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1. Introduction

1.1 Brief description of the initiative

Rationale of the project

After an extreme flood in 2016 that seriously affected Gelephu, the government of Bhutan, initiated the Gelephu Flood Protection Project led by the Ministry of Works and Human Settlement (MoWHS – Flood Engineering and Management Divisions). A Dutch Disaster Risk Reduction Mission visited Gelephu in 2016 and supported the MoWHS to develop this project. Invest International¹ is contributing to partially fund this project and provide support to develop the project through its D2B (Develop2Build) facility. A consortium of six consultancy firms has been established, led by CDR International (Coasts, Deltas and Rivers International) to carry out the required studies. The project started with a prefeasibility study – Phase I (2018–2019). Phase II – the feasibility study started in January 2020. Part of this phase is the development of an ESIA (Environmental and Social Impact Assessment). In the present advisory report, the review findings of the draft ESIA report of July 2021 are presented.

Description of the proposed project

Gelephu is located in one of the rare (relatively) flat areas of Bhutan near the Indian border. The project area concerns a stretch of the Mow River, approximately 10 km long, between the Ai Bridge and the Indian border. This stretch of the Mow River is characterised by a gradient of 1 to 1.5% and several braiding stream channels. The width of the river corridor of the Mow River near Gelephu is between 800m and 1200m. Water- and sediment-related events have recently negatively affected Gelephu. These impacts tend to increase in future if mitigation measures would not been taken.

The problems experienced relate to:

- increasing high water levels, causing flooding of low-lying agricultural areas and vital infrastructures like the (drinking) water treatment plant (WTP) and infiltration gallery, and sewage treatment facility (STP) of Gelephu;
- increasing riverbank erosion, leading to loss of agricultural land and threats to infrastructure, among which a school and the WTP;
- increasing discharge of water and sediment through tributaries which, at the confluence of these tributaries with the Mow River and upstream, leads to severe deposition of sediment, with associated increasing highwater levels and a stronger tendency of the tributaries to shift outlets.

The interventions proposed in the prefeasibility report of Phase I and subsequent elaboration in Phase II, can be categorised in two types:

- riverbank and flood protection by using gabion-based revetments (steel wire containers filled with rock), where required, placed on new dike sections (for the sake of convenience, the gabion protections placed on new dikes are further in this report also denoted as ‘revetments’; Interventions 1, 2 and 5);
- protection against further erosion and flooding by flow diversion structures/groynes (Interventions 3 and 4).

¹ The original request came from RVO (Netherlands Enterprise Agency), however Invest International, replaces RVO and carry out the D2B programme as from October 2021.

These types of interventions will require large volumes of rock, gravels and sand. These materials will be mined from the riverbed (so doesn't require the procurement of a new or existing quarry).

One or a combination of these type of interventions are proposed along the Mow River. See Figure 1 for the location of these interventions:

1. Flood and riverbank protection by means of a revetment along the infiltration gallery (IG) and water treatment plant (WTP). This is in fact a restoration and improvement of existing protection works;
2. Erosion protection by means of a revetment at the Serzhong primary school at the Thewar Stream; the school is situated on a steep cliff, undercut by the Thewar Stream;
3. Erosion protection in a side channel of the Mow River, in the branch North of Jogi Stream, by means of a flow guiding structure (groyne);
4. Erosion protection by means of a flow guiding structure (groyne) in a side channel of the Mow River, close to the sewage treatment plant (STP);
5. Erosion and flood protection measures along the Shetikhari Stream by means of a revetment along the sections prone to erosion and overbank flow, to avoid further land take by the stream and prevent damage;
NB: this intervention (5) replaces the earlier proposal of erosion protection by means of a cross dam plus revetment of the semi-permanent island at Chuzergang Gewog (east riverbank) which also would have enabled shortening the planned Maokhola Bridge.
6. Supporting activity: flood protection by means of an outline sediment management plan of the Mow River and its main tributaries (Thewar Stream, Shetikhari Stream, Dawia Stream, and Jogi Stream).

In addition, a joint monitoring programme will be carried out during the planned two years of construction and three years after completion of the project.

Bhutan ESIA requirements

According to EIA legislation in Bhutan, the proposed project does not require an EIA². Invest International, however applies the IFC-Performance Standards and therefore requires an ESIA. During the meeting between the NCEA and the Environmental Commission of Bhutan, the latter decided an ESIA should be carried out after all, and that this will be done using the legal procedure in Bhutan. The EIA authorities approved the ToR for the ESIA dated 16 June 2020. The Environmental Commission completely included the NCEA advice (June 2020) in the approved ToR for the ESIA.

² The NCEA generally uses the term ESIA, to emphasise that social impacts are included in this process. The Bhutan regulations refers to EIA. Note that these regulations do require that social impacts are addressed.



0 0.5 1 2 Kilometers

Figure 1 Overview of proposed interventions along the Mow River

1.2 Role of the NCEA and justification of the approach

Role of the NCEA

This is the second advice prepared by the Netherlands Commission for Environmental Assessment (hereafter referred to as 'the NCEA') at the request of Invest International. The next section briefly references to the first advice.

First advice

In June 2020, the first NCEA advice was published: Advice on the Scoping Report ESIA for the Gelephu Flood Protection Project (GFPP)³. An NCEA working group of experts visited Bhutan, including the project area, in the period 5–13 February 2020. The recommendations presented in this advice have all been adopted in the ToR for the ESIA (Annex IV of the ESIA report), approved by the Bhutan Environmental Commission (June 2020).

Second advice

In August 2021, Invest International requested the NCEA to assess the quality of the draft Environmental and Social Impact Assessment (ESIA) study for the Gelephu Flood Protection Project (GFPP). It is noted here that the proposed interventions have been changed in the meantime, i.e., omission of the cross dam that connects the east bank of the Mow River (acting as bridge abutment and scour protection of part of the east bank). Instead, protection works have been identified along the Shetikari River. It can be expected that the new set of interventions will have less adverse impacts than the set of interventions in which the cross-dam was still present.

The quality assessment is prepared by a working group of experts that acts on behalf of the NCEA. The group comprises expertise in the following disciplines: river engineering and morphology, hydraulics, land use, ecology and biodiversity, socio-economic and gender aspects. Four of the five members of the working group were also involved in the drafting of the first advice and then visited Bhutan and the project site. For this review, an ecologist was added to the working group. The composition of the working group can be found in the colophon.

It is important to emphasise that the NCEA does not assess acceptability or feasibility of the Gelephu Flood Protection Project.

Justification of the approach to this quality assessment

The NCEA has reviewed the draft ESIA Report (issued July 2021), including Annexes. To review the draft ESIA Report the NCEA used:

- ToR for ESIA approved by the Environmental Commission of Bhutan (16 June 2020). The NCEA primarily reviewed to what extent the recommendations presented in the 1st NCEA advice have been elaborated in the draft ESIA report;
- IFC – Environmental and Social Performance Standards;
- Its long-term practice experience in assessing the quality of scoping report of ESIA's by applying the following review criteria: completeness of the information, quality of the information and relevance of the information for decision-making.

³ See the link for this advice: https://www.eia.nl/docs/os/i72/i7240/26-06-2020_-_advice_on_the_scoping_report_esia_for_the_gelephu_flood_protection_-_buthan.pdf

In addition, the following documents have been read to obtain better insight in the project:

- Gelephu flood protection project; feasibility study – Phase II: Main report (Draft) – July 2021. In particular, Section 4.7: Outline Sediment Management Plan.
- Gelephu flood protection project; feasibility study – Phase II: Hydrodynamic modelling report (Draft) July 2021.

A draft of this advisory report was sent to Invest International for comments on 8 October 2021. The NCEA received comments on this report on 18 November 18. Minor adjustments to the advice have been made. The final advisory report has been publicly available on our website at www.eia.nl since 23 November 2021.

The structure of this advisory report is as follows: after the present introductory Chapter 1, Chapter 2 presents the main findings of the assessment of the quality of the draft ESIA report. In Chapter 3 one of the main findings, i.e. the planning for sustainable sediment management (extraction and usage) is elaborated. Chapter 4 presents the other remaining findings.

2. Main Observations

2.1 General conclusions

The NCEA concludes that the draft ESIA report is in general of good quality. The need for the proposed interventions is well justified. The NCEA would like to compliment the drafters of the report for the systematic structuring of the report, the good readability and helpful addition of illustrations.

The NCEA noticed that all relevant IFC Performance Standards (No. 1, 2, 3, 4 and 6) have been assessed. For IFC-PS number 2 Labour and Working Conditions and number 6 Biodiversity, the NCEA recommends gathering additional information, see Chapter 4.

The NCEA would like to make two main observations related to sediment management. Additional information and our recommendations are provided in Chapter 3.

Firstly, it is proposed that the materials used for the intervention works will be mined from the riverbed. A more sustainable approach has not been described, namely re-use of bed aggregate materials (sands, gravels, stones and boulders) from the present 'old' gabion revetments in the construction of the 'new' gabion revetments. This approach is more sustainable because it requires less energy to transport and break the stones and boulders. Moreover, it would require mining of fewer materials from the Mow River and the importance of that effect is explained in the next chapter. Therefore, we recommend elaborating this alternative approach and its effects in the ESIA.

Secondly, to secure the longer-term stability of the intervention works, as well as to effectively control flood water levels over time, sustainable and effective extraction of deposited sediments is a necessary requirement. Therefore, the NCEA recommended in its advice of June 2020 to develop a management plan for sustainable sediment mining as part of the forthcoming ESIA Report. An outline of such a plan has been presented in the draft ESIA Report (Section 8.5). Based upon the observations during the field visit and newly provided information in the ESIA Report, the NCEA concludes that this outline is currently not yet sufficient to secure the development of an adequate Sediment Management Plan. We further elaborate on this in Chapter 3.

Recommendations

- Describe the re-use of bed aggregate materials, presently used in the old revetments, as an alternative for extraction of sediment from the Mow River and make a comparative assessment of the effects in the ESIA.
- Adjust the outline of the Sediment Management Plan in a manner that secures the long-term stability of the proposed intervention works.

3. PS 1: Sediment Management Plan

3.1 Introduction

In this chapter we justify why the proposed management of sediment is not sustainable and we provide recommendations for sustainable sediment management. Section 3.2 will give a brief impression regarding the significance of the observed large-scale sediment mining of the Mow River, insofar as it is relevant to flood levels and sediment status. Next, in section 3.3 our comments are given on the proposed sediment management (section 8.5 of the ESIA Report and on section 4.7 of the Feasibility Report). Recommendations for sustainable usage and control of sediment from the river are being presented in section 3.4.

3.2 Reflection on the Present situation in the Mow River and its tributaries

River dynamics deal with the hydraulic conditions ('attack') at the one hand and the resistance of riverbed and banks ('strength') on the other. The hydraulic conditions show strongly varying discharge peaks over the years for the Mow River. Due to climate change effects, the flow intensities and associated water levels will tend to increase further in future, and the morphodynamics will become fiercer, as can be seen all around the world. In addition, the dynamic equilibrium between flow attack and bed response is adversely influenced further by likely weakening of the Mow riverbed over time, by excessive sediment mining activities. Such activities have been reported to have taken place over more than a decade now and mining was likely done in a selective way, it has been reported from public consultation that since the mining started, the Mow River increased its dynamics and occasional flooding started to occur, which is a highly alarming situation. When coarse materials (boulders, larger stones) are over-extracted, the natural formation of armouring (coarsening) of the bed top layer during floods is hindered. This may lead to excessive sediment transport in the wet season (e.g. in pulses during flood peaks) and a more fierce overall morphodynamic behaviour of the river.

On the other hand, dedicated sediment mining is required to timely reduce flood water levels in the tributaries and in the upstream Mow River reach. In particular, the annual sediment deposits of the tributaries, forming the mini deltas at the confluence with the Mow River, pose a threat for flooding in the tributaries. Locally, excess sediments should therefore be removed on a regular basis. It should be noted here that the sediment inflow from tributaries and upstream of the Mow River changes strongly from year to year due to the strongly varying discharge hydrographs. This implies that the quantity of sediment that can safely be mined from the yearly deposits will also strongly fluctuate from year to year. This is another factor that complicates sustainable sediment mining that should be addressed in the Sediment Management Plan.

Reviewing the above, the following major conclusion can be drawn. The structural interventions have a modest and localised effect on the flow and morphology of the Mow River and tributaries. Based on the above information, it can be expected that externally induced large-scale sediment extraction in and near the Mow River will have a major impact on the Mow River and its tributaries and in the longer term possibly on the integrity of the proposed interventions. This adds to the necessity to develop an effective sediment mining plan. This

Sediment Management Plan can also be of importance as guidance for comparable rivers in Bhutan.

3.3 Sediment mining

The NCEA notices that in the ESIA and Feasibility report (section 4.7) statements are made on sediment mining. We conclude that some of these statements are premature conclusions.

Current extractions

In both reports, it is stated that current extractions, estimated at 100,000 m³ per year could be continued for the coming 10 years. The NCEA strongly questions this statement.

- Firstly, the extraction data as presented by NRDCL show much higher extraction figures (see Table 4–5 of the Feasibility Report). Furthermore, these data seem to be inconsistent as well (conversion error?).
- Secondly, the extraction seems to be selective (more stones than sands), which is highly detrimental for the riverbed strength, as explained above.
- Finally, the assumed 100,000 m³ per year extraction is not insignificant (about 10 % of the assumed total transport of the Mow River). Moreover, the total transport has been derived from model computations, with a possibly significant inaccuracy as these models have not been verified.

The NCEA recommends applying the principle ‘reversed burden of proof’ concerning sediment management, and to accept the proposed extraction regime only after sufficient substantiation. This principle needs to be elaborated in the ESIA for the sediment use of the project as well as for the preparation of the Sediment Management plan.

Notional areas for extraction

An important comment concerns the proposed ‘Notional areas’ for extraction of sediment in the coming 5 to 10 years (anticipated to result in a preferential flow channel in the Mow River, well outside of the revetments). This seems a logical measure that would in principle be feasible in a low-land river but should be strongly discouraged in this type of high-land rivers due to the danger of further deterioration of the bed strength. This deterioration will occur when all the sediments are removed, and the larger fractions of the strongly graded bed aggregate are not reinstated (the latter seeming technically impractical). Moreover, other aspects of the hydrodynamic behaviour of the river make such a solution most probably unfeasible anyhow (e.g., avulsion periodicity order of 10 years or less, highly dynamic bed change patterns during flood periods, with only about 1/10 of the length of the channel added each year). A proper analysis of this risk has not been included in the ESIA at present.

The NCEA recommends describing the risks of constructing a flow channel in the Mow River by extracting sediment.

Re-use of construction materials

In the reports the re-use of construction materials from old and superfluous revetments) has not been considered as an alternative opportunity. Taking into account the potential lack of coarse sediments in the present Mow River system, it would be wise to re-use as much rockfill materials as possible required for the construction of the embankments of the proposed

interventions. The long dry periods for construction enable effective re-use. As long as a sediment management plan is not in place, such practice can be considered a precautionary principle.

The NCEA recommends that an elaboration should be given in the ESIA on amounts of construction materials needed, which part could come from re-use of these materials and what would be the remaining quantity required for the interventions. The acquisition of the remaining quantities should also be addressed in the ESIA as part of the project-related sediment management plan. The advice here is to make a comparative assessment of the potential re-use alternative and the proposed initiative of mining all materials anew.

Revetment integrity

Actions as mentioned in both reports to safeguard the integrity of the revetments in the short-term do seem adequate (e.g. a wide falling apron at the toe, safeguarding a corridor of 100 m from the embankments from sediment mining). Less clear is that when 'head-on' flow attack threatens to occur, dredging of a preferential channel away from the banks, as proposed in the ESIA, can provide risks to the revetments' integrity.

The NCEA recommends describing another way for guiding the flow away from the banks by forcing the flow with guide bunds, as to avoid weakening of the bed. Include the option of flexible adaptation, based on annual monitoring of the river planform and bathymetry/topography. Alternatively, the foreshore of the revetments may be strengthened, e.g., with larger stones to form a flow-resistant armour layer. Both options need to be described in the ESIA.

3.4 Sediment management

Based on the nature of the project and the complexities related to sediment mining we recommend distinguishing between project related sediment management and the preparation of a sediment management plan for the long term.

Project related sediment management

Project related sediment management aspects deal for example with the usage of bed-aggregate materials for the interventions (how, where, when), re-use (as mentioned under 3.3.), sediment measures for guiding channels away of the revetments, stabilising foreshores (if required, dependent on monitoring and experiences with the extended falling aprons). We recommend including the project-related aspects in the current ESIA Report, whereas the longer-term issues can be introduced in the Sediment Management Plan.

Sediment Management Plan and Monitoring

A Sediment Management Plan should be elaborated as soon as possible, preferably before the start of the construction of the intervention works. It is also important that systematic monitoring starts promptly as well, in order to obtain a good baseline of the present situation. The monitoring should be done annually during the anticipated two-year construction period as well as during three subsequent years.

In the set-up of the plan, the NCEA recommend distinguishing separate parameters, such as: the river system ('knowing the dynamic river's behaviour and characteristics'), actual situation and future developments, present mining methods (including processing, storage, transport), flood mitigation mining requirements/potential yearly deposits from upstream and from tributaries. Also, the NCEA recommends including a good 'learning framework' that may help in updating and transferring new data and knowledge over the years into practical clues for sustainable and effective sediment management, leading to a gradual growing comprehensive plan after five years.

As long as acceptance of large-scale mining is not regulated by and justified from a science-based standpoint (as to be obtained from the Sediment Management Plan), the NCEA would advise to apply the precautionary principle for sediment mining, e.g.: taking away sediments in annual deposits (mini-deltas from the tributaries, deposits near lee areas in the Mow River), rather than at arbitrary places in the Mow River system. And selective withdrawal of larger stones from the Mow Riverbed should be discouraged as much as possible for the time being.

The following information needs to be gathered to gradually develop the Sediment Management Plan:

- An annual differential map of the bed bathymetry/ topography after the flood period. This map needs to be made to identify deposits near lee areas in the Mow River.
- Indicative sediment balance assessment (yearly in and outflow of sediment transport of the Mow River and main tributaries with and without sediment mining).
- If required, e.g. when data are contradicting or remain highly inadequate, supplementary morphological computations with the present 2DH model for obtaining insight in the sediment balance.
- Synthesising the above baseline data into a coherent baseline that provides an answer to major questions: potential effects of present sediment mining practices on flood levels and bed weakening on the Mow River and its tributaries and short-term effects.

SEA supporting Sediment Management Plan

The NCEA is of the opinion that the development of the Sediment Management Plan can benefit if simultaneously a Strategic Environmental Assessment (SEA) will be conducted. As the SEA secures that besides the sustainable mining of material from the Mow River other ecosystem functions and interests will also be taken into consideration. A balanced assessment and decision-making of a variety of interests requires a participatory process and that can also be facilitated through an SEA. The SEA and the Sediment Management Plan can then be used as a format for comparable river basins in Bhutan. To support this, the monitoring should also include measurement of ecosystem services parameters over the five-year period.

4. Other issues

The negative social impacts of this project for the local communities are related to the phase of the construction of the interventions during the dry winter season in two subsequent years. Generally speaking, the NCEA notes that these impacts are well identified and addressed in the ESIA, apart from those mentioned in this chapter.

4.1. PS 1: Social impacts of the intervention along the Shetikhari Stream

The ESIA report (Annex XI – Minutes from public consultation meeting in Shetikhari) states that there are 21 buildings, 1 school and 1 temple within 200 m of the boundary of the Shetikhari Stream. It is not clear whether these buildings are within 200 m of the planned interventions along the Shetikhari Stream. The ESIA main report does not refer to these buildings. This is important to know because within 200 meters from intervention 1, a school is located and for that intervention the ESIA identified a list of mitigating measures to avoid hindrance of the school and its staff and students during the construction.

Recommendation: Information needs to be provided in the ESIA on the presence of any buildings, such as houses or schools, near the newly planned works along the Shetikhari Stream. If they are within the 200 m zone, mitigating measures as proposed for intervention 1 need to be elaborated.

4.2. PS 1: Disaster Management Plan

In the ESIA Report – Annex V, it is recommended that Gelephu Thromde should prepare a disaster management plan (as earlier recommended by UNICEF). The NCEA understands that this is not foreseen as part of the project.

Recommendation: Examine the option that a disaster management plan for Gelephu Thromde is prepared in coherence with the project, especially the sediment management plan, as there may be mutual benefits.

4.3 PS 2 and PS 4: Labour and working conditions and impact on local communities

The ESIA states that the tender document will include the requirements for staff housing and related facilities. Moreover, the ESMP will plan for the location of staff housing and the PMU will approve the ESMEP. The planning and decision-making about the siting of these facilities after approval of the ESIA is not considered as being good practice. An ESIA is meant to support a discussion regarding this type of decisions, early in the planning process and in a transparent manner. Even if the exact site cannot yet be identified, a search area(s) could have been identified. It has not been decided yet, whether the majority of the staff will be recruited from India or locally. In case some labour would still need to be brought in from India, they will most likely stay in semi-permanent camps and from experience we know that the location of such a camp needs to be discussed with the people living in close proximity of the camp. Such a decision will be taken by concerned authorities in Bhutan in coordination with the contractor.

Recommendation: The ESIA should provide information on the proposed size and (search area for the) site or sites for the workers camps and whether they will be semi-permanent for the time of the construction or seasonal. These location specific impacts

for the local people living in proximity of the camp would need to be addressed in the ESIA.

4.4. PS: 4: Impact on communities living on the west bank

In the preliminary ESIA report an intervention was proposed to protect the west bank of the Mow River against erosion of land and flooding. In the ESIA report this intervention is no longer proposed. The ESIA report does not adequately explain why this intervention was dropped. Moreover, expectations have been risen during consultation with the people living on the west bank of the Mow River.

Recommendation: The ESIA should justify why the earlier proposed intervention will not be carried out. This can be done as part of the description of the 'do nothing scenario' with explicit reference to the earlier planned intervention for the west bank of the Mow River. Moreover, this change of the project proposal needs to be explained and communicated with the people living on the west bank.

4.5 PS 6: Biodiversity and ecosystem services

Biodiversity

The ESIA report presents a good profile of biodiversity of the study area. The assessment of biodiversity values both in terms of floristic and faunistic species is commendable given that very little information is currently available on the ecological/biological values or sensitivity of the Mow River and the terrestrial habitats within the area of the project.

The ESIA report indicates incidences of wild elephants crossing the project area without following definite routes. On some occasions the elephant herds are reported to also cross the Shetikari tributary.

Recommendation: Provide information on habitat features that facilitate elephant movement and migration. This would be helpful in evaluating whether the proposed interventions and impacts of mining for construction material, staff housing and related facilities as well as road construction are likely to impair or affect elephant movements. Accordingly, efforts can be made to prioritise areas where disturbance should be avoided or where mitigating measures can be applied. It would be appropriate to first review elephant movement routes and then plan open corridors/routes as intervention. These do not necessarily have a fixed plan (i.e. every 300 meters spacing) but can be adjusted to the requirement based on understanding of current elephant movement.

Ecosystem services

The Mow River at Gelephu is a natural river and is highly dynamic and characterised by a large variety of habitats for different species of plants and animals. These range from small perennial

streams and dune areas during the dry period to a high-flowing river during the wet season, and riverine vegetation types are characteristic for this type of river and inundated flood plains. The detailed accounts of floral and faunal diversity clearly establish that biodiversity values of this river and ecosystems falling within the larger corridor are considerable. This biodiversity value is recognised in the ESIA report and extensively described. However, the services provided by the variety of ecosystems known as ecosystem services are not identified in the ESIA report. Yet, especially present and future sediment management can have a considerable effect on the provision of the ecosystem services, and this effect should be studied in the ESIA.

Recommendation: As part of the sediment management plan, (i) make an inventory of the (key) ecosystem services provided by the Mow River and its tributaries and (ii) analyse to what extent these services might be affected by sediment use and (iii) describe how sediment management can be carried out whilst maintaining the (valuable) ecosystem services⁴. :

Longitudinal connectivity

Like for any Himalayan River, the braiding pattern of the Mow River is formed by the large amounts of sediments brought by quick and strongly varying discharges. The natural riverbed of Mow River has strongly graded material, ranging from sands, gravels to large boulders. The larger boulders form the armour layer and provide morphological stability of the riverbed. Small gravels, pebbles and sediments flow freely with flood water.

Interventions under the project are envisaged to protect the riverbed and surrounding areas from erosion and flooding by closing of less active channels using cross dams; construction of embankments for flow modification and sediment management in tributaries. By doing so, the interventions that would result in channel modification and change in flow velocity may significantly lead to impairment of the longitudinal connectivity of the river affecting the physical parameters in the downstream direction. Structural interventions are also likely to reduce hydraulic connectivity between the river and the floodplain.

Recommendation: The ESIA should consider the impacts of reduced longitudinal connectivity of the river and connectivity between the river and the (current) floodplain, on fisheries terrestrial, aquatic and wildlife habitats. It is recommended to prepare a conservation plan that takes into account the need to maintain longitudinal and hydraulic connectivity. The conservation plan should reinforce all positive actions/suggestions included in the Sediment Management Plan to help conservation and review any action(s) proposed in the sediment management plan that may contradict the objectives of maintaining longitudinal connectivity. Additionally, in some places habitat enrichment activities should be recommended that restore bed levelling and restore disrupted flows.

⁴ An example of an important habitat is mentioned in the Scoping document (Section 3.6) that refers to the information provided by a local expert that: there is a tree species (name not mentioned) that primarily and exclusively grows in the riverbed. This species, confined within a specialised and restricted habitat created by riverbed features, river morphology, sediment transport and hydrological factors needs to be conserved. Further, the river flow may be the only means of regulating its dispersal within other sections of the same river. Destruction of the species in its natural habitat should be avoided, failing which mitigation strategies should be proposed for conservation of the gene pool of this tree species.

