable standards (Volume 1. Para 15.2.6. page 441). However we have not found any further specific discussion on compliance to those standards in the documents analyzed.

³ We always refer to the ESIA volumes disclosed on the dedicated Rogun HPP Project page of the World Bank's website <https://projects.worldbank.org/en/projects-operations/document-detail/P181029?type=projects>. Its contents, chapter and section numbering may be different from the materials disclosed in Tajik/Russian and English by the Project Management Group at <https://www.energyprojects.tj/index.php/ru/>. The editors of the review bear no responsibility for those discrepancies and have requested the PMG to fix those before final consultations.

- The robustness of the assessment methodology, including the definition of the Area of Influence (AoI) and the process for identifying sensitive receptors.
- The classification of habitat types and degree of their modification (Modified, Natural, Critical) and the assessment of impacts upon them.
- The application of the mitigation hierarchy (avoid, minimize, restore, offset).
- The adequacy and feasibility of proposed mitigation and enhancement measures, particularly the Biodiversity Management Plan (BMP) and the No Net Loss Project Framework (NNLP).

2. Contents of the Rogun ESIA

2.1 Key Biodiversity Impacts Identified in the ESIA

The ESIA documentation identifies several significant adverse impacts on biodiversity resulting from the construction and operation of the Rogun HPP. The primary impacts are driven by the creation of a large reservoir (170 km² at Full Supply Level) and the construction of associated infrastructure (ESIA Vol. I, p. 24, 44). The area of impact considered in the documentation is largely confined to the area of the future reservoir and a 100-500 meter buffer zone. For the freshwater ecosystem the AoI (Area of influence) also includes lower reaches of tributaries of the future reservoir and a stretch of Vakhsh river downstream of Rogun dam to the Nurek dam wall, only 17 km of which is the remaining riverine habitat and the rest - Nurek reservoir.

The documentation states that the Critical Habitat Assessment (CHA) "has concluded that there are no areas of Critical Habitat within the Project AoI". This is a significant conclusion that shapes the subsequent mitigation strategy.

The assessment does, however, identify two types of **Natural Habitat** that will be impacted. This triggers the requirement for No Net Loss (NNL), which is the central focus of the proposed mitigation strategy.

Key impacts identified by the Project proponents are limited to:

- **Habitat Loss and Degradation:** The Project will result in the permanent and irreversible loss of terrestrial habitats within the flooding zone (its covers at least **16500 ha**). The ESIA specifically identifies the loss of **Natural Habitats** as defined by ESS6, including approximately **77 ha of floodplain habitat** and **185 ha of juniper woodland** (Volume 3, No Net Loss Framework, p. 7). The assessment also acknowledges that the creation of the reservoir will **fundamentally change approximately 70 km of lotic (river) habitat to a lentic (lake-like) system**. However, it does not recognize that this river ecosystem contains any "natural habitats".

- **Habitat Fragmentation:** The construction of new infrastructure, particularly the 55 km left bank road and associated bridges, will lead to the fragmentation and severance of terrestrial habitats along its route.
- **Impacts on Aquatic Biodiversity:** According to the ESIA the dam will create an insurmountable barrier to fish migration, further fragmenting the Vakhsh River ecosystem, which has already been impacted by the downstream Nurek dam. The ESIA notes that "long-range fish migrations...have already been interrupted" by other hydropower dams of the cascade downstream and that the Rogun dam will exacerbate this. Entrainment and impingement of fish in the turbines are also identified as impacts during both construction and operation.
- **Impacts on Flora and Fauna:**

The assessment points to potential total loss within the Aol of the Tajik Red Data Book (TRB) Critically Endangered plant species **Vitex agnus-castus**, for which the impact is assessed as **major (significant)**.

The assessment predicts direct mortality and displacement of fauna due to habitat clearance and inundation. Special attention is given to several species listed in the Red Book of Tajikistan (TRB), though the ESIA concludes that no Critical Habitat (as defined by ESS6) will be affected by the Project. The assessment of impacts on fauna appears to conclude that most effects will be minor or negligible, on the basis that **sensitive species will be "readily displaced" to other habitats** (ESIA, Vol.1, para 15.6.16 and 15.6.19). (Our comment: *This assumption may be overly optimistic and not valid without a more detailed analysis of the carrying capacity, the adjacent populations and the existing pressures in adjacent habitats.*). Chapter 15 (Biodiversity) states that "the cumulative impact assessment concluded that Rogun may have added to a small extent to a further reduction in short-range fish migration from Nurek reservoir upstream" (*an assumption not supported by any research or monitoring data*).

2.2. Transboundary and Cumulative Impacts

The Transboundary Cumulative Impact Assessment Annexes (TCIA, Volume 1, Chapter 23) broadens the geographic scope significantly, focusing primarily on hydrological changes and their effects on downstream riparian countries and ecosystems, such as **Tigrovaya Balka World Heritage site**. Its central argument is that the re-operation of the Vakhsh cascade, with Rogun HPP in place, will not alter the seasonal water distribution downstream of Nurek dam, and therefore, cumulative impacts on downstream biodiversity are considered negligible.

The ESIA concludes that "No transboundary effects upon terrestrial biodiversity have been identified" and that impacts on aquatic biodiversity will be absent or very limited. This conclusion appears to be based on the **commitment of the Government of**

Tajikistan to operate Rogun HPP in a way that does not alter the seasonal flow pattern downstream of the Nurek dam (*similar commitments previously made by other governments and companies, without turning those in a firm legal agreement/regulation enforceable by international bodies, have been violated soon after the projects were built as in cases of Bujagali Hydro offsets in Uganda⁴ or Ulog HPP in Bosnia-Herzegovina⁵. But in the case of Tajikistan the alleged “commitment” has no enforcement mechanism or any relation to biodiversity considerations*).

Another (*rather superficial*) assumption is that during the 16-year reservoir filling period annual withdrawal of 1.2 cubic kilometers will not affect ecological conditions in downstream ecosystems (e.g. Ramsar wetlands of the Amu-Darya River Delta).

2.3. Proposed Mitigation Measures

The primary mitigation measure for the loss of Natural Habitats is a **No Net Loss Project Framework (NNLP)** (Volume 3 document). Key elements of this framework include:

- Applying an area-based **3:1 compensation multiplier** to account for uncertainty and delivery risks, aiming at a total restoration requirement of **555 ha of juniper woodland** and **231 ha of floodplain** (NNLP, p. 15).
- Prioritizing **like-for-like or like-for-better** habitat restoration, with a focus on "Restoration and protection of juniper woodland" and "Restoration and protection of native riparian woodland" (NNLP, p. 5).
- Developing a **long list of potential restoration sites** in collaboration with the State Forestry Agency (SFA), totalling 7,599 ha, to demonstrate that suitable areas can be secured.
- Describing a tentative timeline for a **“Phase-2”** of the NNL project dedicated to planning and restoration efforts at specific sites, which are yet to be selected. This further planning and implementation process is aimed at producing and implementing a “NNL Plan” by end-2030 (the date of dam completion) as described in a very general way in the Biodiversity Management Plan.

For sensitive flora, the primary mitigation measure proposed is **translocation of affected plants** in advance of clearance activities. The **ESIA commendably acknowledges that this intervention has an "inherently variable success rate"** (ESIA, Vol.1. para 15.6.36).

⁴ Insights from the Kalagala biodiversity offset associated with the Bujagali power project in Uganda <https://www.inspectionpanel.org/sites/default/files/publications/Emerging%20Lessons%20Series%20No.%205-Biodiversity%20Advisory.pdf>

⁵ <https://riverwatch.eu/en/balkanrivers/news/ecocide-neretva-scientists-raise-alarm-after-mass-fish-die>

The **Biodiversity Management Plan (BMP)** is a brief 40 page document (44 pages), the first half of which is largely repeating information from other biodiversity-related chapters with significant unjustified variations from the original sources. Beyond repetition of the No Net Loss Framework>NNLF action points, it includes the following measures:

- Development of a “Biodiversity Conservation Tracker” to identify biodiversity issues during project implementation, plan and implement biodiversity mitigation “on the go”.
- Hiring a single botanist (in 2025) to be responsible for identifying rare plants and suitable places for their translocation as well as identifying invasive species in the inundation zone.
- Hiring a herpetologist to undertake ad-hoc relocation of reptiles in advance of clearance activities in 2025-26
- Hiring a bat-mammal specialist to identify location with presence of bats, acquire artificial bat-roosts on-line, remove bats prior to construction works and clearance, etc.
- Maintain good practice: 1) biodiversity precaution measures during construction; 2) competing pre-clearance checks; 3) avoiding clearance in nesting season; 4) Deliver “toolbox-talks” to project workers.
- Developing and implementing “Invasive species management plan” with main focus on a single species *Xanthium_spinosum*.
- Manage biodiversity risks with new project infrastructure outside of inundation zone (*no further detail provided*)
- Inform planting plants both for landscaping and soil stabilization (*should be implemented in the Site Rehabilitation Plan -which is absent from ESIA documentation*)

The BMP also has a monitoring section, which proposes to develop an “aquatic ecology monitoring program” (para 4.2.8 - 4.2.9.) geared towards understanding the new reservoir fishery and tracking changes, rather than mitigating impacts on the original riverine biodiversity.

3. Gaps in fulfilling the 2014 ESIA obligations and the Terms of Reference for 2023 ESIA

Before discussing in depth specific aspects of the ESS6 fulfillment in the 2025 ESIA we must note that the documentation only partially fulfills requirements of the Terms of Reference (ToR) for the ESIA Update (May 2022)⁶.

According to that ToR *“Among the major environmental and social issues identified in the (2014) ESIA and RPF were impacts on downstream riparian countries from filling of the reservoir and operation of the HPP,...impacts on aquatic biodiversity, impacts on natural habitats in the future reservoir area, increase in landslides and sedimentation in the reservoir area, etc. Following the disclosure and Tajikistan’s acceptance of the 2014 ESIA, Rogun JSC **committed to implementing the mitigation measures specified in the 2014 ESMP and to meeting international environmental and social standards during construction and operation.**”*

In 2021, the World Bank reviewed the ongoing construction to evaluate the adequacy of the mitigation measures in the ESMP but has not released publicly the result of that assessment. the 2024 CSO comments on the Rogun ESIA pointed to lack of implementation of numerous agreed essential monitoring programs⁷ and other ESMP commitments (e.g. not implemented feasibility study on artificial floods)⁸. Cessation of monitoring and information analysis after 2014 was one of reasons why the 2023 draft ESIA contained no reliable basin-specific up-to-date information on climate change, hydrology, sedimentation, etc. The Terms of Reference of the “ESIA Update” (*which is a very questionable approach given immense time lapse*) only partially addressed this problem, which then caused the project to order five new studies to account for the changes in the natural conditions after the draft ESIA was released and heavily criticized (*most of those not finalized yet and results absent in the ESIA*).

Even more worrying is our finding that even the limited scope of “updates” prescribed in the 2022 ESIA ToR has not been implemented in full. The following tasks related to biodiversity and habitat dynamics were listed in the 2022 ESIA TOR but are not found in the 2025 ESIA:

- a. **Feasibility study on artificial floods below the cascade:** The ESIA has not implemented the ToR consistent request to “assess the feasibility of having Rogun (reservoir) release water in a pattern and amount that at least partially

⁶ [Terms of Reference Update of Environmental and Social Instruments of Rogun Project and Support to Rogun Implementing Entity Technical Assistance for Financing Framework for Rogun Hydropower Project \(P178819\) \(English\)](#) May 15, 2022

⁷ [Rogun HPP ESIA violates Environmental and Social Standard 1](#) April 2, 2024

⁸ [World Heritage and Biodiversity issues](#) 27 February 2024

mimics previously naturally occurring floods, which ended with the construction of Nurek HPP” (to ensure viability of Tugai Forests of Tigrovaya Balka World Heritage). The NNL in Volume 3 has a Table 5-3 and a short paragraph refuting this task as “**a comprehensive hydrological and feasibility study would be required**” and the task “would require significant political will at the highest level” (NNL page 54-57). This means that the project proponents refused to implement this most crucial study based on assumptions that it is too complicated and time-consuming.

- b. **Fish Stock, Habitat, and Fisheries Study and Plan** (as described in the 2014 ESIA and ESMP) -- Absent from documentation, the BMP contains a vague wish to develop a very limited aquatic monitoring program.
- c. **Watershed Management Plan** (“with the intent of reducing erosion upstream of the dam in the watershed basin that drains to the reservoir area, ... developing improved habitat, revegetating barren erosion features with native species...”)-- Absent from documentation, while the term “watershed management” mentioned once in the ESMP as a possible planning task during the reservoir operation phase.
- d. “Equivalent to an **Integrated Water Resources Management Plan** The Plan should evaluate and include appropriate mitigation of significant impacts on river flows, quality, and morphology at the scale of the basin in order to protect ecological flows and water users.”- Absent from the ESIA documentation
- e. “Assessment of transboundary impacts that would result from changes in river flow that would result from operation of Rogun HPP”. This task was substituted with a superficial TCIA (**Transboundary Cumulative Impact Assessment**). The TCIA largely denies any such impacts based on political arguments, and without any baseline survey or detailed assessment studies.
- f. Evaluation whether “**environmental flow rate** established in the ESIA is **sufficient to maintain aquatic biodiversity and to support downstream uses in Tajikistan and riparian countries**”. E-flow study is substandard, confined to a short 15-km stretch between Rogun dam and Nurek reservoir. It does not properly consider aquatic biodiversity requirements, nor potential impacts in riparian countries.
- g. **Cascade Sediment Study and Modeling program, Cascade Dam and Reservoir Operating Plan, Bathymetric Monitoring and Sediment Characterization program, and Residual Flow Monitoring Plan, and**

Vakhsh/Amu Darya Hydrologic Monitoring program, so they are consistent with recommendations of the 2014 ESIA and ESMP. – Absent from documentation despite being crucial for assessing biodiversity impacts and habitat dynamics.

- h. **“Landslide Management and Monitoring system** as described in the 2014 ESIA and ESMP”. Volume 3 includes the “Reservoir Landslide Management Plan” section – reduced to generic 10 page outline (Vol 3.Section 36, pp 169-178). It is not specific to Rogun HPP project circumstances, but just briefly lists a generic approach to landslide management planning. Here or in the BMP there we found no discussion on mitigating landslide impacts on natural habitats, species and ecosystem processes. The plan does not have a specific budget, while the overall ESMP generalized budget allocates to its implementation just USD 0.5 million clearly insufficient for any engineering works or real-time monitoring system development.

From the biodiversity conservation perspective, those are huge gaps in fulfilling original ESIA ToR, which makes the assessment incomplete and non-credible. There are many other gaps related to other aspects of the ESIA, besides biodiversity. Despite several CSOs’ inquiries on reasons for these discrepancies between ToR and ESIA, no satisfactory explanation was provided by the project promoters or WB officials.

4. Detailed Analysis of the Rogun HPP ESIA (2025)

4.1. Fulfillment of the ESS6 Objectives:

Objective 1: Protect and conserve biodiversity and habitats.

This objective is only partially fulfilled. The ESIA identifies less than 2% of reservoir inundated area as terrestrial Natural Habitats, representing juniper woodland (185 ha) and floodplain(77 ha) and commits to compensating for their unavoidable loss through a No Net Loss Plan (NNL). (However, the actual plan is yet to be developed in “Phase-2” in the future).

The ESIA fundamentally fails to protect the biodiversity of the Vakhsh River itself. By not classifying the river as a Natural Habitat (or Critical Habitat), the ESIA avoids the requirement to mitigate or offset the project's single largest ecological impact: the permanent transformation of over 170 km of a lotic (river) ecosystem into a lentic (lake) one. For example these natural river at around 1100 masl:



The ESIA also fails to analyze, assess threats to and design mitigation measures for many endemic and endangered species (e.g. endemic salmonids, sturgeons, etc.) excluding those from the detailed analysis based on biased reasoning not supported by reliable data.

Objective 2: Apply the mitigation hierarchy.

The hierarchy is acknowledged but applied inconsistently and inflexibly. For the most significant impacts, particularly the transformation of the Vakhsh River, the "avoid" and "minimize" steps are not robustly demonstrated, and the "restore" and "offset" steps are entirely absent. The discussion on alternatives, such as a lower dam height, is dismissed primarily on economic grounds without a balanced assessment of the significant biodiversity impacts that could have been avoided). This suggests the **hierarchy was used as a justification exercise** rather than a guiding principle for project design. This is addressed further in part 4. of the Detailed Analysis.

Objective 3: Promote sustainable management of living natural resources.

This objective has not been pursued beyond the NNLF. Management of biological resources, like fisheries, is not analysed in sufficient detail. To this end, the history of filling and operating Nurek Reservoir shows the absence of consistent effort to sustain stable fisheries in the reservoir or downstream (Vol.1 :15.7.25). The ToR for this ESIA prescribed development of a “Fish Stock, Habitat, and Fisheries Study and Plan” (ToR ESIA, 2022) but those are not mentioned in Vol.1 and have not been disclosed as a part of documentation. Management of grasslands/pastures reduced and reconfigured due to river valley inundation is also left completely out of the scope of assessment.

Objective 4: To support livelihoods of local communities through the adoption of practices that integrate conservation needs and development priorities.

The assessment of impacts on ecosystem services lacks any site-specific detail, qualitative, and retrospective. While it identifies services like the provision of wild plants and fisheries, the analysis is not fully integrated into the mitigation framework. It is not clear how the quantitative loss of these services for affected communities will be mitigated or compensated beyond general resettlement frameworks, especially for services provided by the riverine ecosystem. Meanwhile the Resettlement Action Plan (RAP-2) presents clear evidence that at resettlement sites project-affected people lack access to water, pastures and many natural resources their traditional livelihoods rely on in the Vakhsh river valley. RAP-2 contains no detailed, credible measures to fully restore or compensate the ecosystem services that local people utilized before resettlement.

4.2. Biased Approach: Terrestrial vs. Freshwater Biodiversity.

The approach to terrestrial and freshwater biodiversity is fundamentally different and inequitable, representing the largest gap in the ESIA's compliance with ESS6.

Terrestrial: ESIA combines historical data, remote sensing, and targeted 2023 field surveys only at 16 locations. For the two tiny habitats identified as "Natural," a quantitative loss assessment was conducted, and an offset framework focused on revegetation (NNL) was developed to achieve No Net Loss. While limitations in survey effort are noted (e.g., for bats, grassland types), there is at least some traditional habitat assessment (its diverse flaws will be discussed in other sections).

Freshwater: The approach is substantially weaker and heavily constrained.

4.2.1. Critically Weak Baseline: The baseline is critically weak due to alleged access constraints and an over-reliance on eDNA methods. There is a lack of robust, quantitative data on fish and invertebrate populations, spawning grounds, and community structure.

The baseline assessment, citing dangerous river conditions, relies heavily on Environmental DNA (eDNA) analysis. *For the absence of basin-specific DNA libraries, the eDNA also fails to identify many species (Vol.2, para 9.4.69 and 9.4.78).* Likely example of that is misidentification of the non-native Common Bleak (*Alburnus alburnus*), a species, likely, never registered in this river, which is far more likely to be a native *Alburnus* species, a sample for which was absent in the eDNA library⁹. While, as long as

⁹ The latest review of the fishes of Tajikistan provides several potential candidates from Amu Darya basin : *Alburnusamu d taeniatus* Kessler, 1874; *Alburnus cf. chalcoides* (Güldenstädt, 1772); and with less likelihood a member of a very close genus *Alburnoides holciki* Coad and Bogutskaya, 2012. Besides

reference libraries are available, eDNA may serve as a valid modern supplement tool for detecting species presence, it provides no quantitative data on population size, structure, health, or habitat use, which is essential for a credible impact assessment.

4.2.2. Neglect of Dependent Species: Even for correctly identified species the wrong taxonomic status is reported. For example, it has been established by recent research that the Amu Darya Trout, is a stand-alone valid species of migratory trout endemic to Amu-Darya basin- *Salmo oxianus*¹⁰. However, the ESIA treats it as a subspecies of Brown Trout (*Salmo trutta oxianus*), which downplays its endemism, and does not contain any additional information on current range, status of populations, their migration habits and specific mitigation measures. Meanwhile, because of rampant hydropower dam development on mountain tributaries in Uzbekistan and Kyrgyzstan, the Upper Vakhsh river system may well be the best remaining stronghold for this endemic species. Similar lack of analysis is typical for descriptions of all other fish species.

No systemic characteristic of invertebrates is found in the ESIA.

For river-dependent mammals like the Central Asian Eurasian Otter (*Lutra lutra seistanica*), presence is noted but its population status, habitat use within the AOI, and key feeding/denning areas are not properly analysed. According to the latest review, Eurasian otters are rare in Central Asia and their populations may be declining toward extinction in parts of the region. Eurasian otter is listed in the Red Lists of all adjacent countries “endangered” in China, Uzbekistan, Turkmenistan, Tajikistan, “vulnerable” in Afghanistan¹¹. Mitigation measures are essential because of the intended destruction of the large natural habitat of the otter. Due to lack of recent data on the otter in Tajikistan, a nation-wide assessment to determine what % of the overall national otter population may be impacted had to be carried out before making any judgments. The ESIA’s conclusion that the impact is “beneficial” because a greater number of otters will be able to thrive in the fluctuating Rogun reservoir (Volume 1. Biodiversity 15.7.45) seems to be counter-factual and without very detailed scientific justification likely belongs to the domain of science fiction¹².

missing a fish endemic to Central Asia, this eDNA misidentification contributed to the false narrative of “prevalence of non-native species”. <https://bioone.org/journals/american-museum-novitates/volume-2025/issue-4032/4032.1/Ichthyofauna-of-Tajikistan--Diversity-and-Changes-Over-the-Past/10.1206/4032.1.full?tab=ArticleLink>

¹⁰ Segherloo I.H. et al (2021) A genomic perspective on an old question: *Salmo* trouts or *Salmo trutta* (Teleostei: Salmonidae)? <https://pubmed.ncbi.nlm.nih.gov/34015446/>

¹¹ https://www.iucnsgbull.org/Volume42/Savage_et_al_2025.pdf Besides, the most recent surveys documented gradual disappearance of the otter from the Vakhsh headwaters in Kyrgyzstan making remaining otter habitats on Vakhsh/Surkhob even more important for transboundary restoration of the species populations.

¹² The World Banks’ ESIA for Nurek HPP modernization and TRB 2017 do not list reservoirs as otter habitat. Research referenced by this ESIA was done on small reservoirs of Portugal/Mediterranean and is largely irrelevant for large reservoirs in Tajikistan. Besides, it does not support the conclusions suggested in the ESIA.

For birds, the ESIA fails to adequately consider specialists that depend on riverine features (e.g., Ibisbill¹³), and the loss of more than 70km of braided channel, island, and bank habitats is not assessed in terms of its impact on such species. Judging from the ESIA there was not enough effort to find nests, the methodology, effort and season were inappropriate or insufficient.

4.2.3. Undescribed Ecosystem Function: The assessment focuses on compilation of species lists but lacks a deep analysis of ecosystem functions, such as nutrient cycling, primary productivity, and the specific habitat requirements (e.g., flow velocity, substrate) for key native species. Assessment of importance of the riverine ecosystem services for humans lacks quantification, while those resettled are dwellers of a Vakhsh river valley.

4.2.4. Gaps in Impact Analysis:

Focus on Inundation: The analysis focuses on direct habitat loss via inundation but fails to analyze the profound ecological consequences of converting a high-energy, turbid lotic system into a deep, stratified, clear-water lentic system.

Altered Regimes: The impacts of altered thermal regimes ("thermal pollution") and flow patterns on aquatic life between Rogun and Nurek are not adequately assessed for invertebrates and fish spawning cues.

Sediment Blockage: The long-term effects of the complete blockage of sediment transport on downstream channel morphology, habitat complexity, and the Nurek reservoir ecosystem are not analyzed.

Fragmentation and Entrainment: The impact of the Rogun dam as a new barrier to fish migration is understated in cumulative impact assessment (TCIA) and not assessed at all in actual biodiversity assessment (where it should have been addressed in detail¹⁴). Meanwhile, this relates to a number species of concern, for example, the Aral salmon (*Salmo (trutta) aralensis*) was last registered in Nurek Reservoir (TRB 2017) from which it had to migrate in upstream tributaries of Vakhsh for spawning. While Aral salmon may have already disappeared, as it has not been registered by scientists since the 1990s (but its extinction has not been proven yet), this, likely, was a migration route for its closest

¹³ The brief mention that floodplains of Vakhsh and Surkhob are "unsuitable" for Ibisbill is not supported by any credible evidence, while there is clear statement that Ibisbill is using similar floodplains in adjacent areas. For example, there are summer records of Ibisbill in Romit Nature reserve at similar altitudes (floodplains located at 1200-1350 masl). Since the team found a nesting pair Ibisbill in the tributary upstream, it would be important to explore where the birds descend in winter, so winter search in the AOI is necessary to look for wintering birds.

¹⁴ GN19.2 (Footnote 11). Where a habitat was converted in anticipation of the proposed project, the requirements of ESS6 that are appropriate for the original habitat are applicable. Conversion of habitats in the project area in anticipation of the project is considered as an adverse impact of the project, even if it takes place before project identification.

relative, Amudarya trout, as well as one or several native snow trout (*Schizothorax*) species.

The risk of fish entrainment through turbines is also deemed "minor" based on a weak assumption of low fish diversity in the future reservoir, without quantitative analysis or consideration of mitigation (e.g., fish-friendly turbines, fish barriers repelling devices).

Gaps in Mitigation: Mitigation for freshwater ecosystems is generally vague, relying on unspecified "general good practice environmental management" rather than specific, measurable actions. No such "good practice" specific to dam impacts beyond avoiding pollution is prescribed in the BMP. There are no proposals for using multi-level dam outlets to manage water temperature, or enhancing habitat elsewhere to compensate for lost main-channel habitat. The aquatic ecosystem monitoring program suggested for development in the BMP does not aim to mitigate impacts from reservoir creation, but rather to consider fisheries management conditions in the new water-body.

No Mitigation for River Loss: The most significant gap is the complete lack of specific mitigation measures, restoration proposals, or offsets for the loss and alteration of the more than 170 kilometers of riverine freshwater ecosystem itself. The ESMP and NNLP are silent on this massive impact. See sections 4.3. and 4.5. for in depth analysis of this gap and suggestions how to fill it.

4.3. Free-flowing Vakhsh River – Denied the Natural Habitat Status.

The ESIA explicitly excludes the Vakhsh River (even within the inundation zone) from the "Natural Habitat" classification and, therefore, from any No Net Loss obligation. Consequently, the ESIA acknowledges the profound ecological transformation of the river by the Rogun HPP Project but proposes no specific mitigation, restoration, or offset for this permanent impact. The existing Rogun dam built around 2016 floods 9 km of the Vakhsh River, whilst the proposed dam at 1290 masl would additionally flood approx. 60 km of the main stem of Vakhsh-Surkhob River and 100-140 km of its tributaries (e.g. Obikhingou river and 40 smaller tributaries).

The ESIA states that "*Vakhsh River within the Aol is therefore not considered to be Natural Habitat as per ESS6*" (ESIA Vol. 1, Table 15-4 – Receptor Evaluation). The justifications provided for "modified character" of the river is the existing fragmentation from dams, the presence of non-native species, "absence of IUCN-listed invertebrates" (sic!), and past construction activities. Such conclusion is a gross misapplication of the ESS6 definition of "natural habitat" and is inconsistent with that WB standard or the EIB standards.

The discussion in the rest of this section will narrowly apply to the river ecosystems affected by the planned inundation and those which are connected to them upstream¹⁵, while other affected segments of Vakhsh River downstream from Rogun dam not properly analyzed by the ESIA will be discussed in subsequent sections.

4.3.1. Vakhsh River Satisfies the Definition of Natural Habitat: ESS6 defines Natural Habitats as areas where human activity has not “essentially modified” the area's primary ecological functions and species composition. While altered downstream by the Nurek Dam, and lately by the existing small Rogun reservoir (as of 2025 it modifies only 9 km of the river upstream of the Rogun dam), the Vakhsh River in the planned Rogun HPP reservoir inundation area is connected to extensive free-flowing river reaches upstream and still performs the primary ecological functions of a large river (e.g., conveying water, transporting sediment, providing aquatic habitat for an array of typical species). This is what the project will completely and irreversibly transform.

The Baseline biodiversity assessment is not based on a complete inventory of habitats and even fails to give quantitative characterization and map different types of river habitats. Meanwhile, just the inundation area (at the level 1290 masl) includes up to 90 km of large river channels (Vakhsh, Surkhob, Obikhingou) and 80-120 km of their tributaries fully interconnected with extensive upstream ecosystems and preserving a natural character not affected by any sizable water infrastructure. The EAAA failed to include the whole free-flowing river complex upstream of Rogun, which exceeds 600 km of large rivers (not considering smaller tributaries). In the inundation area those rivers with floodplains occupy more than 4850 hectares (Volume 2, Table 9-3,). As noted in the ESIA's Geomorphology section of the Baseline assessment (Vol 2. para 7.6.7.) braided channels that are free of anthropogenic influences are found along 54 kilometres of the river length, representing a diverse valuable riverine habitat. At the same time, this subbasin upstream the Nurek/Rogun dams represents the second-largest unmodified natural mountain river complex in Amu-Darya River basin after the Panj River. The area to be inundated represents the downstream part of the Upper Vakhsh river complex which, following the general pattern of all mountain rivers, most likely, has significantly higher freshwater biodiversity value than the upstream reaches. None of these important facts is properly discussed in the ESIA.

The ESIA claims about interruption of long migration of native fish by Vakhsh Hydropower Cascade located 70 km downstream are potentially relevant only for 1-3 species inhabiting lower reaches of Panj and Vakhsh and capable of long-range migration (we

¹⁵ The length of the main rivers of the free-flowing Upper Vakhsh River system is at least 600 km from its source to the 1290m inundation boundary (Surkhob-Kyzylsu (length >350 km), Obikhingou (>200 km) and Kamarob (>50 km) rivers and their tributaries). Together with planned inundation, this represents 670 km of large free-flowing river system.

found relevant evidence only for the Aral salmon)¹⁶, but cannot justify the characterization of the upstream habitat as “not natural”. Regrettably, the ESIA does not present any review of ichthyological studies for this area apart from the project surveys, therefore even the claim about interrupted migration is unsubstantiated.

The ESIA also makes a completely scientifically unjustified claim that naturally turbid waters of Vakhsh make it less valuable as a natural habitat, completely ignoring the fact that sediment transfer is a natural ecosystem process to which local biota has been adapting for millennia¹⁷.

Prevalence of Native Species: The presence of viable assemblages of largely native species must trigger river recognition as natural habitat. The ESIA falsely claims that the mountainous river has low diversity of native fish. Meanwhile Table 1-33 “Fish species expected and recorded within the Rogun HPP Aol” shows potential and actual presence of 8 native species, which compared with other rivers in mountainous regions of Central Asia (e.g. Naryn) should be considered a very high native fish species diversity (See GIS [Key Freshwater Habitats in the Mountain regions of Central Asia](#))¹⁸. According to the ESIA, at least 5 native species were identified with high certainty through direct catch and eDNA methods. The BMP does not identify any introduced fish species as “invasive” (i.e. potentially causing irreparable damage to local biota) and does not suggest any specific measures to mitigate their impacts.

As for other aquatic fauna, eDNA from water samples collected within the project area, confirmed the presence of 483 species of freshwater animals, but only 16 of those could be identified to species level(!). “No invasive species identified among those”. Given that 95% of species could not be identified at species level, the statement on “absence of IUCN-listed invertebrates” is hardly justifiable.

Therefore, according to the baseline study, the composition of aquatic fauna in the Aol is largely dominated by native species in all groups assessed. The same largely holds for species composition of water-dependent birds and mammals¹⁹.

Presence of nationally threatened fish like the Amu Darya Trout (*Salmo trutta oxianus*^{*20}) and Turkestan Catfish (*Glyptosternon oschanini**), as well as endangered major

¹⁶ Other possible long-range migrants would be two endangered burbules, which are also known to dwell in the reservoirs in Central Asia. However, the ESIA baseline study does not include those species as potentially present in the affected stretch of the river, while it considers those species in the CHA Chapter.

¹⁷ For example, further downstream lack of turbidity caused by Vakhsh Cascade reservoirs is believed to be one of factors negatively affecting survival of endemic shovelnose sturgeons and pike-asp adapted to turbid waters.

¹⁸ Table 9-10 in Volume 2 combines species expected/found in Nurek reservoir with those above the new Rogun dam, which is a major inaccuracy preventing informed judgements on native and introduced species of fish in each of two very ecologically different parts of the Aol.

¹⁹ No specific data on aquatic flora found in the ESIA.

²⁰ By asterisk * we marked *Latin names* used in the ESIA, likely not reflecting current scientific understanding of the current taxonomic status of a species, which is a problem throughout the ESIA. We

piscivorous carnivore Eurasian otter (*Lutra lutra seistanica*) also confirms that the river still qualifies as a Natural Habitat.

The ESIA also denies the presence of migratory species in the Aol and fails to analyze seasonal migrations of several native species such as Amu Darya Trout and Snow Trout (*Schizothorax intermedius**). Meanwhile, for the vulnerable Amu Darya Trout (*Salmo oxianus*) Upper Vakhsh basin now is the second largest remaining contiguous river ecosystem suitable for habitation and migration after the Panj-Amu Darya (However, Panj, has much smaller number of historic records for this species).

4.3.2. The clause that Vakhsh River is “not considered to be Natural Habitat” is unjustifiable : The Guidance Note for ESS6 (GN19.1) clarifies that “*Modified habitats are areas that may contain a large proportion of plant and/or animal species of nonnative origin, and/or where human activity has substantially modified an area’s primary ecological functions and species composition*”.

Habitats affected by human activities are still considered natural if “*those activities have had a limited impact on the species composition or ecological function*”, or “*despite human impacts habitat supports a mature and diverse community of predominantly native species*”, or “*human activities have not profoundly affected the habitats ability to recover its former ecological characteristics*”. The Vakhsh river and tributaries upstream of Rogun dam largely satisfy all those requirements and must be recognized as natural habitat.

Neither presence of several introduced species, nor river blockage by Nurek dam far downstream, nor traditional use of some floodplains for agriculture by local populations could justify calling large still free-flowing river ecosystem with robust assemblage of native species of invertebrates, fishes and birds a “non natural” or “modified habitat”.

This judgment equally applies to the dynamic floodplains, which are an intrinsic part of the river ecosystem and are capable of very quick recovery from local human disturbance unless natural processes are constrained by water infrastructure (e.g. dams, dykes).

Although we have demonstrated relatively high fish species diversity and presence of several endangered river-dependent species of vertebrates, those are add-on values to the “natural” state of the river ecosystem. The very definition of “natural ecosystem” does not include as necessary a requirement for a presence of threatened/vulnerable “IUCN-listed species”. Besides, many species of fish in this region, like the Amu Darya

follow the most recent source on current taxonomy: **Artaev, o. et al. Ichthyofauna of Tajikistan: Diversity and Changes Over the Past Century** <https://bioone.org/journals/american-museum-novitates/volume-2025/issue-4032/4032.1/Ichthyofauna-of-Tajikistan--Diversity-and-Changes-Over-the-Past/10.1206/4032.1.full?tab=ArticleLink>

trout, lack IUCN assessments, while assessments of the status made for others happened to be overoptimistic.²¹ Neither the diversity of species as such can be used as a proof of the habitat “naturalness”, which can be demonstrated by natural increase of diversity of fish species from mountain river sources to foothills in a large river system, while the degree of human impacts, usually, has the opposite gradient.

The ESIA also uses as “habitat modification” argument the Rogun HPP construction works eventually leading to intended transforming of more than 90km of river length into a deep lake. However, claims that such impacts are already part of the biodiversity baseline as the initial dam has already been built, and a small-scale inundation is already in place are illegitimate in the light of the World Bank’s ESF. For such cases ESS6 Footnote 11 clearly explains that **“A habitat will not be deemed to be a modified habitat where it has been converted in anticipation of the project.”**²² But even if taken into consideration, the current inundation by Rogun reservoir modified less about 9 kilometers of river length, while the remaining 81 kilometers of large rivers and even more of tributaries remain a part of large free-flowing river ecosystem (containing more than 600 km of large river courses).

By classifying the river as merely “modified habitat” of low value, the ESIA sidesteps the rigorous “no net loss” requirements for Natural Habitats, leading to a failure to mitigate or offset the project's largest ecological impact.

4.3.3. Necessary Corrective Measures - Apply Full Mitigation Hierarchy:

4.3.3.1. The ESIA must re-classify the 170km of river segments and most of the 4850 ha of floodplain to be affected by inundations as Natural Habitats, acknowledging its existing very limited modifications and recognizing its high value as a major river ecosystem supporting natural process, native biodiversity (including vulnerable endemic species) and ecosystem services.

4.3.3.2. The ESIA must quantify the significant residual impact of losing over 90 km of major riverine habitat with floodplains and its complete, permanent conversion into a lentic system. The ESIA still considers the impact as large, the adverse effect as significant (moderate), but states that *“No additional mitigation measures are possible given that habitat change will be a permanent component of the Project”* (Volume 1. Biodiversity para 15.7.55). This is not consistent with the ESS6 or EIB policies.

4.3.3.3. The ESIA must use precautionary approach and reassess the status of the *Salmo oxianus* and *Glyptosternon cf. akhtari* Silas, 1952, which were described based on

²¹ Thus neither the endemic trout *Salmo oxianus* Kessler, 1874, nor native catfish *Glyptosternon cf. akhtari* Silas, 1952 have been assessed by the IUCN, while an endemic loach *Dzhunzia ilan* from nearby Zeravshan River was assessed as the “Least Concern” and recognized as likely extinct soon after that as a result of repeated surveys.

²² Besides, 90% of aquatic habitats upstream of the Rogun dam site have not been modified before the ESIA preparation in 2023.

outdated taxonomic status. Now both species must be assessed as endemics of the Amudarya river basin with ranges gradually reduced by dam development. Given increasing fragmentation of other documented habitats, the *Salmo oxianus* may trigger critical habitat threshold, lest it follows its closest relative, Aral salmon, on the path to extinction. Even if they don't trigger Critical Habitat, both species should trigger Natural Habitat/Priority Biodiversity Features (as per different bank policies).

4.3.3.4. Approach to Central Asian Otter listed endangered in the TRB (and likely to several other highly vulnerable species) should be revised. Mistakenly, the otter was not included even into critical habitat screening (Volume 2. Critical Habitat Assessment. Table 3-2) after it was registered with footprint photographs provided in ESIA Vol II. Given its shrinking range, decreasing numbers and vast natural habitat to be converted by the Project, the otter is likely to trigger Critical Habitat threshold, and even if not, it still requires special mitigation measures as an important biodiversity feature and should be included into NNL planning. The BMP\NNLP does not address that.

4.3.3.5. Mitigation hierarchy must be properly used, analyzing possibilities for avoidance, and then minimization of impacts on biodiversity. If it is proven that avoidance and minimization of all impacts are not possible (for example, through reducing the dam/reservoir size), mitigation of residual impacts must be included in the No Net Loss Plan. As a last resort, the ESIA must propose compensation measures aimed at creating or improving riverine habitats elsewhere (a "like-for-like or better" approach). The most adequate "like-for-like-or better" measure for mitigating fragmentation and destruction of aquatic habitat would be designing legal protection of Panj River (and adjacent stretch of Upper Amu Darya) as a "free-flowing river" protected in perpetuity from damming, large water diversions and other major intrusions.

This also could involve other mitigation measures, such as restoring other degraded river stretches/ecosystem processes in the same river basin, e.g. instituting artificial floods as part of environmental flow regime downstream of Vakhsh Hydropower Cascade to support floodplain forests of Tigrovaya Balka World Heritage site and the most valuable aquatic biodiversity of Lower Vakhsh River ecosystems.

4.4. Flaws in delineation of the Area of Influence (AOI)

The delineation of the Area of Influence (AOI) and the Ecologically Appropriate Area of Analysis (EAAA) is insufficiently justified, inconsistent, and not ecologically meaningful for all receptors.

According to Table 4-4 (Volume 1. Analysis of alternatives) the AOI occupies 282 km², which covers only 112 km² above inundation line²³. Specific information on locations and acreage of affected habitats in resettlement sites is not found in the Aol description. No coherent map of the Aol related to biodiversity impacts was found in Volumes 1 and 2. Therefore, there is no clear delineation of the Aol in the ESIA.

Terrestrial AOI and EAAA: The terrestrial AOI is primarily defined by the project footprint and an arbitrary, fixed-distance "disturbance zone" of 100m, extended to 500m for invasive species (ESIA Vol. 1, para 15.4.4.-15.4.5.). This buffer-based approach is ecologically meaningless for wide-ranging and mobile species. It fails to consider impacts on the foraging ranges, home ranges, dispersal corridors, or territories of species like the brown bear, snow leopard, or raptors that extend far beyond the immediate footprint. For example, the ESIA excludes the Snow Leopard from consideration in the critical habitat assessment, noting "*Desk study records obtained from c. 2.5km south-east of the Aol*". Obviously, this is immediate proximity to the project impact area for such wide-ranging species as the snow leopard.

The EAAA is not explicitly defined for most species, and when defined tends not to cover the full "continuous habitat within which the ecology (of species) is functionally linked.

Freshwater AOI: The aquatic AOI is defined as the Vakhsh River upstream of the Nurek Reservoir. Its effective termination at the Nurek dam²⁴ is a major weakness of the whole ESIA. It is based on the unsubstantiated assertion that the re-operation of the cascade will have no impact on the downstream environment, as Tajikistan committed to not introducing any changes to seasonal redistribution of flow. The potential downstream impacts resulting from annual withdrawal of more than one cubic kilometer during 16 years of Rogun reservoir filling were also dismissed on an irrelevant excuse that Tajikistan will use its water quota in full in any case. This approach is inconsistent with the precautionary principle and fails to assess the hydropower cascade impacts on sensitive downstream ecosystems (See dedicated section 3.5. on potentially affected World Heritage and other ecosystems below Vakhsh Hydropower Cascade).

Current delineation of the Aol, as presented in the ESIA, directly contradicts the adjustment announced by the World Bank in 2024 in official correspondence with the CSOs: "*The ESIA that is currently being finalized acknowledges that this scope was too*

²³ According to paragraph 1.11.68 (Volume 2. Baseline data. P. 175 and Table 1-26) the "high-level summary of overall habitat composition within the Aol " covers only 16282 hectares, which is, likely, less than area covered by maximum inundation level (170 km²) and definitely excludes arbitrary buffers of 100 and 500 meters.

²⁴ Even that is uncertain as aquatic Aol is defined as "Vakhsh River upstream of the Nurek Reservoir", but no map provided to show its proposed limits.

limited and has expanded the Area of Influence (AOI) to include the downstream sections of the Vakhsh and Amu Darya rivers.”(WB Response to CSOs. October 28, 2024)²⁵.

Inclusion of the downstream (and upstream) areas into the Aol delineated for the Transboundary Cumulative Impact Analysis (TCIA volume 1, Chapter 23) does not help the assessment, as the TCIA analysis is far more shallow than the ESIA and discussing the biodiversity impacts it is based on a false assumption that nothing will change in comparison with current operation of Nurek dam. It does not have any appropriate detail on biodiversity baseline situation, misidentifies biodiversity receptors (talks about abstract “fish migration” instead impacts on full life-cycle of specific species) and fails to analyze threats even for critically endangered species of fish. The whole TCIA is based on trust in political commitments rather than on rigorous analysis of impacts under different possible scenarios. It is an absolutely inappropriate substitute for the proper biodiversity impact analysis in the ESIA. The TCIA recognizes, though, that the current operation regime of the Nurek dam has the most detrimental impacts on the downstream freshwater biodiversity and floodplain ecosystems, including Tigrovaya Balka World Heritage site.

The fact that those areas were fully excluded from the Aol for biodiversity-related chapters in ESIA results in several detrimental consequences:

- Globally most important biodiversity downstream of Vakhsh HPP Cascade potentially affected by the Project is excluded from the baseline assessment;
- Environmental flow regime necessary to sustain that biodiversity was not assessed in the ESIA
- Recurring negative impacts resulting from reoperation of the hydropower cascade, when Rogun Reservoir becomes the leading regulator of water regime have not been taken into consideration;
- Negative consequences of extending the Rogun/Nurek reservoir system lifetime from 30-40 to 100–120 years have not been assessed, while prolonged impacts may have a decisive influence on the World Heritage site survival;
- Whether the policy commitment by Tajikistan to maintain status quo is feasible and sufficient for long-term biodiversity preservation has never been analyzed in the ESIA;
- The Tugai Forests of Tigrovaya Balka Nature Reserve was screened out of the Critical Habitat Assessment on the basis that “impact of Rogun HPP.... can be excluded” (Volume 2. CHA, Table 3-2, p.30), while the freshwater ecosystem downstream of hydropower cascade has not even been mentioned in the CHA.

Next section 4.5. will examine it in detail.

²⁵ <https://thedocs.worldbank.org/en/doc/7eaa0adb0e15f657a729660cfe27d786-0080012024/original/World-Bank-October-28-2024-Response-Letter-Rogun.pdf>

Possible Alternatives:

The AOI and EAAA must be receptor-specific and delineated based on scientific evidence and ecological principles.

For Terrestrial Fauna: The AOI for wide-ranging mammals should encompass the typical home range or territory size of the species, centred on the project area. For migratory birds, the AOI should consider the entire Vakhsh valley as a critical migratory corridor. For large mammals, the AOI should consider the surrounding mountains.

For Aquatic Ecosystems and Floodplains: The aquatic AOI/EAAA must be defined as a series of continuous units encompassing the entire river reach subject to altered hydrology, sediment, and thermal regimes. The EAAA must be extended from the upstream extent of the reservoir to the headwaters of Upper Vakhsh river system to account for ecosystem process and fish migration.

As for the Lower Vakhsh the AOI itself should end at a scientifically justified point far downstream of the cascade, which is likely the Ramsar wetlands in the Amu Darya Delta, while the EAAA may also include Panj as interconnected river ecosystem which processes define the ecological dynamics of Amu-Darya River.

Ecological impacts on tributaries upstream of inundations zones should be reflected not by uniform 2km buffer, but by river stretches of varying length as justified by ecosystem process such as fish population structure and migrations, including such migration changes induced by inundation (e.g. Amu Darya trout *Salmo oxianus*).

4.5. Refusal to assess the impacts on the World Heritage site and other ecosystems below Vakhsh Hydropower Cascade

The ESIA, particularly in the TCIA, explains the perceived absence of downstream impacts by stating that Tajikistan is committed to operating the cascade in line with existing outdated water allocation agreements, ensuring the overall seasonal water flow pattern will not change. This explanation is inconsistent with ESS6 requirements because it substitutes a robust ecological impact assessment with political or legal commitment (which is actually not directly related to biodiversity conservation). It also contradicts other “commitments” listed in the same ESIA, such as promise to improve flood control and promise to consider alleviation of droughts in low flow years²⁶. Meanwhile, fulfillment of such promises would result in the modification of the water flow downstream from Nurek dam.

²⁶ See CSO correspondence with the World Bank for more detailed description <https://thedocs.worldbank.org/en/doc/0171ab019f0cc19836239b02600826f6-0080012024/original/World-Bank-May-3-2024-Response-Rogun-Letter.pdf>

The exclusion of the Lower Vakhsh and World Heritage site from biodiversity baseline study and its dismissal at early stages of CHA allowed the ESIA to avoid naming it a critical habitat, which would require development of solid safeguard measures (e.g. development of feasible legal guarantees of sufficient environmental flow release throughout the Rogun HPP lifetime).

The ESIA's argument is flawed and completely fails the precautionary principle required by ESS6. While the total annual or seasonal water volume may remain the same, the “pattern” of water release (operation regime), sediments flow and temperature regime may change, altering key ecological drivers. The assessment ignores or dismisses several critical factors:

4.5.1. The Highest Biodiversity Value omitted: Despite negative pressures from hydropower and agriculture, Lower Vakhsh River below the hydropower cascade remains among the most important biodiversity hotspots in the Vakhsh-Amudarya basin. It has the best remaining natural floodplains centered at “Tugai forest of Tigrovaya Balka Nature Reserve” World Heritage site with a viable population of Burkhara Deer and hosts several critically endangered endemic fish species, such as shovelnose sturgeons²⁷. The ToR for this ESIA rightfully requested to ensure that “environmental flow rate established in the ESIA sufficient to maintain aquatic biodiversity” and prescribed to explore feasibility of releasing “artificial floods” to Tigrovaya Balka as the first priority among mitigation measures.

4.5.2. Narrow Framing of Impact: The argument focuses only on preventing “additional” negative impacts beyond the existing degraded baseline. **It fails to assess how the Rogun HPP project would have cumulative impacts with the rest of the Vakhsh Cascade and solidifies and makes this degradation permanent**²⁸, foreclosing any future possibility of ecological restoration (unless such measures are incorporated in the project itself). It also misses the opportunity to use Vakhsh Cascade growing storage volume to enhance downstream conditions (e.g., through managed flood pulses), which is a key part of the mitigation hierarchy and top priority in terms of addressing threatened biodiversity values.

²⁷ Lower Vakhsh River within the UNESCO World Heritage property and beyond is one of the key remaining critical habitats for several endangered species of fish: Large Amu-Darya shovelnose sturgeon - *Pseudoscaphirhynchus kaufmanni* (listed as Critically Endangered) , Small Amu-Darya shovelnose sturgeon - *Pseudoscaphirhynchus hermanni* (listed as Critically Endangered), Pike asp - *Aspiolucius esocinus* (listed as Endangered), Aral barbel - *Luciobarbus brachycephalus* (listed as Endangered) , Sharpray - *Capoetobrama kuschakewitschi* (listed as Endangered), which are also listed as rare and endangered in the Red Book of the Republic of Tajikistan (2015). Status of populations and possible impacts on those species have not been properly assessed in the ESIA.

²⁸ IUCN. 2025. World Heritage Outlook. Tugay forests of the Tigrovaya Balka Nature Reserve <https://worldheritageoutlook.iucn.org/node/2579/pdf?year=2025>

The Rogun HPP project envisions major reoperation of the whole Vakhsh hydropower cascade. The Rogun reservoir would become the primary regulator, introducing new short-term (daily and hourly) flow fluctuations. Nurek would act as a counter-regulating reservoir, and detailed assessment is needed of how this new operational regime would alter the downstream environment, affecting aquatic life and floodplains downstream of the Vakhsh hydropower cascade, where the key biodiversity values found in Amu-Darya basin are still present.

4.5.3. Flood Control not analyzed: The ESIA recognizes the potential (and even desirability) of the Rogun HPP's decisive impact on flood regulation downstream: *“The construction of the Project will improve flood routing capacity for the area downstream of the Vakhsh cascade. This positive effect could be increased by appropriate flood management. The inclusion of Rogun HPP in the cascade would also reduce risks of floods of lower magnitude, but with a higher probability of occurrence.”* (ESIA Volume 1, para 4.6.13., p.109)

Floods are necessary to sustain river and floodplain ecosystems. It was the flood control by Nurek HPP that previously led to the deterioration of the Tigrovaya Balka ecosystems, and the ESIA says that now it may be further exacerbated/perpetuated by the functioning of the Rogun reservoir during the next 105 years. There are multiple other points in the ESIA testifying that the flow regime downstream of the Vakhsh Hydropower cascade may be changed, including in the interest of riparian countries.

The ESIA and TCIA also fail to take into consideration recurring and lasting impact of flood control by the Vakhsh Cascade which occurs each year, when a large flood is expected, but it does not happen. **Once Rogun assumes the role of main regulator in this hydropower cascade, it will become the main source of this major negative impact leading to floodplain ecosystem degradation.**

4.5.4. Reservoir filling effects neglected: Despite the 2022 ToR requirement the ESIA downplays and does not properly assess potential impact on biodiversity from approximately 1.2 -2 cubic kilometres being used annually during 16 years to fill the giant reservoir. Meanwhile the water modelling annex of the ESIA demonstrates that it could take 5-20% of annual flow (Volume 2. Table 5-8. P.427). At the same time 1.2 cubic kilometres constitutes 25% of current inflow into the Aral Sea Delta.

The TCIA shows a contradictory and inaccurate approach to this problem. On one hand, it completely misidentifies current water management institutions and objectives as well as fails to name Ramsar sites and other wetlands to which this water is currently delivered in the Amu Darya Delta. It conceals the fact that the legal regime which enables the Delta to receive this water is enshrined in the same old water-sharing agreements and mechanisms to which it refers as the basis for future water resources management. Then the TCIA argues that the “amount (reaching Delta) is too small to have kept the Aral

Sea from shrinking further”, not only implying it is not any longer important to sustain this legally agreed environmental flow, but also misrepresenting current management objectives for the release of this e-flow. Meanwhile, this small amount of water is used to sustain wetlands and plant forest to mitigate the immense negative impacts of the Aral sea drying on the population of the Karakalpakstan Republic.

Finally, the TCIA misleadingly hints that “there is no direct relationship between the amount of unused water and inflow into the Aral Sea” and dismisses the impact even without analyzing it. Contradicting itself, in its last chapter devoted to water management the TCIA shows both the significant impact of different scenarios of Rogun reservoir filling and operation on the residual flow into Amu Darya Delta, and discusses the use of greater amounts of water in water-abundant years to fill Rogun. Meanwhile, it conceals the fact, that according to current water-sharing agreements, this is exactly the “extra water” in water-abundant years that is supposed to be used for replenishing Ramsar wetlands and other water bodies of Amu Darya Delta.

4.5.5. Sediment Trapping Impacts Unassessed: The ESIA acknowledges that Rogun HPP will trap nearly all remaining sediment. This means the water released from Nurek will be even more sediment-starved, possibly creating "hungry water" that will cause riverbed and bank erosion far downstream, altering habitats and infrastructure. Besides, the Vakhsh River turbidity is a very important ecological factor to which its endangered endemic fishes are adapted²⁹. Further reducing sediment content in river flow may negatively affect the sturgeons and other endemic aquatic fauna. Besides, Nurek reservoir without Rogun will be filled with sediments and lose capacity to block their flow in 30-40 years, while Rogun will extend that negative effect to 100-120 years.

4.5.6. Thermal Regime Not Analysed: The ESIA does not adequately assess how the release of cold, deep water from the massive Rogun reservoir will alter thermal regimes downstream, impacting spawning cues and invertebrate life cycles.

4.5.7. Environmental flow assessment is falsified. E-flow assessment starts with a false assumption that “biological value of this part (of the river between Rogun and Nurek reservoir) was low already without Rogun dam in place”(Volume 1. Impact on water. para 4.4.7.). In section 4.3. we have shown that this statement is false, as before Rogun dam it was part of almost 700 km long free-flowing river system. The main flaw in the e-flow assessment - it was not applied to the overall downstream length of Vakhsh-Amu Darya river system, but only to 15-kilometer stretch between Rogun and Nurek reservoirs (which is planned to be fully modified by a new Shurob HPP in near future). The assessment is done on the most simplistic level possible, based on an excuse that this

²⁹ Zholdasova, I. Sturgeons and the Aral Sea ecological catastrophe. *Environmental Biology of Fishes* 48, 373–380 (1997). <https://doi.org/10.1023/A:1007329401494>

is just 15 kilometers of river gorges between two giant reservoirs. It still does not satisfy the requirements of either World Bank E-flow guidance, not the EIB's requirements. It has no explanation how recommended "minimal flow" will guarantee well-being of habitats and species downstream. The assessment is largely treated as an awkward formality devoid of any practical value, as the planned release from one turbine of Rogun HPP exceeds the volume of recommended minimal e-flow. Little attention is devoted to hydropeaking, which is likely the main source of impacts at this stretch.

Still, the main flaw of this approach to E-flows is refusal to assess other much more ecologically significant and biodiversity rich areas downstream of Vakhsh cascade. The first area of particular concern for which environmental flow should be defined with use of a much more comprehensive methodology is the Lower Vakhsh downstream of Vakhsh Hydropower cascade where the main biodiversity features are subjected to the greatest impact from hydropower. A second obvious area in need of e-flow assessment is the Amu-Darya Delta below Nukus City during the reservoir filling period, which may deprive its Ramsar wetlands of necessary water allocations.

4.5.6. What should be done:

- A. **An Ecological Cascade Operation Model:** A detailed hydrological model is needed to show the expected daily and hourly flow fluctuations, temperature changes, and sediment transport downstream of Nurek under several possible operational regimes of the Vakhsh Cascade. The ESIA openly talks about three different possible regimes but does not assess and compare their impacts. Even continuation of the "current operation pattern of flow regulation by hydropower cascade" proposed in the ESIA as the only possible option will have a negative impact on the World Heritage Site. Feasibility of maintaining it in the foreseeable future is in question due to climate change, competition for water and lack of binding international agreements. On the other hand proposed regime, even if feasible, is not optimal for Tajikistan or other riparian countries, and therefore is likely to be challenged. In order to justify this regime, the ESIA must include a study of these impacts on the outstanding universal values of the UNESCO World Natural Heritage property, as well as a study of impacts under other alternative operation pattern regimes.
- B. **A Downstream Impact Assessments and E-Flow Planning:** A dedicated biodiversity study is required to assess the impacts of these altered regimes on the aquatic and riparian habitats of the lower Vakhsh River, including its food web, fish populations, floodplain ecosystems and geomorphology. Another study is needed for the ecological impacts in the Amu-Darya Delta. Wider environmental flow study for this and other selected stretches down to the Amu Darya delta should highlight ecological requirements of other key riverine ecosystems and ways to satisfy them by water management measures.

- C. **An Evidence-Based Assessment for Tigrovaya Balka and Feasibility Study for Artificial Floods:** A revised assessment of potential impacts on the Tigrovaya Balka Nature Reserve is crucial, as this reserve is highly dependent on the flood and sediment dynamics that the Rogun-Nurek system will now almost completely control. Detailed feasibility study for artificial flood releases must be carried out and become the base for management of environmental flows from the hydropower cascade below Nurek Reservoir.
- D. **World Heritage Impact Assessment Process:** In accordance with requirements of the World Heritage Convention and following its Guidance on impact assessment³⁰, implement and consolidate in a single document all impact studies relevant to the Tugay Forests of Tigrovaya Balka Nature Reserve World Heritage property and present to the UNESCO World Heritage Centre/IUCN for review as a part of the ESIA.

4.6. Baseline Data Insufficient and Unreliable

The baseline data collection was not sufficient for a project of this scale and risk profile, falling short of the Good International Industry Practice (GIIP) referenced in ESS6. The ESIA itself acknowledges several critical weaknesses:

4.6.1. Reliance on Outdated and Highly Fragmented Data: The assessment continues to rely heavily on findings from the 2014 ESIA, which is a decade old and may not reflect current ecological conditions or species distributions in a dynamic landscape. Both 2014 and 2023-4 field inventories have very limited scope and do not cover significant part of potentially impacted features (e.g. Tigrovaya Balka World Heritage site, critically endangered fishes of Lower Vakhsh, most natural habitats to be transformed and their importance for endangered biota, ecologically meaningful analysis of local populations of endangered species, fish migrations etc.).

4.6.2. Insufficient Aquatic Data: As detailed previously, the ESIA notes "significant constraints" to traditional aquatic surveys. The heavy reliance on eDNA is a valid adaptation, but is not a substitute for a comprehensive baseline. It provides only presence data, is limited by the completeness of reference databases, and offers no quantitative data on population size, biomass, health, or structure, which are essential for impact assessment.

4.6.3. Insufficient Terrestrial Species Data: The ESIA explicitly states that for some species, "most notably bats, the level of survey effort has been lower than would be expected to fully align with Good International Industry Practice (GIIP)". For many

³⁰ UNESCO et al. [Guidance and Toolkit for Impact Assessments in a World Heritage Context](https://whc.unesco.org/en/guidance-toolkit-impact-assessments/). 2023. <https://whc.unesco.org/en/guidance-toolkit-impact-assessments/>

species considered for Critical Habitat status, the screening relies on superficial qualitative assessments of potential presence rather than robust population data from within the project's EAAA.

4.6.4. Lack of Seasonal Data: The 2023 surveys were conducted in late spring and autumn. This limited timeframe may miss critical life-cycle periods for various species (e.g., wintering birds, migratory passage, breeding amphibians), leading to an incomplete understanding of the area's biodiversity importance.

4.6.5. Lack of credible inventory results: Documentation is incomplete as it lacks unified presentation of data collection results for each taxa and habitat type. Selection of sample data collection sites is not justified, and it is not fully clear what habitats and species were observed in each such area. If those sample areas were supposed to represent certain typical habitats\ecosystems, there is still no attempt to explain how results obtained there could be extrapolated to much wider areas within the AoI and EAAA. Baseline biodiversity surveys not reported for areas downstream of Vakhsh Hydropower Cascade, road/infrastructure construction areas, remote resettlement areas, etc.

Botanical surveys were done in too few sampling sites (15 locations for a very large area) and in very limited time of the year (BMP 2.2.3). Very insufficient fauna surveys, not using GIIP. For example, camera traps should have been used for large mammal surveys, vantage points during breeding and nest surveys for birds, electrofishing for fish (BMP 2.2.10). Survey of floodplain habitat was very limited and, likely, done in the inappropriate season (October).

4.6.6. Possible Supplementary Data Collection to Fill the Gaps :

- A. **Systematic Seasonal Surveys:** Conduct multi-season surveys for flora and fauna to capture a full annual cycle of biodiversity use.
- B. **Targeted Quantitative Surveys:** Conduct targeted surveys to estimate population densities for all species that trigger, or are close to triggering Critical Habitat thresholds, as well as for other key species of concern (e.g., otter, large mammals, important birds, native fish).
- C. **Advanced Aquatic Monitoring:** Supplement eDNA with innovative and safe methods for quantitative sampling, such as stationary nets, sonar, hydroacoustic surveys, or advanced remote sensing, to build a more robust aquatic baseline.
- D. **Specialist Surveys:** Commission a comprehensive bat survey using modern acoustic detectors and roost identification techniques to address the acknowledged GIIP gap. Conduct systematic surveys of aquatic and terrestrial invertebrates, which are key indicators of ecosystem health. Conduct extensive

botanical surveys in all habitats to ensure possible endangered or endemic flora is assessed.

As there were found several very rare raptors - Egyptian, bearded, cinereous and Himalayan vultures, golden eagle, saker falcon, etc. and additional survey efforts are needed especially during breeding season to ascertain importance of the area for each local population of these species.

- E. **Full baseline survey of Lower Vakhsh:** To enable impact assessment for most globally important biodiversity and habitats in the Lower Vakhsh river below the hydropower cascade (e.g. Tigrovaya Balka World Heritage property) a full baseline assessment with identification of current negative impacts and prospects for their mitigation should be carried out. IUCN critically endangered and endangered species should be paid particular attention.
- F. **Full baseline survey of Amu Darya Delta Wetlands:** To ensure implementation of water-sharing agreements and preservation of wetlands of international importance a baseline assessment of the wetlands in Amu Darya Delta must be carried out to be used in impact assessment, especially for impacts during the Rogun reservoir filling period.

4.7. Improper Identification of Natural, Modified and Critical Habitat.

The ESIA's data is barely sufficient only to support its own preliminary and overly broad classifications, but the rough habitat classification scheme (woodland, grassland, river and floodplain, agriculture, settlement) does not meet the full intent of ESS6 for a thorough biodiversity assessment. It also, likely, does not satisfy the EIB requirements³¹.

4.7.1. Critical Habitat: The screening process against IFC PS6 criteria arrives at the conclusion that no Critical Habitat is triggered. However, this conclusion is not robustly justified due to the lack of quantitative population data for several potentially triggering species and denial of possible and already occurring impacts on biodiversity downstream of the Vakhsh HPP cascade. The precautionary principle is fully neglected - critically endangered sturgeons and some other endemic species or floodplain tugay forests downstream of the hydropower cascade are dismissed, along with fish endemics and endangered otter in the reservoir inundation area. The importance of inundated areas for populations of other species is not assessed with sufficient detail. Meanwhile, even one territory of Egyptian vulture lost would have a significant impact on the local population and the project will not achieve NNL.

³¹ For example, following the Habitats Directive, the ESIA should prove (based on surveys and scientific arguments) what of the 16500 ha is not natural or seminatural protected habitat or not habitat of species of conservation importance. The ESIA dismisses naturalness/significance of habitats and species with very shallow general arguments, usually based on lack of detailed surveys and/or up-to-date information.

4.7.2. Natural vs. Modified Habitat: The identification of juniper woodland and specific floodplain areas as Natural Habitat is justified based on limited field surveys confirming their relatively unmodified nature. But the extent of this habitat in the AoI (185 ha) is likely grossly underestimated, judging by the satellite imagery.

As explained in 4.3. the area to be inundated likely contains not 77 ha, but approximately 3000-4000 ha of natural floodplains, as all floodplains not directly modified by settlements and infrastructure retain their key ecological processes, while traditional land-uses (e.g. wood collection, grazing, small-scale farming) are adapted to natural flooding regime and other ecosystem dynamics. Denying them natural habitats' status is an illegitimate violation of the ESS6 and respective requirements of the EU regulations. Moreover, Geomorphology Chapter characterizes them as natural habitats.

In section 4.3. it was shown that the justification for excluding the Vakhsh River from Natural Habitat status is inconsistent with ESS6 definitions. However, the classification of full area of other “landscapes” as “heavily modified” is also weak and appears to be used as a justification to lower the significance of impacts.

Attributing large unsurveyed areas impacted by the project to Modified Habitat is not in line with ESS6 and [Guidance Note for Borrowers on ESS6](#). More specifically, GN19.1 gives clear examples that the river, the pastures and cliffs around it should be considered natural habitat as plants and animals (for example vultures) have adapted to the long-term pattern of traditional use (grazing, fishing, etc.). Speaking of pastures specifically, the rugged terrain and uneven distribution of settlements would inevitably lead to very different degrees of human impacts at different locations, which is not reflected in the ESIA baseline survey and neglected in habitat classification.

4.7.3. Insufficiency of Habitat Classification: The broad classification (e.g., “pasture/degraded grassland,” “woodland”-essentially land-cover types rather than specific ecosystems/communities) is an oversimplification that does not satisfy ESS6 requirements. ESS6 requires an assessment of “primary ecological functions and species composition,” which these coarse categories obscure. No species composition has been described for any particular terrestrial habitat type. This approach risks overlooking smaller patches of high-value habitat and masking significant internal biodiversity variations. Moreover, no internationally-recognized habitat classification scheme was used when mapping the habitats. The assessment fails to adequately consider or differentiate key habitats, such as the following examples:

- **Gorges, Ravines, Cliffs, and Rocky Habitats:** These are mentioned as landscape features and potential habitat for species like Egyptian Vulture, but they are not mapped or assessed as distinct habitat units with unique ecological functions. This is a significant omission, as these features often serve as crucial refugia for raptors, large mammals, bats, and specialized flora.

- **Other Woody Vegetation:** The assessment focuses almost exclusively on juniper woodland. Other woody vegetation, such as riparian scrub, bush thickets or mixed woodlands in tributary valleys, is not distinctly classified or assessed for its specific conservation value for birds and mammals. Brief examination of Google Earth imagery suggests the presence of sizable patches of such vegetation throughout the Aol.
- **Grassland Variation:** The category "Pasture/degraded grassland" is the largest single habitat type but lumps together everything from heavily overgrazed areas to potentially valuable, less-disturbed native grasslands on steep slopes. It does not differentiate between different grassland communities present in the area. This lack of differentiation makes it impossible to assess the true impact of habitat loss.
- **Tributaries:** Gorges and tributaries, which provide clearer, cooler refuge areas for aquatic species, are not treated as a distinct habitat type with a specific assessment of impacts.

The habitat assessment work is completely insufficient and biased, the mapping of habitats should be developed at the detail of EU Habitats Directive-Habitats Directive Annex I. (additionally requested by the EIB policy) or EUNIS classification in order to assess threatened natural and semi-natural habitats. Most habitats of the inundation zone are “natural” per ESS6 and should trigger mitigation action to achieve NNL.

Habitat assessment and mapping is also critically needed downstream of the Vakshsh Cascade, as information included in TCIA is extremely superficial and misleading.

4.8. Uneven analysis of direct, indirect, and cumulative project - related impacts

The ESIA fails to adequately consider and analyze the full scope of relevant impacts. While direct impacts are at least partly covered, the analysis of indirect and cumulative impacts is superficial and largely absent.

The ESIA provides an assessment of some direct impacts, primarily of the "land-take" from habitat inundation and construction.

4.8.1. Indirect Impacts: The analysis of indirect impacts is weak and fails to systematically assess several key issues:

- Habitat Fragmentation:** The ESIA does not quantify the fragmentation effect of the new reservoir and road network as barriers to movement for terrestrial species or assess its impact on population viability.

- B. **Edge Effects:** The creation of a large reservoir will change the microclimate along its new shoreline, but these "edge effects" on adjacent terrestrial habitats are not analyzed.
- C. **Increased Human Pressure:** The impacts of improved access to previously remote areas on illegal logging, poaching, and grazing are mentioned but not quantified. For example, the filling of reservoir will necessitate adjustment in land-use practices of the surrounding population, which has not been assessed either in biodiversity or social parts of the ESIA.

4.8.2. Transboundary Cumulative Impacts Assessment Gaps: The Transboundary Cumulative Impact Assessment (TCIA) is the primary chapter for this analysis, but its scope and degree of detail is highly problematic. It lumps together domestic and transboundary issues, some of which (like impact on World Heritage of critically endangered fishes of Vakhsh River) should have been addressed in specialized biodiversity assessments. It dismisses obvious impacts without assessment based on unfounded political assumptions unrelated to biodiversity matters. Finally, it is prepared by a single consultant, whose views are predetermined by being the team leader for 2014 ESIA on the same project. Despite direct requests of CSOs and the WB officials [making promises](#)³², no meaningful consultation has been conducted on the draft TCIA, neither with international CSOs nor with civil society in affected regions of riparian countries.

TCIA focus is overwhelmingly on hydrology and transboundary water allocation, with biodiversity impacts addressed in a cursory manner with use of anecdotal evidence instead of detailed data.

TCIA acknowledges that future upstream dams will cause "floodplain submersion" but does not assess the ecological significance of this cumulative loss. The conclusion that cumulative impacts on biodiversity will be "neutral" or "negative" without detailed analysis is unsubstantiated. It delays assessment of cumulative impact to the point in time they become practically irreversible.

The assessment fails to adequately assess the significant cumulative fragmentation of the Vakhsh river system and the combined effect on migratory fish and other aquatic species in the context of the entire basin, as required by ESS6. It adapts the "death by a thousand cuts" approach in which none of consecutive hydropower projects is held responsible for increasing loss of biodiversity and no strategic measures are proposed to prevent such loss in the development process.

³² <https://thedocs.worldbank.org/en/doc/e4536d867e713be1288ae0532a2760f0-0080012024/original/World-Bank-November-8-2024-Response-Letter-Rogun.pdf>

4.9. Selective use of mitigation hierarchy

The mitigation hierarchy is applied selectively and, as a result, ineffectively. Its application is evident for small areas of two terrestrial habitats, but is almost entirely absent for the project's most significant impact on the freshwater ecosystem.

4.9.1. Selective Application: The hierarchy is explicitly and most clearly applied only to the two terrestrial Natural Habitats, which together constitute only 262 ha (under 2% of the 16,500 ha of inundation zone). Even here, the process appears to jump from acknowledging the impact directly to the "Offset" stage (the NNLF). For the rest 98% of narrowly identified Aol no systemic mitigation hierarchy has been applied.

4.9.2. Ineffectiveness for Major Impacts: For the transformation of the Vakhsh River, impacts on habitats, and impacts at ancillary sites, the hierarchy is not systematically applied or documented.

4.9.3. Weak Avoidance: The analysis of alternatives (e.g., a lower dam height) is dismissed primarily on economic grounds without a balanced assessment of the significant biodiversity impacts that would be avoided. Only 2% of the Aol (limited to inundation zone) are considered as biodiversity-relevant in the analysis of alternatives. Under ESS6, avoiding impacts on Natural Habitat should be a primary driver of design, not just an economic trade-off.

4.9.4. Insufficient Minimization: Instead of minimizing impacts, the ESIA minimized recognized "natural habitats", which in case of self-regenerating floodplains and free-flowing river itself is not justifiable. Mitigation of impacts on biodiversity features is extremely weak if present at all beyond the NNLP. The standard construction best practices listed in the ESMP are not framed as a strategic effort to minimize impacts on specific, high-value biodiversity features. There is no intention of modifying dam design or adjusting other operations to minimize already significant downstream ecological disruption. A program minimizing reservoir-filling impacts on biota and ensuring formation of new productive aquatic habitats is fully absent. Physical collection of individual animals is insufficient and hardly feasible. Minimization of negative impacts on biodiversity from periodically inundated reservoir wide margins is not discussed in the ESIA.

4.9.5. Questionable Restoration and Offset: The NNL Framework to reforest 786 ha to compensate for the loss of 262 ha of existing woodland carries a high risk of failure. While the 3:1 multiplier acknowledges this, the NNL framework lacks detail on how the long-term ecological functionality of the offset sites will be guaranteed. Most importantly this scheme is false from the outset, because the scale of natural habitat conversion has been underestimated by at least an order of magnitude and natural habitats in need of NNL action likely occupy at least 6000-10000 hectares.

4.9.6. Areas for Improvement:

- A. **Scope:** The application of the full mitigation hierarchy must be explicitly documented for **all** significant biodiversity impacts, including: (1) The loss of the Vakhsh River ecosystem; (2) Downstream ecological changes; (3) Loss of other natural habitats in inundation zone (4) Habitat loss at all ancillary sites; and (5) Impacts on all species of conservation concern (e.g. Central Asian Otter, Egyptian Vulture and other endangered raptors, Central Asian Tortoise and other endangered reptiles, Turkestan Catfish, Amu Darya Trout, etc.).
- B. **Freshwater Ecosystem:** The approach to the river transformation must be revised. The impact must be recognized as the conversion of a Natural Habitat, and the ESIA must demonstrate that no viable alternatives existed before moving to compensation.
- C. **Specific Fauna:** The approach to mitigating impacts on bats and migratory birds needs improvement. Given the baseline data gaps, reliance on pre-clearance checks is insufficient. Proactive measures, such as creating alternative roosts for bats and robust collision risk modelling for isolating or undergrounding new power lines, are needed.

4.10. Impacts beyond the inundation zone unaddressed.

The ESIA does not adequately address biodiversity impacts at resettlement sites, areas for extraction of material (e.g. for concrete manufacturing), or other "associated facilities" in a manner consistent with ESS6. The biodiversity impacts are fragmented, not systematically assessed, and excluded from the central impact accounting and compensation framework.

ESS6 requires that the assessment cover all direct, indirect, and cumulative impacts from the project, which explicitly includes associated facilities necessary for its construction and operation. The ESIA fails this requirement due to:

4.10.1. Fragmented Assessment: The main biodiversity impact assessment and the NNL Chapter focus almost exclusively on habitat loss within the inundation zone. Impacts at other sites are either ignored or handled in separate, unconsolidated assessments.

4.10.2. Unaddressed Resettlement Sites: The ESIA focuses on the socio-economic aspects of resettlement. It fails to provide a biodiversity baseline for the new resettlement sites or to assess the impacts of their construction (e.g., habitat loss, fragmentation from new infrastructure, increased human pressure for firewood and grazing). These sites can cover large areas and their development constitutes a direct

project impact. It also fails to assess needs for and ensure restoration and compensation of ecosystem services, which local populations enjoyed before resettlement.

4.10.3. Material Extraction Areas (Quarries, Borrow Pits): The ESIA mentions quarries but lacks a specific biodiversity assessment for these major project activities. Impacts such as habitat destruction, dust, noise, and potential water pollution from these sites and from the transportation of the materials are not evaluated in the biodiversity chapter. The identification of material sources in Dushanbe and Yavan (ESIA Vol. 1, p. 87) does not absolve the project of responsibility for assessing the impacts at these critical linked facilities.

The loss of habitat—whether Natural, Critical, or Modified with significant value—at quarries, new road alignments, construction camps, and resettlement sites is not quantified or compensated for. This is a major accounting and mitigation gap.

5. Concluding Remarks and Recommendations

The ESIA documentation for the Rogun HPP represents a substantial effort to address a complex project.

However, our review identifies significant and systemic inconsistencies and gaps that compromise a full and robust assessment of biodiversity risks. The assessment suffers from an over-reliance on a heavily modified baseline to downplay impacts, insufficient and outdated data (especially for aquatic ecosystems), an inadequately justified Area of Influence, and a superficial analysis of indirect, cumulative, and downstream impacts. The application of the mitigation hierarchy is selective, appearing to prioritize economic outcomes over the avoidance of biodiversity impacts, particularly concerning the Vakhsh River. The conclusion of no impacts downstream of the Vakhsh cascade is not credible from an ecological perspective and is inconsistent with the precautionary principle central to ESS6.

To strengthen the ESIA and ensure full compliance with World Bank ESS6, the following key actions are recommended:

The ESIA documentation for the Rogun HPP represents a substantial effort to address a complex project.

However, our review identifies significant and systemic inconsistencies and gaps that compromise a full and robust assessment of biodiversity risks. The assessment suffers from an over-reliance on a heavily modified baseline to downplay impacts, insufficient and outdated data (especially for aquatic ecosystems), an inadequately justified Area of Influence, and a superficial analysis of indirect, cumulative, and downstream impacts. The application of the mitigation hierarchy is selective, appearing to prioritize economic outcomes over the avoidance of biodiversity impacts, particularly concerning the Vakhsh

River. The conclusion of no impacts downstream of the Vakhsh cascade is not credible from an ecological perspective and is inconsistent with the precautionary principle central to ESS6.

To strengthen the ESIA and ensure full compliance with World Bank ESS6, the following key actions are recommended:

A. Additional Assessments and Baseline Data Collection

The current baseline is critically weak, relying on outdated data, insufficient field surveys, and an over-reliance on eDNA without qualitative nor quantitative validation. To rectify this it is necessary to:

A.1. Expand the Area of Influence (Aol) and Ecologically Appropriate Area of Analysis (EAAA):

A.1.1: Redefine the freshwater biodiversity Aol to include the entire downstream reach of the Vakhsh and Amu Darya rivers, extending to the Tigrovaya Balka World Heritage site and the Amu Darya Delta wetlands.

A.1.2: Expand freshwater EAAA to the upstream reaches of Vakhsh River basin.

A.1.3: Define terrestrial Aol based on the specific home ranges of wide-ranging species (e.g., snow leopard, vultures) rather than arbitrary buffer zones.

A.1.4.: Include all associated facilities (resettlement sites, quarries, access roads) in the biodiversity impact assessment.

A.2. Strengthen the Biodiversity Baseline Study:

A.2.1. Lower Vakhsh: Conduct detailed baseline biodiversity study of the ecosystems of Lower Vakhsh River with specific attention to World Heritage site and endangered aquatic fauna.

A.2.2. Fish: Supplement eDNA with quantitative sampling methods (sonar, stationary nets, electrofishing, etc.) to determine population size, structure, migration paths, and health of fish species populations.

A.2.3. Terrestrial: Conduct systematic, multi-season surveys to fill data gaps on flora and fauna (specifically bats, breeding, migratory and wintering birds, and invertebrates) to capture full annual life cycles. These surveys must aim to establish population baselines, not just presence/absence. Carry out targeted surveys for the Central Asian Otter, Amu Darya Trout (*Salmo oxianus*), Turkestan Catfish, and endangered raptors to determine if they trigger Critical Habitat or Priority Biodiversity Feature thresholds.

A.2.4. Refine Terrestrial Habitat Mapping and Classification: Abandon the overly broad habitat classification. Map habitats using international standards (similar to EUNIS or EU Habitats Directive) and ESS6 requirements to reflect ecological functions, species composition and different degree of modification. Conduct a finer-scale habitat mapping exercise that identifies, maps, and assesses specific habitat sub-types of ecological importance (e.g., different grassland communities, riparian scrub, forests, cliffs, ravines). Clarify the extent of would-be-impacted natural habitat using satellite imagery and additional field surveys.

A.2.5. Refine Riverine Habitat Mapping and Classification: Re-classify the Vakhsh River, most of its floodplain, and its tributaries within the main impoundment zone as a Natural Habitat under ESS6, recognizing their primary ecological functions and native species composition despite the presence of downstream dams. Acknowledge that the project will fundamentally and permanently alter its primary ecological functions and composition.

A.3. Conduct Comprehensive Downstream Impact Studies:

A.3.1. Perform a dedicated study on the impacts on biodiversity of altered flow, thermal regimes, and sediment starvation on the Lower Vakhsh River aquatic life and floodplain ecosystems. Consider all possible operation regimes of the Rogun HPP, recurring nature and cumulative temporal impacts during its 100-year service.

A.3.2. Assess the specific impacts of the 16-year reservoir filling period (water withdrawal) on the Amu Darya Delta including the Ramsar wetlands.

A.3.3. Conduct World Heritage Impact Assessment and present results to UNESCO for review.

B. Avoidance and Minimization of Impact

The ESIA currently applies the "avoid" step of the mitigation hierarchy inconsistently, largely dismissing alternatives on economic grounds. For impacts that cannot be avoided, the current proposals for minimization are vague and lack site-specific rigor.

B.1.Re-evaluate Project Design Alternatives:

B.1.1. Conduct a rigorous analysis of alternative dam heights and reservoir sizes, explicitly weighing biodiversity losses (specifically the inundation of Natural Habitats) against economic benefits.

B.1.2. Create a detailed eco-hydrological model to simulate daily/hourly flow fluctuations, temperature stratification, and sediment transport under various Rogun-Nurek operational scenarios and climate change influence. Use this model to design an

operation regime that minimizes negative environmental impacts (e.g. "hydropeaking", flood control, thermal pollution) on Lower Vakhsh River and other sensitive downstream areas.

B.1.3. Manage Reservoir Filling: Develop a specific plan to minimize ecological shock to the Amu Darya Delta during the 16-year filling period, ensuring strict adherence to environmental flow requirements for downstream wetlands.

B.2. Improve Legal Agreement to Avoid Impacts. Assess effectiveness and long-term viability of existing water-sharing agreements and institutions to design and adopt additional improved legal and monitoring mechanisms to safeguard biodiversity during Rogun reservoir filling and hydropower cascade operation.

B.3. Avoid impacts on critical habitats. Acknowledge that if the re-classification of the Vakhsh River and associated threatened species triggers **Critical Habitat** status, and if impacts cannot be adequately mitigated, the project design may need significant alteration to avoid irreversible loss of biodiversity values.

B.4. Implement Technical Minimization Measures:

B.4.1. Install fish-friendly turbines and/or behavioural barriers to minimize fish entrainment and mortality.

B.4.2. Design multi-level outlets to manage water temperature releases, mimicking natural thermal regimes essential for aquatic life cycles.

B.5. Auxiliary Infrastructure Adjustments: Apply robust collision risk modelling for new power lines and implement undergrounding or bird diverters in high-risk zones for migratory birds and raptors.

C. Mitigation of Impact (Restoration and Rehabilitation)

The ESIA lacks specific mitigation for the loss of riverine ecosystems and relies heavily on a yet-to-be-developed No Net Loss Plan with extremely narrow scope.

C.1. Develop a robust environmental flow (E-flow) regime and prioritize artificial floods for Tigrovaya Balka:

C.1.1. Design and implement E-flows based on the biological requirements of aquatic species and floodplain ecosystems, not just hydraulic minimums. This must cover the reach between Rogun and Nurek, and the Lower Vakhsh.

C.1.2. As a priority part of e-flows complete the “Feasibility Study on Artificial Floods for Tigrovaya Balka” (originally recommended in 2014 ESIA/ESMP and requested in the 2022 ToR but dismissed as “complicated” in the NNL Framework).

C.1.3. Operationalize these floods as a mandatory mitigation measure to sustain the Tugai forests and threatened fauna populations in the World Heritage site. Incorporate the e-flow regime into Operation Rules for Rogun HPP/Vakhsh Cascade and Management plan for the World Heritage.

C.2. Restore Ecosystem Services for Communities:

C.2.1. Implement restoration programs at resettlement sites to compensate for the loss of access to natural resources (pastures, water, wild plants) that local populations relied upon in the Vakhsh valley.

C.2.2. Develop and implement ecosystem conservation and restoration plan for the Upper Vakhsh subbasin to improve natural ecosystem resilience during and after reservoir filling and minimize erosion.

C.3. Address Invasive Species: Develop and implement a comprehensive Invasive Species Management Plan that goes beyond *Xanthium spinosum* to address aquatic invasive risks in the new reservoir environment.

D. Compensation of Losses (Offsetting)

The current No Net Loss (NNL) framework is insufficient because it excludes the massive loss of the Vakhsh River ecosystem (treating it as "modified") and focuses only on small terrestrial patches.

D.1. Apply No Net Loss to Natural Freshwater Ecosystems:

D.1.1. Expand the No Net Loss Framework: Based on the re-classification, develop a specific compensation strategy within the NNLP for the irreversible loss of over 170 km of lotic (riverine) habitat and its associated biodiversity,) recognize this as a residual impact on Natural Habitat requiring compensation pursuing a "like-for-like or better" offset.

D.1.2. Recalculate the offset requirements to include the 3000-4000 ha of floodplains and riparian zones to be inundated, not just the currently identified 262 ha of woodland.

D.1.3. Target specific species for mitigation/compensation measures: As a part of NNL develop conservation programs for the Egyptian Vulture and other raptors, Eurasian Otter, endemic fish species (e.g., *Salmo oxianus*), reptile species to ensure net gains in their broader populations to balance local losses.

D.2. Implement "Like-for-Like or Better" Offsets: To compensate for the fragmentation and loss of the Vakhsh River, designate and legally protect the Panj River (and adjacent Upper Amu Darya reaches) as a "free-flowing river," protecting it in perpetuity from future damming or diversion.

E. Finalize NNL Plan

E.1. Add new abovementioned elements and complete development of conclusive NNL Plan, while now there is only partial and open-ended NNL Framework.

E.2. Secure Long-Term Implementation: Establish a binding financial mechanism and legal structure to guarantee the implementation of the NNL Plan and the protection of offset sites for the lifespan of the project (100+ years). E.g. link financing NNL plan and Benefit Sharing Fund developed with money from Rogun electricity sales.

For inquiries regarding the contents of this paper and additional information, please contact Eugene Simonov, Chief Expert of the Rivers without Boundaries Public Fund at esimonovster@gmail.com

Selected sources:

1. Oleg Artaev, Ryan Thoni, Nuriddin Mirzoev, and Boris Levin "Ichthyofauna of Tajikistan: Diversity and Changes Over the Past Century," *American Museum Novitates* 2025(4032), 1-55, (31 January 2025). <https://doi.org/10.1206/4032.1>

<https://bioone.org/journals/american-museum-novitates/volume-2025/issue-4032/4032.1/Ichthyofauna-of-Tajikistan--Diversity-and-Changes-Over-the-Past/10.1206/4032.1.full#bibr96>

2. Segherloo I.H. et al (2021) A genomic perspective on an old question: *Salmo trutta* or *Salmo trutta* (Teleostei: Salmonidae)? <https://pubmed.ncbi.nlm.nih.gov/34015446/>

3. Savage, M., Oleynikov, A., Sedash, G., and Li Fei (2025). The Status of the Eurasian Otter (*Lutra lutra*) in Central Asia: A Literature Review. *IUCN Otter Spec. Group Bull.* 42 (3): 106 - 119

https://www.iucnosgbull.org/Volume42/Savage_et_al_2025.pdf

4. IUCN. 2025. World Heritage Outlook. Tugay forests of the Tigrovaya Balka Nature Reserve <https://worldheritageoutlook.iucn.org/node/2579/pdf?year=2025>

5. Zholdasova, I. Sturgeons and the Aral Sea ecological catastrophe. *Environmental Biology of Fishes* 48, 373–380 (1997). <https://doi.org/10.1023/A:1007329401494>