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Review of Nenskra HEP ESIA Study

To Ministry of Environment and Natural Resources of Georgia

13 May 2015

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1 Background

Considering, that the realisation of the Nenskra hydropower project would significantly change the natural character of both valleys of Nenskra and Nakra River, the preparation of an Environmental and Social Impact Assessment is highly ambitious. The Environmental and Social Impact Assessment Study (ESIA) has to assess, whether the implementation of the Nenskra HPP is going to risk the present "Good State of Water Body" (according to the EU Water Framework Directive objective for any river basin in Europe) of the water bodies of Nenskra and Nakra River.

Therefore, the ESIA elaborated by the Consultant Gamma (Georgia), in the following named "Study" is highly difficult due to the following conditions:

- Political frame and willingness in Georgia using hydropower
- Multitude of hydropower projects in development
- Technical details from hydrology over engineering issues up to biodiversity and socio-economy
- Perception of the local population
- Knowledge that hydropower is the most ecological energy.

The Ministry of Environment and Natural Resources of Georgia lastly based upon the Study has to balance the overall impacts and benefits. Nenskra HPP is one project belonging to the Enguri cascade, which is why the decision should be in accordance with the national strategy on high mountain ecosystem preservation, especially in these highly sensitive and still undisturbed mountainous valleys of the western Great Caucasus.

The Review in hand, considers Nenskra HPP as "stand-alone project" and hence focuses only on the subjects outlined in the ESIA design and operation. This Review has been prepared between 27 April and 08 May 2015 in Georgia for which the Reviewer got the best support from the Ministry of Environment and Natural Resources, especially having the opportunity to make a site visit to both basins (29/04-01/05/2015) joined by Ministry, National Environmental Agency and National Forestry Agency' experts.

2 General Impression

2.1 Overall Approach of ESIA Study

Structure and format of the ESIA Study on the Nenskra HPP, submitted by the Consultant Gamma, largely is in line with the international and Georgian requirements. Substantial works in relevant environmental analysis and assessment especially in Physical and Biological Environment had been made. The Study itself illustrates the capacity of the Consultant Gamma (Georgia) to handle the required environmental assessments of hydropower and to combine with necessary formulation, presentation, and mapping capacities.

The ESIA Study in general is in compliance, with the international requirements especially

- EU DIRECTIVE 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment), and
- Georgian laws and regulations, especially the "Regulation on Environmental Impact Assessment" (15 May 2013).

The Table of Content is in accordance with the international practice and logically guides through the Study distinguishing following environmental topics:

- Introduction
- Legislation
- Alternative Assessment
- Technical Description of the Project
- Environmental and Social Background of the Project (“Baseline Investigations”)
- Environmental and Social Impact Assessment
- Mitigation Measures and Monitoring
- Environmental and Social Monitoring Plan
- Possible Emergency Situations
- Public Awareness and Participation in the ESIA Process, and
- Conclusions and Recommendations.

2.2 Environmental Focus

However, the detailed analysis and consideration of environmental topics in many chapters suffers from following gaps:

- Insufficient alternative considerations
- Avoiding considerations of different solutions (for example in HPP type, operational mode)
- Unclear description of basic hydrological conditions (monthly flows missing)
- Lacking (avoiding by intention FS ?) precise description of operational mode of HPP Nenskra, its impacts and developing required mitigation measures
- Impact Assessment in many cases not specific on receptor and scale of impact area
- Insufficient handling of socio-economic issues (relevant criteria, baseline investigations, impact assessment and mitigation)
- Absence of Livelihood Improvement and Benefit Sharing approach
- Environmental Management Plans missing to determine mitigation or/and compensation measures in “key impact areas” (such as mountainous habitats, almost dry river channels below the dams, and Livelihood of Nenskra and Nakra Council "Obtshina") for the environmental obligations of the Constructor.

A substantial revision of the Study is recommended, aiming at the permission requirements in Georgia. However, the logical structure and in many parts evidenced technical content of the ESIA Study should make this revision not so difficult. In connection with a strong shortening these additional specifications the revised Study would meet the permitting requirements.

2.3 Format

The Study formally is lacking under an extremely too long volume of 490 pages. Various chapters such as Geology and Geophysics, Hydrology, Noise, Climate like Evaporation are partially overloaded with descriptions and modelling, which do belong to the Design Study, but are not part of an ESIA. The environmental focus and relevance in these and other chapters is not documented.

Geology and Geophysics should be taken as example, however is not the only areas for which the above assessment is relevant. Under Baseline Investigations (Chapter 5) Geology and Geophysics are described on 122 pages. However, in Chapter 6 “Impact Assessment” (which is the central part of any ESIA) geological receptors are only soils and natural hazards. Hence, the long descriptions of geology and geophysics, including seismicity are to be refused from the ESIA and only those related to environmental subjects such soil degradation, groundwater, community safety, geomorphology and landscape, channel erosion, land sliding, and mudflows especially should be in detail considered, for which the huge data is not required.

Likewise, climatic and hydrological considerations, which are the “key factors” of any hydropower ESIA, need significant revision in order to be consistent, understandable, and first of all focused on the requirement of an ESIA. An ESIA study is not the place for hydrological modelling (it is obligatory part of the Design and Operation Study).

In connection to the shortening of the Study the readability and comprehensibility should be improved significantly. This is from the point of view of the Reviewer not a question of sometimes unclear and wrong Georgian-English translation. This in general is the inability to switch from the engineering, hydrological, climatologic and economic approach to environmental focus only. An ESIA Study has to be understandable, which does not mean that the necessary scientific approach should be lost. There is the recommendation to use the English Spelling and Grammar (Great Britain) tool for the last check of the text avoiding many grammar and translation errors either.

Taken into account the above observations the Study revision focusing on formal aspects should be improved:

- Engineering and economic approach: At many places, engineering and economic approaches dominate (alternative considerations, habitat impacts only calculating the loss of timber) and have to be replaced by environmental considerations.
- Repetitions: Very often repetitions (partially with not consistent data and numbers) hamper the readability and consistency of the Study. Obviously, contributions from various authors just had been pasted, neither focusing on ESIA subjects nor checking the consistency of supplied data.
- Language: The overall language, which in first order is not a translation issue has to be improved in order to be more understandable.
- Used numbers: Often used numbers are inconsistent (as concrete example the Ecological Release for Nakra River of 1.2 and 1.5 m^3/s is taken).
- Study volume: The Study with 490 pages is by far too long for an ESIA report and has to be concentrated on most important environmental subjects and statements
- Numbering of pages: Missing page numbering between 49-68, 90-91, and 159-164.

The following considerations are designated to analysing the main gaps of the Study and suggesting necessary changes to achieve a significant improvement of the Nenskra HPP ESIA Study.

3 Considerations and Suggestions for Improvement of the Study

3.1 Executive Summary

Unfortunately, an Executive Summary, which is required for any State-of-the-Art ESIA Studies, is not prepared. The final Chapter 11 “Conclusions and Recommendations” despite the valuable listing of issues cannot replace an initial outline of main findings and the overall environmental statement of the Consultant.

Superior result of the entire Study should be the attempt to addressing the overall environmental conditions and based upon that to address the statement how the Project had been assessed and which advantages and main critical factors had been considered. The issues listed under “Conclusions and Recommendations” in general do not have the quality to be taken as basis, because they mainly address smaller subjects simulating a “no concern” assessment. The main environmental issues are not addressed.

3.2 Project Alternatives

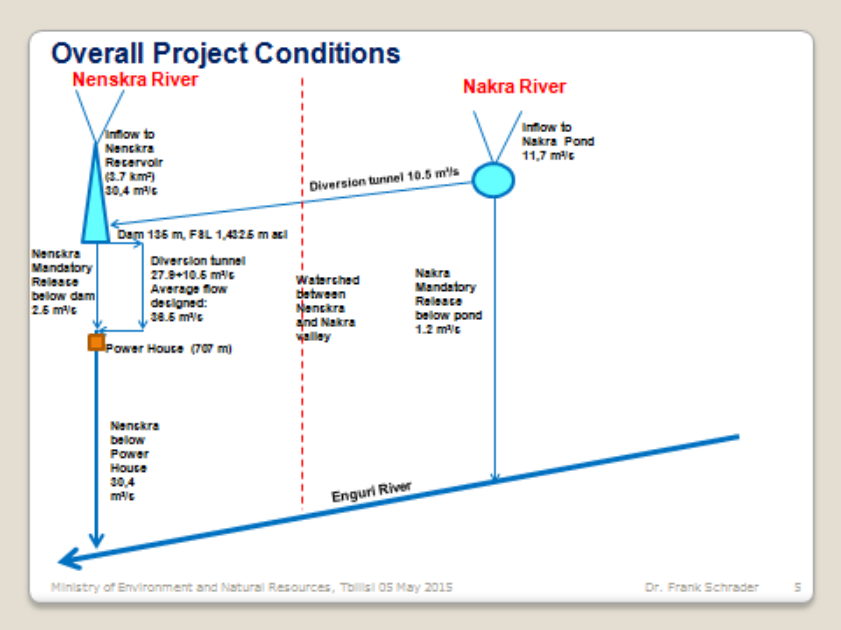
3.2.1 Study Alternative Consideration in the Study

Considerations were made in the Study on 16 pages (including tables) to apply this important methodological approach of any ESIA to identify and assess other Project alternatives. This included the investigation of

- Site alternatives: 1,600 m, 1,500 m, 1,475 m, 1,300, 1,190 m asl
- Layout (height) alternatives: 130 m, 150 m, 200 m, 250 m
- Alternative energy sources: wind, solar, geothermic energy.

However, main target was not achieved, which is to identify better environmental approaches and solutions and lastly to justify the "environmentally preferred option", what might not be in line with the designed alternative.

Site Alternatives: Unfortunately, there is no justification why Alternative Site 4 (1,300 m asl) is preferred? Main aim of this exercise is to shifting the dam site in order to minimise the loss of environmental values (natural mountainous habitats, wildlife, settlements, cultural heritage objects, and others).



Layout Alternatives: Choosing only higher dam layouts than the designed alternatives is neither understandable nor justified. There is no information why dam heights below 135 m were not investigated, which in general would reduce the potential environmental threats.

Figure 1 Nenskra HPP Scheme (FS)

Dam heights from 150 up to 250 m should be excluded because of the in general higher negative impacts at least in the Upstream Impact Area (larger reservoir, thus Foot Print, increased regulation capacity). The investigation of an alternative to increasing the dam height (aiming at more storage) would only acceptable if under this alternative the implementation of the Nakra diversion Project (see Alternative 2) would be refused.

Alternative energy: Those sources had been shortly addressed, however only in general terms not specifically for the potential replacement of the HPP by wind, solar or geothermic energy sources.

In summary, the Alternative discussion does not satisfy and should significantly be improved using the following approaches.

3.2.2 Alternative 1: Nenskra Storage and Nakra Diversion Project

Alternative 1 follows the design selected by the Consultant, which is illustrated in the scheme shown in Figure 1. This Alternative is viewed as "preferred" option.

3.2.3 Alternative 2: Nenskra with Higher Dam and Abstaining Nakra Diversion

As outlined above, the Nenskra HPP ESIA, in the light of the above addressed high ecological sensitivity of the valleys has to consider the increase of the storage in the Nenskra reservoir

by raising the dam height in order not to implement the diversion option for Nakra. This Alternative 2 would have the advantage in saving the Nakra valley from direct hydropower related threats and preserve the hydrological flow, high mountain habitats, and the livelihood of Nakra Obtshina.

3.2.4 Alternative 3: Run-of-River HPP Type

The Study addresses very briefly (p 36-37) the three available HPP types existing (impoundment, diversion, and pumped storage). However, the "run-of-River" HPP Type is mentioned once, but not at all assessed. Plants of this type are working in many regions of the world and in Georgia as well.

Therefore, the revision of the Study has to analyse in Alternative 3 instead of the reservoir (impoundment) type the establishment and operation of small hydropower plants (HPP installed capacity between 1 and 50 MW).

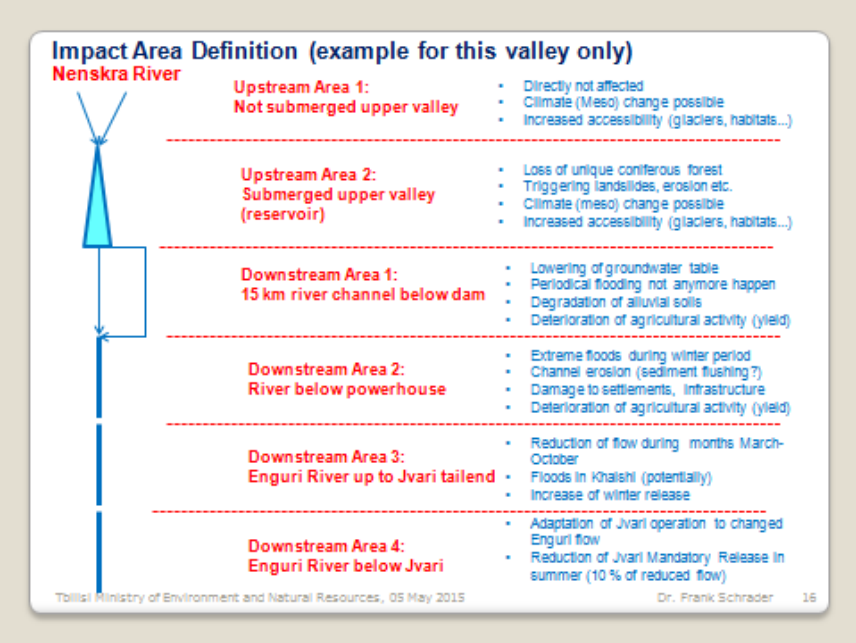


Figure 2 Nenskra HPP Impact Areas (FS)

The run-of-river option in both valleys Nenskra and Nakra would have the following positive environmental aspects:

- Not submerging 3.7 km³ upper Nenskra Valley area
- Not changing the flow of the natural rivers Nenskra and Nakra
- Preserving the morphological character and beauty of the high mountain valley landscape
- Not changing the downstream conditions in both valleys potentially deteriorating the quasi-natural alluvial forest, local water supply, and agriculture
- Preserving the Downstream Area of extreme floods during non-generation period (spring-autumn).

3.2.5 Alternative 4: Mixture of Storage and Run-of-River HPP Types

This Alternative 4 is aiming at the investigation of environmental improvements when only the Nenskra Dam (height 135 m, 182 million m³ storage, installed capacity 210 MW) would be established, but in the Nakra valley independently small hydropower plants of "run-of-River" type would be erected. The comparison has to be made, how the abandonment of the Nakra diversion replacing the diversion concept by certain numbers of small hydropower plants of "run-of-River Type" (70 MW) would contribute saving the high natural hydrological and ecological state of Nakra valley.

3.2.6 Alternative 5: Change of Operation Regime

The hydrological regime in this Semo Svaneti Mountains due to the snow-pack and glacier sources (in addition spring rainfalls) favours the use of the water for electricity generation in summer (June-August) see **Diagram 3**. However, the Study does not investigate this natural,

hydrological scheme and without any justification stipulates the winter operational mode (p 37), which would potentially have following threats to the downstream of powerhouse area:

- Extreme releases from both rivers during winter months (4-5 times more than in average presently in Nenskra)
- Frost conditions during winter months in the main Obtshina Lekalmakhi
- Ice-covered alluvial zone in Downstream Impact Area 2
- Potential damage of bridge, houses, forest, and further infrastructure.

Therefore, Alternative 5 needs to be assessed switching the operational mode from winter towards summer. Economic considerations are not relevant for this investigation. The ESIA Study has to identify solutions, which are less harmful for the environment.

3.2.7 Alternative 6: Wind Energy Instead of Hydropower

Although the Study is assessing Solar Energy, Wind Energy, and Geothermal Energy, the necessary investigation to replace hydropower by wind energy is not made. Doubtless, the perspectives for exploitation of the wind in the mountains are good. Therefore, one further alternative should be designated to investigate the environmental (not economic consequences).

Taking into account the worldwide enormous development of wind energy (only in Germany presently electricity generated by wind power plants of installed 27,000 MW) this alternative is worth to be investigated. Despite the situation that wind not always (river flows as well not in the same amount) is blowing there are serious environmental advantages:

- Not submerging Nenskra (and Nakra) valley
- Preserving natural undisturbed ecosystems and livelihood
- Supply all over the year, not only during winter months (however fluctuating).

3.2.8 Alternative 7: No-Action (Zero) Alternative

The Study is investigating the “No-Action (Zero) Alternative, however only from the economic point of view referring to the necessary development of the energy sector in Georgia, especially in winter. However, the ESIA is the superior instrument to recommend not to establish the project because of the potentially too severe impacts on the nature, ecosystems and/or social sphere.

3.3 Project Description

3.3.1 Overall Evaluation and Gaps

In general, the Project description lacks a systematic and substantial consideration of the intended operational mode of the Nenskra HPP. A description of the operational mode (see under 4.3.3) is not made. However, the clear description of matter to changing the flow of the present rivers is the most important issue after addressing the Foot Print of the Project.

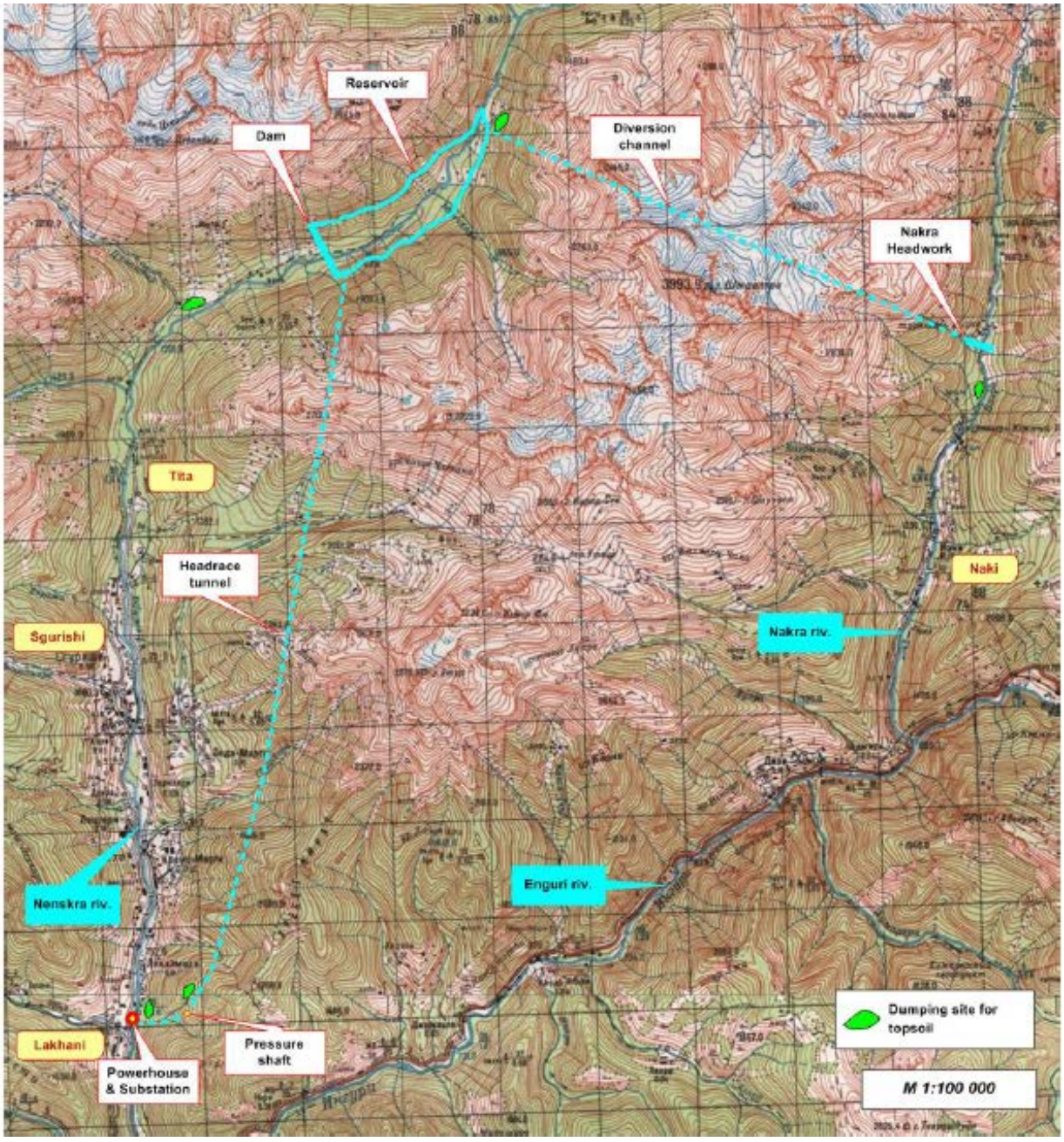
The situation that some of these operational data are supplied in the impact assessment cannot explain the absence of these data in this main chapter describing the impacts systematically from the design and operation features. The layout (see Map Scheme 1) and Table 4.1.1 “Main technical features” only inform about overall construction features and some few operation parameters such as

- Reservoir: Area, storage capacity, Full Supply Level (FSL)
- Energy Output: annual and sustainable output.

A thorough description of the operational mode for the Nenskra HPP is not available in this basic chapter.

3.3.2 Construction Focus Dominating

As highlighted the Project Description is dominated by only construction features. After the Alternative considerations finally justifying the preferred option, the Study outlined on pages 49-68 the main construction layout of headworks, diversion system, powerhouse, transmission line, construction zone.



Map Scheme 1 Layout for Nenskra HPP (preferred option, Scheme 4.1.1, p 50)

In general, the Project Description is lacking by

- Overloaded with design and construction details, calculations, and drawings
- Used figures are often inconsistent (for example reservoir bottom elevation: 1,297.5 m asl under the condition that FSL is 1,432.5 m asl (Table 4.1.1), but 1.315 m under 5.2.6.1.6, page 286)
- Confused description also due to many repetitions

- Only focus only on construction
- Operation stage absent.

One of the main subjects under Project Description is the quantitative inventory of following construction parameters (land data are partially given):

- Land needs: permanent land demand for the “foot print” and temporal needs as for the labour camps, storage, dumping places for construction materials, as supplied for example for units of power unit construction site Figure 4.6.3.1, page 72
- Construction material: rock and earth material, cement, steel, timber, fuel, water, energy for estimation of transport needs (number of vehicles daily as made for tunnel drilling, see page 72, rock waste from drilling, see page 73, water demand for concrete mixing, see page 73)
- Construction period: length and sequence of various works, rough workplan
- Labourer: number of permanent staff, locations.

For the above items, a “bill of quantity” is required, which under impact assessment enables to estimate the land and pressure to the local environment (habitats, wildlife, and population). Some of these figures are given (examples are highlighted above), however not in one table summarising the construction impacts in a quantified manner per construction element, subject and envisaged construction period.

3.3.3 Operation Focus Required

The most concrete statement on the operation of Nenskra is given under 3.3.1 “Alternatives of HPP Type”. Here one can find the following considerations:

- "Output of the HPPs that operate on the natural runoff depend on the base load/regime if the river runoff. Considering hydrological regime of the river Nenskra annual production in spring-summer season (April-September) will be 80 % and in winter period (October-March) 20%;
- It should be noted, that the project capacity does not allow consumption of the river potential fully in spring-summer period;
- Seasonal regulation type HPP allows to reserve water and therefore, river potential will be used throughout the year. This scheme allows maximal generation of electricity even during dry periods. Operation regime of such HPP is highly flexible and is less dependent of seasonal distribution of runoff. These characteristics are very important for the winter period." (Page 37 of the ESIA Study).

Firstly, the Chapter on Alternatives is not the place for describing the main intended operational regime for the hydropower project. Secondly, the main features on the change of the water regime are described in the "Impact Assessment", Chapter "Aquatic Environment". A solid Project Description has to be prepared in order to inform in the very beginning about the expected change of the Nenskra and Nakra River regimes.

3.4 Legislation

The legal frame of the ESIA is based upon the "Georgian, EU and IFC/World Bank" requirements, which meets the overall requirements for such privately developed project. However, the description of legal and regulatory frame for the ESIA Study Nenskra with 22 pages is too much and would need revision and significant shortening in order to be useable for the project. In general, legal and regulatory subjects in an ESIA Study are committed to the following two main tasks:

- Justifying the compliance with international and national legislation
- Consideration of requirements for the Investor to get the permit for future steps (lastly for construction)

The ESIA Study is not the place to list all Georgian Environmental legislation. Important regulatory issues are not considered (the important legal national act on the “Change of Forest Land” is referred in Chapter 6.10.2 "Impact on Flora") but only listed. The ESIA has to discuss the legal frame and the consequences for the development of the Project, especially getting the environmental permit.

After 2014, when Georgia signed the “Agreement on Stabilisation and Association” with the European Union, the main requirements from the EU Legislation should be addressed as well. Doubtless, the EU Water Framework Directive (EU WFD) is a fundamental legal act, which will guide Georgia in the future in two main directions:

- Application of basin approach
- Environmental quality target for basins, developing over a certain period for all basins the “good state of water bodies” (in ecological, chemical terms).

The EU WFD is not only listed at the very end of a table with main European legal and regulatory documents but moreover is not considered from the river basin point of view.

3.5 Baseline Investigations

3.5.1 Impact Area Definition and Baseline Investigations

Intensive Baseline Investigations on climate (6 pages), topography (1 page), geology and geophysics (122 pages), soils (2 pages), hydrology (10 pages), vegetation and nature conservation (56 pages), wildlife and nature conservation (16 pages), air (half page), noise (half page), economic-social conditions (22 pages), and cultural heritage 6 pages) are made. Most of them are primary works, which especially in the biological and cultural heritage parts are very substantial.

The Baseline Investigation chapters despite the large extent of pages definitely could be improved along the two following general aspects:

- More precise receptor-based definition of the relevant Impact Area (see Figure 1), and therefore the clear determination of the Baseline Investigation Area (see 6.3 "Impact Description", p 336)
- Addressing baseline investigation only in this Chapter 5 (avoiding many repetitions in Chapter 6 "Impact Assessment").

The vegetation baseline chapter is a good example, where the "habitat locations" are shown in a map (p 285) and clearly coincide with the description of the plots under risk by submergence of the reservoir. Similar is the same good approach of Impact Area definition in the Cultural heritage chapter.

A specific issue is the impact area handling in 5.3.1 "Socio-Economical Environment Research Area and Information Sources" (p 307-308). Addressed as "settlements in the project influence zone" are the two councils ("obtshina") working in the valleys. However, the inserted map (Figure 5.3.1.1) does not follow the names of villages in the list above. Either the map has to be changed in accordance to the official administrative set-up or the listed settlements need to be renamed.

3.5.2 Geology and Geophysics

The Study is overloaded with long descriptions of geological and geophysical issues (lots of borehole profiles, stability of dam axis, slope analysis, excavation issues of diversion tunnels etc.) which definitely are necessary for the design and construction parts of the Nenskra HPP project. However, they in this extent do not belong to an ESIA Study.

Another aspect should also be considered: Geological and geophysical chapters are outlined on totally 122 pages. In comparison to that the Socio-Economical baseline investigations are described on just 22 pages. Moreover, most of the issues are not to be found in the main chapter on "Impact Assessment".

The ESIA Study has to be improved in order to illustrate in the baseline investigation chapter those geological issues which are related to the following two issues:

- Geological receptors potentially affected by construction and operation of HPP
- Baseline information therefore to be improved on surface geology and geomorphologic structure
    - in reservoir area related to land sliding and mudflows especially
    - in downstream area below the dam related to flooding, channel erosion and sedimentation

The revision of the ESIA Study should improve the spatial issues of those soil types, which are potentially submerged or temporally lost (page 221). This would enable to assess the loss of land for agriculture purposes but also for overall ecological functions (which has to be done later under Impact Assessment, Chapter 6). Another issue is the attempt under Baseline Investigations to address the main types of landscapes endangered (see Georgian Regulation, Article 3, Point h) and d).

3.5.3 Hydrological Baseline Investigations

The Baseline Investigation Chapter 5.2.5 Hydrology (p 223-233) outlines many issues including geology, soils, ecosystems, of the catchment area which are described in the related other chapters either.

To some extent it is overloaded with (for environmental considerations) unnecessary hydrological consideration on issues such as deviation, error, and provisions calculations (see Tables 5.2.5.2.1 and 5.2.5.4.1) and would enjoy to be condensed on the environmental important parameters and conditions of the hydrological regime of the two rivers.

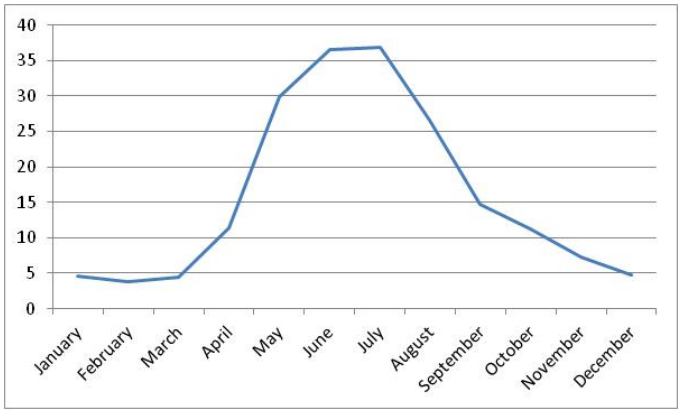


Diagram 1 Nenskra River Flow at Lakhami Station in m³/s per month (extrapolated from Enguri 3 Project and designed by FS)

The ESIA in general has to presume a solid hydrological assessment for the creation of the Operational Mode (see later chapter). However, these calculations for the environmental assessment have to be overwork in order to determine condensed information like:

- Monthly average flow
- Daily flow: at least the highest daily maximum and lowest daily minimum flows (and not the provision data in the above two tables)
- Seasonal distribution of maximum and minimum flows (monthly average minimum, monthly average minimum).

The Reviewer assumes that for the Lakhami gauging station (Nenskra River) and Naki gauging station (Nakra River) daily data are available. As for the annual flow regime Diagram 3 had been developed by FS (extrapolation from Enguri 3 data) in order to understand and illustrate the seasonal character of natural Nenskra River discharge.

3.5.4 Biological Environment

As underlined above the Baseline Investigations of the Biodiversity subjects is prepared substantially addressing the present high ecological status of vegetation potentially affected in two areas, namely reservoir submergence and downstream of dam river. Long descriptions of all vertical vegetation zones in the Semo Svaneti region above (and therefore most likely outside of the Impact Area) should be shortened (also in relation to Chapter 6.15.1.1 Physical-Geographical Characteristics of the Basin and Cascade Morphometry, p 402-403).

The extensive description of timber losses due to submergence of the reservoir under Baseline Investigations (p 286-288), which might be relevant for the impact assessment provokes a calculation of lost most important habitat areas. Taking the long description of investigated habitat plots the questions for the later mitigation are: which are the main habitat types endangered and is their area?

Terrestrial zoological investigations on mammals, birds, reptiles and invertebrates have been made, are recorded and compared with the nature conservation status (Red Data Book) and their presence in Georgia entirely. None of the protected species had been found, however not clearly addressing the year and period of research (perhaps not systematic spatial and seasonal appearance).

Fish investigations are made, however also not clearly indicating the mode of investigation. Finally, the Study describes in general terms the aquatic conditions of "mountain form of trout" (p 301), however, does not indicate results of a fish inventory such as

- diversity of fish in Nenskra and Nakra River (and main tributaries)
- trout and species differences in both rivers
- role and abundance of trout in the water bodies
- spawning areas of trout in both rivers.

The Baseline Investigation on fish (especially on trout) needs to be improved taking into account the above aspects and mode of investigation (types of catches, locations of catches, fishermen interviews, market observations).

3.5.5 Socio-Economic Baseline Investigations in Nenskra and Nakra Obtshina

The provision of socio-economic information does not meet the requirement because relevant criteria such as population, occupation and income, ethnic structure, migration (despite the visible high number of empty and deteriorated houses), water supply, infrastructure, health and sanitary conditions, education for the settlements in the two valleys are not supplied at all (income, occupation, ethnic affiliation, community structure) or the data are focused on the large Mestia region only. In some few cases some summarised data are included, which however only indicate the total number of people, income and poverty, migration of the two valleys, but not the differentiation between the settlements in the Obtshina. The overall Socio-Economic Baseline Investigation (despite the situation that there is no resettlement) has to be improved focusing on an actual analysis of the main criteria (which are important for the Livelihood Improvement and Benefit Sharing Programme of the Investor, see ....).

Totally missing in this Baseline Chapter is the description of the present perception with regard to political, religious and community cohesion issues in relation to hydropower. The lessons from the long conflicts on Khudoni since the 1980s, nowadays the perception on present projects like Nenskra and Enguri 3 require high attention. Visible are poverty and exmigration in the Nenskra and Nakra valleys up to Khaishi. Religious issues (affected submerged forests delivering the timber for icons) should be addressed as well.

Even when the Chapter 5.3.13 "Cultural Heritage" describes in more detail the present values in the Nenskra and Nakra valleys significant improvement would be necessary to be condensed the provided information on the environmental subject (at the same time shortening the Study).

The application of the above outlined approach in the entire abundant baseline part would not only contribute to a more precise impact area definition in all receptors but also contribute to a significant shortening of the Study.

3.6 Impact Assessment

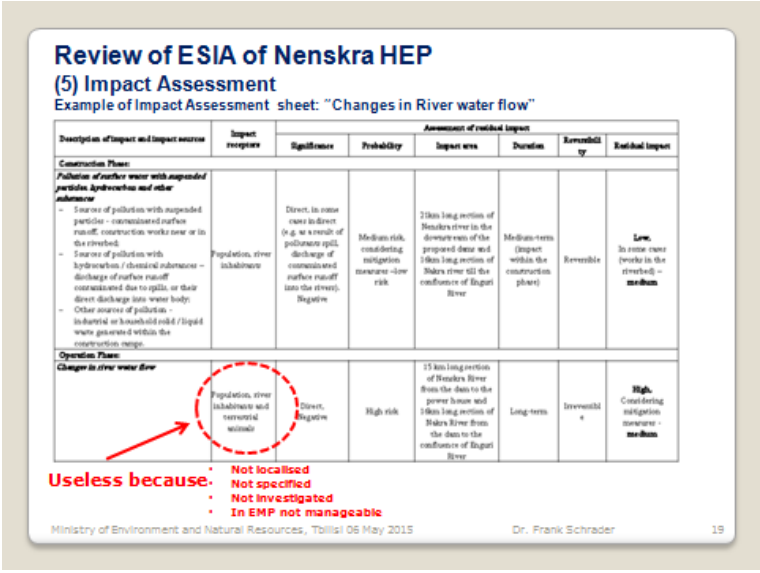
3.6.1 Overall Impact Assessment Approach and Implementation

The Study applies stringently the internationally required impact assessment methodology. Each receptor-related chapter establishes the relevant criteria, mainly using five degrees ("ranges"), partially three from very low up to very high respectively low to high. Following is a text assessing the main impacts, which in general is a relevant basis for the entire Study. In table-format afterwards the main results of the assessment are summarised. This good approach however is suffering due to not stringent implementation of following subjects:

- o Single impacts for each receptor has to be addressed (see Figure 3)
- o Impact Area definition to be improved (see also 3.5.1 of this Review)
- o Partially impact assessment not comprehensible (see **Fehler! Verweisquelle konnte nicht gefunden werden.**).

In any case the impact assessment summary has to be separated for each receptor. The given example on "Change of river water flow" shows that an assessment taking into account criteria such as significance, probability, impact area, duration, reversibility and residual impact for as well "population" and "river inhabitants and terrestrial animals" should be avoided. Assessment and mitigation measures for each of the receptors are different and therefore require the revision of the tables. In this connection the spatial approach significantly should be improved in order to define in detail the affected value:

- o settlement (even if only indirectly) and group of population
- o river section with relevant fish habitat
- o species/group of terrestrial animals (such as reptiles, or birds).



The Reviewer in addition proposed to split into two large chapters "Construction Impacts" and "Operation Impacts" and within these chapters to go through the various receptors. The Study does this distinction, however receptor-based and therefore the reader has to jump always in the receptor-related sequence from construction to operation.

Figure 3 Example Table Impact Assessment on "Change of river water flow"

For the impact area "Change of River Water flow" the following proposal for impact definition is supplied (see **Fehler! Verweisquelle konnte nicht gefunden werden.**).

Figure 4 Example for Improved Impact Definitions (FS)

Impacts on Water during Construction
Pollution of surface water due to heavy vehicle accidents
Pollution of surface water due to earth material dumed into the river(s)
Pollution of surface water due to release of communal water (without treatment)
Lowering of groundwater related drinking water supppy due to construction works
Degradation of alluvial forest due to pumping for civil works
Impacts on Water during Operation
Loss of natural mountainous alluvial (riverine) ecosystem
Submergence of natural alluvial coniferous forest and habitats in Upstream Area 2
Reduced supply of water for broad-leaves forest on alluvial sites of Downstream Area 1
Absence of periodical floods (relevant for ecosystem and community safety) in Downstream Area 1
Degradation of agricultural groundwater-supplied plots (especially in Nakra Valley) in Downstream Area 1
Deterioration of local water supply in Obtshina Lekalmakhi in Downstream Area 1
Increased water discharge from powerhouse affecting Donwstream Area 2
Changing water regime of Enguri River In Downstream Areas 3 and 4

Likewise the above example the Summary Impact Table has to be split into the various receptors such as river abstraction, illegal fishing, hydrological structure, vehicle passes erection (?), water pollution, and bottom sediment contamination.

In general, the Impact Assessment, especially the text descriptions demonstrate the Consultant's capacity to assess the environmental impacts of the Nenskra HPP. There is the suggestion to improve the summary tables in order to place the findings of the text correctly. Furthermore it is recommended to rearrange the chapter starting with "Impacts during Construction" and then moving towards "Impacts during Operation".

3.6.2 Impacts on Air and Mitigation Measures

The chapters on air should be revised with regard to the impacts during the operation period. As experienced in many reservoirs in the world, due to longer stagnation of the water body stratification appears during warm season. The Study based on climate data for the reservoir area (1,300-1,450 m asl) should consider the physical processes in the reservoir water body and assess the probability of reservoir stratification during summer period. Under the operational mode there will not be significant water releases, which in connection with heating up of the upper water layer ("epilimnion") might support a thermal stratification and oxygen reduction over the summer season. The development of methane gas (CH_4) emissions should be investigated and potentially excluded due to climatic conditions.

3.6.3 Impacts on Population from Noise and Mitigation Measures

The ESIA considerations on noise should be revised in order to clearly address the potential receptors (as it is done on page 342 below and following pages) avoiding sophisticated noise calculations which in this respect do not make sense. Those parts focusing clearly on the receptors local people and wildlife should remain in the text only. The preparation of a separate "EMP on Labour and Local Population Safety" should be considered in order to develop for the Contractor specifications enabling noise protection measures (as outlined under "Mitigation Measures", page 343-344)

3.6.4 Impact on Soils and Mitigation Measures

The chapters on soils are in accordance with the requirements. Especially the estimation of land permanently or/and temporally required for construction sites, earth material dumping and other land issues should be taken for preparation of an "EMP on Land Issues" transforming the mitigation measures (page 349) into specified activities of the Contractor (quantities of land required, locations, ownership, other issues) and lastly addressing the mode of compensation (according to the Georgian legislation and regulatory framework).

With regard to the analysis of waster there is the suggestion to reconsider the Chapter 6.6 on Soils and Chapter 6.11 on Waste. Firstly, waste is not an environmental receptor. Secondly, both chapters should be revised significantly along the following suggestions:

- Large parts (especially page 385) should be addressed under "Project Description" (4.6.11)
- Systematic description of related subjects such as
    - Quarry/ies
    - Earth material storage
    - Labourer camp(s) and other construction-related sites
    - Waste disposal sites.

The chapters on waste water in the Project Description could be taken as example. The Impact Assessment of waste and other issues then should be considered in each of the main receptors during Construction Stage mainly.

3.6.5 Impacts on Surface Geology and Morphology and Mitigation Measures

In contradiction to the long description of deep geology and geophysics issue (overweighing the Baseline Investigations Chapter on Geology and Geophysics) the Chapter "Risk of Dangerous Geodynamic Process Development" does fulfil the requirements for the Impact Assessment. The main natural geological hazards namely landslides, gully activation and erosion, mudflows and avalanches are sufficiently addressed.

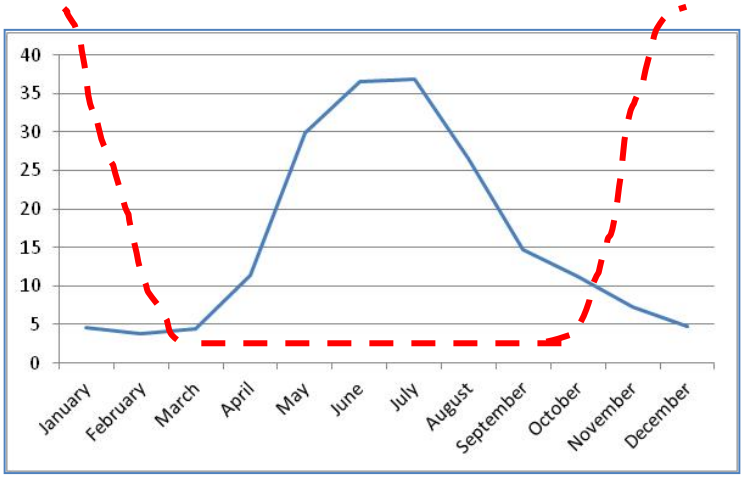
The Consultant is requested to reconsider the assessment in Table 6.7.4.1 on mudflows, where the residual impact is only evaluated as "medium, in case of mitigation measures low"?

Photograph 1 Mudflow Zone in upper Nakra Valley

Photograph 1 shows one of the four mudflow zones illustrating the enormous power and rocks masses making mitigation measures quite difficult or even impossible. Furthermore, there is the question why mudflows in the Nenskra valley were not considered to be relevant?

3.6.6 Impact Assessment on Surface Water and Mitigation Measures

The Chapter 6.8 "Impact on Aquatic Environment" should be renamed in order to make clear that fish subjects are not considered in this part of the Study. After impacts on surface water (mainly due to construction-related measures polluting the river water) the central impacts of the entire ESIA on the change of the river water regime Nenskra and Nakra are referred.



First time in the ESIA Study on the hydropower project on page 359 the operational mode and the issues of the environmental flow are clearly presented! Necessarily, the main operational features have to be listed and described under “Project Description” (see Chapter 3.3.3 of the Review).

Diagram 2 Nenskra Hydrological Flow (blue) and Expected Release from HPP (in m³/s), extrapolated by FS using Enguri 3 monthly flow data

In addition, it has to be stated again that the ESIA Study also "hides" the description in numbers and diagram of the present hydrological flow of the two rivers! There is the urgent need to revise the Study addressing the hydrological regime (daily flow data per seasons, maximum, minimum, see baseline Investigations, see Chapter 3.5.3 of this Review) and the proposed changes of the water regime due to the preferred operational mode.

However, even the Chapter 6.8.2.2 "Operational Phase" does not address the extreme increase of water flow during winter months. In order to understand the resource and the main impacts for the release from the powerhouse in the Nenskra stream the Reviewer himself calculated the monthly dynamics of flow (extrapolating the monthly flow data from Enguri 3 Project, Gamma 2012) based upon the average of 30.4 m³/s for Nenskra and 11.7 m³/s for Nakra (see **Diagram 3**).

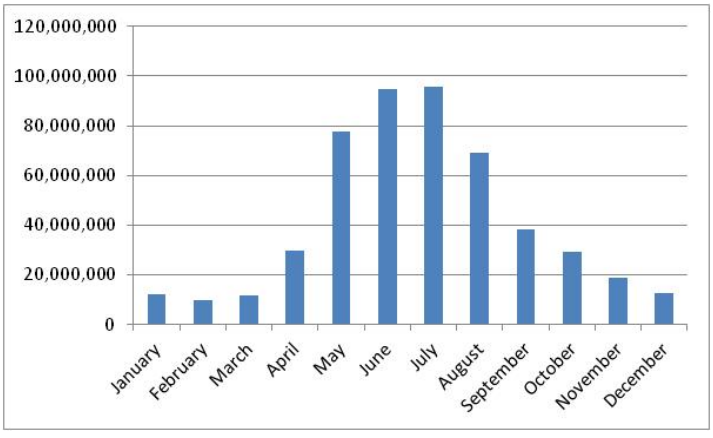


Diagram 3 Monthly Flow of Nenskra River in m³ (extrapolation FS)

Under the condition that Nenskra HPP will generate electricity (using also the Nakra diversion amount) as stipulated the total annual flow is 629 million m³, whereas the reservoir storage is 182 million m³. That means, taking into account the information about the winter operation mode only the flows during summer months August, September, October in average are sufficient for filling the reservoir (202 million m³).

The most important concern however is the substantial higher release situation during winter:

- Presently, Nenskra flow during the three winter months in average is ranging between 9,700 and 12,500 m³.

- In future at least 60.000 m³ water would be released in each month (182 million m³ divided by three).

This issue of extreme releases of water during winter months November-February has not been addressed in the Study and requires not only explanation, but significant assessment and mitigation measures including a specific EMP on protection of the Lekalmakhi Obtshina against these winter floods under frost conditions.

The Study in the Chapter "Operational Phase" almost only focuses on the flow conditions in the Nenskra river channel below the dam. However, there is the demand to assess the potential future hydrological conditions severely negatively affecting erosion and sedimentation, aquatic live especially trout, alluvial forest preservation, damaging houses and infrastructure and others. Some of these issues are analysed in the Study, however would require deeper assessment and mitigation measures (including EMP).

Subsequently the Study addressed the Environmental Flow. Long and confusing explanations justify lastly the 2.5 for Nenskra respectively 1.5m³/s for Nakra River environmental flow. Basis for the calculation is the 15% average flow of 95 % river provision. The Consultant justifies the low environmental flow data with the so-called "Swiss methodology" (see page 362 below). Even if the proposed ratio is slightly higher, the decision should take into account the related season/months significantly changed and the character and demand of water users. The quasi natural alluvial forest for example in the downstream of the dam section most likely would significantly suffer when in hot summer season the natural floods do not occur and in addition the groundwater table substantially would be lowered.

This solely quantitative approach is outdated as stated in the USAID Report: “Environmental flows are still calculated based on the outdated Soviet approach of a flat minimum environmental flow, currently 10 % of mean annual flow, not taking seasonal variation in flow and dependencies of aquatic ecosystem into account” (Reducing Transboundary Degradation in the Kura-Ara(k)s River Basin, 2013, p 184).

The Reviewer does not apply this approach and suggest using the lowest daily flow data during the relevant month/season of the respective stream/river during the past observation period in order to meet the requirements of water users including habitats, wildlife (amphibian, mammals, water fowl), population with water supply etc.

3.6.7 Impact on Biological Environment and Mitigation Measures

In general, the vegetation related issues are well-prepared including impact area focused baseline research of main habitats and their investigation plots. Methodological issues should be excluded because they were already addressed in Chapter 5 Baseline Investigations on Flora.

However, there is the subject of permanent loss of highly valuable forest habitats (investigated in detail in the Baseline Chapter) due to inundation of the reservoir area, which is missing under impact assessment during operational phase (p 376). The assessment should address

- main habitats types lost
- area of each habitat type
- nature conservation assessment related to critical habitats, Red Data Book plant and animals species.

Relevant explanations on wildlife are made (pages 372-376), however also focusing mainly on the construction phase impacts. Potential negative impacts during operation phase are excluded. The Reviewer suggests reconsidering this statement observing following issues:

- large mammals: reservoir as barrier

- otter and its population: habitat damage in downstream Nenskra and Nakra river section
- reptiles and amphibians: habitat damage in downstream Nenskra and Nakra river section.

The assessment of impacts on Fish Fauna is in good shape as well except the question whether the flow change after starting operation will only "...cause quantitative reduction of stream trout population..." (Page 378). Under the condition that the spawning areas are damaged or not accessible for the trout there is the risk that the entire endemic species ("red trout", in accordance to verbal information during the site visit) would be lost totally. This important item has to be reconsidered.

3.6.8 Impacts on Socio-Economic Issues and Mitigation Measures

The assessment of impacts on the socio-economic environment and related mitigation measures requires significant changes along the following issues.

Firstly, it is suggested to distinguish clearly between Local Population and Labourers. Despite the situation that no one house directly would be affected (damaged or deteriorated) one of the most important receptors is the local population. Lastly they are lastly suffering negative impacts also after completion of the construction works.

Secondly, that has been underlined already in the Baseline Investigation Chapter, required is a detailed assessment of impacts on local population in each of the potentially affected settlements in the two Obtshina Nenskra and Nakra. Visible is a significant poverty and actual migration in both valleys. The necessary assessment of impacts during construction and operation on various socio-economic issues such as occupation, migration, house and living quality, traffic in the narrow valley and related accidents, community cohesion requires precise knowledge (which so far the Study does not provide).

Another issue requiring the above data is the obligation of the investor to improve the livelihood in the settlements. This might include measures to support infrastructure (bridges), education, health care and others. This is in line with the international guideline of "Benefit Sharing".

Lastly, the past and perhaps ongoing discussions in the communities of Enguri River and related Nenskra and Nakra Valleys should be conveyed. At the day of the site visit a meeting of local people (potentially affected by the powerhouse constructions) happened. Another reason to have profound information on these political conditions and discussions is the need to prepare and successfully conduct the public hearing. Notions on "discontent on property rights" (as addressed on page 394) are discussed under "Land Ownership and Use". However, in many hydropower projects the perception of the local population is negative not only because of ownership and compensation issues. Quite often there are deep political questions, and concerns.

3.6.9 Impacts on Global and Regional Climate including Cumulative Impacts

The Study considers potential changes of the regional and global climate taking into account cumulative impacts from the point of view of the three cascade projects, namely Jvari HPP (since 1978 operating), Khudoni HPP (during 1980s started, later collapsed) and Nenskra HPP. The Study should shorten the long climatic considerations, partially to be shifted to baseline Chapter, some of the long modelling calculations are not be deleted.

3.6.10 Cumulative Impacts

The Study on pages 424-427 also observed the potential impacts when the various hydropower projects would be established cumulatively. The valuable assessment considering po-

tential impacts on noise, emissions, biodiversity, water quality, socio-economy (during construction) and hydrological regime, sedimentation, water quality, fish, climate should include

- Enguri 3 (Gamma Prefeasibility Study, 2014, USAID)
- Construction (under condition that all or several projects are implemented simultaneously)
- Other projects such as road construction, development of tourism (in the Study assessed as not relevant).

4 EMP

Required for any ESIA is the preparation of Environmental Management Plans (EMP), which aim at the detailed description of obligations, measures and activities for implementing compensation and implementation. This document is the basic basis for the tender procedure on the Contractor for the construction. The issues addressed are the guideline for the Contractor and the Checklist for the Monitoring Agency.

The Study does not provide information about the EMP approach. The Reviewer does not know the Terms of Reference for the ESIA whether this task was included in the Gamm obligations.

Almost at the very end considers briefly the need to prepare an Environmental and Social Management Plans (EMP). It is recommended at least to prepare following EMP's:

- **A) Nenskra Alluvial Forest and Habitat Preservation Plan** addressing especially
  - Upstream area of submerged reservoir bottom with natural coniferous/mixed forest (measures to substitute/replace an area in another valley of Semo Svaneti)
  - Preservation of downstream area with broad-leave alluvial forest
- **B) Livelihood Development Plan of Nenskra Obtshina**
- **C) Labour Safety Plan (during construction)**

5 Review Conclusions

5.1 Overall Statement and Questions of the Reviewer

The ESIA Study has significant strengths enabling to prepare a sound environmental assessment satisfying the permitting requirements of the Ministry of Environment and Natural Resources of Georgia. Most of the assessments established in the Study are agreed by the Reviewer. The main purpose for the many suggestions was to comply with international requirements on ESIA and to improve the results of the Study. However, with other words, despite the various suggestions and hints for improvement there are no substantial objections against the overall assessments of the Consultant.

What remains at the Reviewer are concerns on the applied weighting? One has to consider that some impacts were assessed as "high" partially changing totally the present environmental character and status such as

- loss of biodiversity in the upstream Nenskra valley
- change of hydrological regime of both rivers
- deterioration and/or damage of endemic fish stocks.

Therefore, all responsible stakeholders including the Ministry of Environment and Natural Resources, the Consultant, and the Reviewer are required to answer questions like this:

- Should the Nakra valley be degraded only because of 10 m^3/s inflow to Nenskra HPP?
- Could not be identified more suitable valleys where the losses are not so high?
- Would not be other energy options available for replacing the overall Nenskra Project or Nakra at least?

- Would in not recommended to only use in the unique highly divers tributaries run-of-river hydropower systems?
- Would it not appropriate to establish storage hydropower plants in the main Enguri River (because of certain degree of past degradation and much lower biodiversity and hydrology)?

These and other questions should be reflected. Two more approaches might be helpful:

5.2 Rapid Environmental Assessment

Perhaps one additional tool for an overall evaluation of a hydropower project might be included and also reflected in the Executive Summary. This tool is the methodology of assessing the sustainability of hydropower projects elaborated for the World Bank (2003) by George Ledec/David Quintero (Good dams, bad dams: environmental criteria for site selection of hydroelectric projects, Latin America and Caribbean Region Sustainable Development Working Paper 16). This methodology had been used recently by NCEA for the Prefeasibility Study of the Khudoni HPP (see above chapter).

5.3 Comparative Assessment of Hydropower in Georgian River Basins

Under the present situation that Georgia is going to develop various hydropower projects (TDA 2013: "...83 small, medium and large HPPs", p 184) it is recommended not only to develop the ESIA for those projects which are under consideration in the Georgian Ministry of Energy. It is suggested to prepare and agree in Georgia a "Comparative Analysis and Assessment of Hydropower in Georgian River Basins". Only such basin-committed approach enables to qualify ESIA studies in order to permit projects with the best environmental and economic conditions.

In this line in 2013 already, NCEA, the Netherlands Commission for Environmental Assessment, in regard with the Khudoni Project requested in a letter from 06 May 2013 the Minister of Environment Ms. Gogoladze for "a Strategic Environmental Assessment for the development of a National energy/hydro-power strategy in cooperation". A Cost Benefit Analysis had been prepared (2014-2015) "Model of watershed based hydropower development in the Enguri watershed area, including assessment of the environmental and social costs" (see http://www.eecgeo.org/en/projects.htm).

Practically all rivers in this region, originating in the glacier and snowpack regions, have high hydropower resources. However, from nature preservation point of view, not all of these larger like Enguri and smaller rivers like Nenskra and Nakra should be used for hydropower generation. The conservation of these undisturbed high mountain ecosystem is a target of national significance as well! From the nature conservation point of view hydropower projects in the main Enguri course are much less sensitive than the tributaries like Nenskra and Nakra.