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Environmental Assessment

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Advisory Review of the ESIA for the Kisii-Nyamira Water Supply & Sanitation Project

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Advisory Report by the NCEA

To	Netherlands Enterprise Agency (RVO)
Attn	Ms Sylvie Sprangers
From	The Netherlands Commission for Environmental Assessment (NCEA)
Date	6 September 2018
Subject	**Advisory Review of the ESIA for the Kisii-Nyamira Water Supply & Sanitation Project, Kenya** By: Working group of the Netherlands Commission for Environmental Assessment: Ms Tanya van Gool (Chair) and Mr Arend Kolhoff (Technical secretary) Quality control by: Mr Rob Verheem
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1. Introduction

The project initiative

The Kisii-Nyamira Water Supply and Sanitation Project is a project located in the South-West of Kenya. It covers both the Kisii & Nyamira county (see Annex 1 for a map of the project area) rural areas that are characterised by a densely populated mountainous landscape. The proponent for this project is the Lake Victoria South Water Services Board (LVSWSB). This Board operates under the supervision of the Ministry of Water & Irrigation of the Republic of Kenya.

Presently only 10% of the residents in both Kisii and Nyamira is connected to a piped network. People in both counties rely on rivers, shallow wells, springs, dams, pans and boreholes whose availability varies considerably between seasons as well as across regions depending on the time of the year.

The main objective of this project is aimed at improving the access to drinking water for 360,000 people in 2020, 436,000 people in 2030 and ultimately about 528,000 people in 2040 in Nyamira and Kisii county. As a result of better access to domestic water of drinking water quality the project aims to contribute to the improvement of the sanitation and health situation and economic empowerment.

The Lake Victoria South Water Services Board has asked the Netherlands Enterprise Agency (RVO) for funding. The project consists of:

- The Bonyunyu dam that has a maximum height of 18.4 meter, is made of earth and with a length of a few hundred meters, located at an altitude of 1860 meter in the upstream part of the Gucha river that is discharging into Lake Victoria;
- A reservoir with a maximum length of about 3.5 km and a width varying from a few hundred to 500 meters;
- Water treatment plant;
- Hydropower plant;
- Relatively small water reservoirs or tanks made of reinforced concrete will be established;
- Pumping facilities and generators are installed as a back-up when electric power supply fails;
- Distribution network of pipelines;
- Training of staff (GWASCO & WRMA).

With costs eligible for ORIO funding, a grant/loan of 55/65 million Euro is asked for by the LVSWSB to realise the project objectives. BAM International, responsible for the preliminary design of the project, has hired Gauff, an international consultancy firm to execute the Environmental and Social Impact Assessment (ESIA)[1]. RVO requires that an ESIA is available to support decision making on funding of this project. Moreover, the IFC Performance Standards, indicated by RVO as their reference framework, explicitly require an ESIA in order to support decision making.

In May 2018, the Netherlands Commission for Environmental Assessment (NCEA) was asked by RVO to review the ESIA report that was received on June 19.

[1] The term Environmental and Social Impact Assessment (ESIA) is used by RVO to emphasise that social aspects are included.

The main purpose of this advisory review report is to give advice on the quality of the ESIA report and process. A draft of this advisory report has been discussed with RVO on 20 July 2018.

Approach taken by the NCEA

This advice was prepared by a working group of experts acting on behalf of the NCEA[2]. The group comprises expertise in the following disciplines: hydrology, ecology, civil engineering, social impacts and resettlement procedures. See Annex 2 for the composition of the working group.

The NCEA has reviewed the following version of the ESIA report:

- Kisii-Nyamira Water Supply and Sanitation Project, Environmental and Social Impact Assessment (June 2018).

In addition, the NCEA has reviewed the following supplementary information to better understand the information provided in the ESIA report:

- Kisii Geotechnical Report;
- Kisii Hydrology Report;
- Kisii Topographical Survey Report;
- Institutional Organisational Development Plan.

For the review of the ESIA report the NCEA has made use of the following reference framework:

- Kenyan Laws and Regulations concerning Environmental Assessment, mandated by the National Environmental Management Authority (NEMA) of Kenya;
- The IFC Performance standards;
- International Good Practices such as the World Bank policy document OP 4.37 Safety of dams and procedures BP 4.37 (incl. Annex A: Dam safety reports) have been taken into account, International Association for Impact Assessment Good practice principles.

The objective of the ESIA is to provide information for well-informed decision making by RVO. The NCEA has reviewed the ESIA report complemented with information received during the site visit to Kenya 3-6 July 2018.

Reading guide

In chapter 2 the main findings of the working group are presented and explained. In chapter 3 the detailed findings are mentioned and explained.

[2] The NCEA is an independent statutory body of experts based in the Netherlands and has provided independent advice on EIA in the Netherlands since 1985 and abroad since 1993.

2. Main findings

This Environmental and Social Impact Assessment (hereafter 'the ESIA') contains major flaws. Only one of the relevant IFC performance standards has been met. The NCEA noticed essential shortcomings in the ESIA on the following issues:

- Institutional tasks and responsibilities: Division of roles, tasks and responsibilities are not clear among the authorities and the involved contractor and sub-contractor;
- Scope of study and alternatives: The scope of the ESIA is too limited, for example, information on the borrow areas and quarries that will provide the construction material for the dam are not considered;
- Availability (and quality) of water: Due to a lack of data and analysis, the ESIA does not justify that drinking water for 528.000 inhabitants will be secured;
- Safety of the dam: The dam safety cannot yet be secured because the risks of seismicity and extreme rainfall are insufficiently addressed;
- Sediment load and lifetime of the reservoir: The sediment load, which could affect the lifetime of the reservoir, is insufficiently assessed;
- Environmental flow and downstream effects: The environmental flow and the downstream effects of the dam and reservoir are not adequately assessed;
- Socio-economic aspects: The ESIA lacks essential information on socio-economic procedures and plans such as the Resettlement Action Plan.

These issues are further elaborated here below.

Institutional tasks and responsibilities

The NCEA noticed that the tasks and responsibilities of the involved authorities and the lead and sub-contracted consultants are not clearly defined in the ESIA. During the presentation of the ESIA by the consultants at the office of the proponent (dd. 4 July) additional information was presented on tasks and responsibilities of involved actors. The NCEA noticed that the contractors who will construct the project will get more responsibilities than acceptable to the IFC PS.

It is recommended to:

- Provide clarity about the tasks and responsibilities of all authorities and the contractors and sub-contractors that will be involved in the construction of the project;
- Meet the standards on sharing of responsibilities between the proponent/authorities and (sub-)contractors as described in the IFC PSs.

Scope of study and alternatives

The NCEA noticed that the borrow areas and quarries that provide for example sand, clay and boulders for the construction of the dam are not considered to be part of the proposed project. It was stated by the proponent that each of the borrow and quarry areas require separate ESIAs when they pass the threshold according to the EIA regulation of Kenya and that it is the responsibility of the contractor to carry out these ESIAs. The NCEA is of the opinion that it is good practice to assess the borrow areas as these are inextricably part of the project and thus the responsibility of the proponent.

It is recommended to assess the following aspects of the borrow areas and quarries for each of the materials that will be used during the construction of the project and in particular the dam:

- Selection of the borrow sites and quarries;
- Possible positive and negative direct impacts and indirect impacts related to transport and mitigating measures;
- Need for involuntary resettlement (needs to be elaborated in the Resettlement Action Plan – hereafter referred to as 'the RAP');
- Operation and management of the sites and quarries needs to be elaborated in the social and environmental management plan.

According to the ESIA, the proposed site of the combined water treatment plant/pumping station/hydropower plant is approximately two kilometres downstream of the proposed dam site. This site is not justified nor compared with a site in the direct vicinity of the dam site. The NCEA noticed that the hydropower plant at the proposed site may generate less electricity as compared to a site close to the dam, because the water to the hydropower station will be transported through an almost horizontal pressure pipe at a length of about 2 km, causing friction and loss of energy as well as water hammer surges. These phenomena will particularly be the case if more of the excess flow from the reservoir would be used to generate electricity.

It is recommended that a comparative assessment will be made of the proposed site and possible sites close to the dam by making use of at least the following criteria: electricity production, access to the grid, use of energy costs for pumping of drinking water.

Availability (and quality) of water

The project aims to provide drinking water for 528.000 people in Nyamira and Kisii county. It is assumed but not specified as a design criterion that drinking water will be available to these people all year round, even during dry years. However, the ESIA does not provide evidence whether the required amount of water for this will be available during dry years because essential data are lacking on the flow regime.

For this part of the basin only streamflow data are available up to the 1970s. Unfortunately, since the start of the project preparations six years ago no measurements have been made that could have been useful to verify certain assumptions. Over the past decades, the upstream water catchment has evolved from an area that was principally forested to principally used for agriculture. It is thus very likely that the hydrological regime (flow variability) has changed accordingly. Streamflow data measured at a downstream gauge confirms that the catchment reacts faster to intensive rainfall events than it used to do[3]. Also, last year was reported to be drier than before. The rainfall runoff modelling was calibrated using only the historic dataset of 1970s and before. It appears that the above recent changes have not been considered in the modelling assessment.

[3] Gauge KB01A, source: "Assessment of Integrated Water Resources Management Practices in Gucha River Catchment" by PN Muiruri et al, in Nile Water Science & Engineering Journal, Vol. 7, Issue 1, 2014.

It is recommended to:

- Define and agree on the service level and reliability of the drinking water supply for the targeted 528.000 people;
- Given the above considerations, execute a more robust analysis of flow variability, and verify the calculations for maximum draw-off and dam capacity. It is recommended that this analysis is based on the current situation of the catchment in terms of land use, but also considering possible future changes of the catchment. This could for example be done through hydrological modelling using recent satellite data on rainfall or land use including possible scenarios on future changes over the next decades (land conversion from tea to other crops, forestry cover changes, unpaved versus paved roads etcetera, but also possible changes in rainfall due to climate change). Based on these scenarios, the risk can be assessed that the required amount of water in the proposed reservoir will not be available during the dry period in a dry year in the next 30 years;
  With this updated flow variability assessment, a more reliable computation can be made of the risk for unmet (not satisfied) demand (supply exceeding demand) or the times or months the reservoir is empty and thus the service level of the water supply. If this is below acceptable requirements or expectations, the ESIA needs to elaborate the following two alternatives and execute a comparative assessment of the proposed project and these possible alternatives:
  - An alternative that targets less people, or;
  - An alternative with increased capacity of the reservoir.

  The NCEA wants to emphasise that this is only required if indeed the assessment of the proposed project shows that the service levels are below the required / desired service levels.

The quality of the water has been assessed in the ESIA (table 2-13 and 2-14) and it showed that the World Health Organisation thresholds are not passed. The samples were taken in February 2017 at the end of the dry period, and not during the rainy period when many contaminations tend to peak.

In the ESIA, it is recommended to justify the moment for water quality sampling given the load variabilities during the year and to justify the effects on the expected pollution load.

Safety of the dam

The safety of a dam and the population living downstream of the dam is determined by the following main factors: design, construction and management of the dam, seismicity (risk and magnitude of earthquakes), the risk of overtopping. The latter two factors are respectively not (seismicity) or inadequately (risk of overtopping) addressed in the ESIA.

In table 9-2 in the ESIA, seismicity is being mentioned as a factor of influence to the dam structure, but no earthquake magnitude and acceleration have been described. The NCEA assesses the design of the dam as robust but to what extent it is resistant to seismicity is not described in the ESIA.

The proposed dam is an earth dam. These structures are more vulnerable to overtopping than dams made from concrete or rock fill. Serious overtopping of an earth dam can result in bursting of the dam after a few hours. To avoid overtopping, it is therefore important to know the Probable Maximum Flood (PMF) value that need to be used as a design criterion for the construction of the dam (height and robustness) and the spillway.

In the ESIA report (page 8-13, table 8-7) the PMF at Bonyunyu Dam is claimed to be 1,400 m3/s (see Table 8-7). However, in the text below this table a figure of 1.100 m3/s is mentioned. In para 8.2 of the Hydrology report it is claimed that a PMF of 710 m3/s has been computed. The variation in these PMF values is too large to be acceptable, a more consistent and well justified approach is required. The ESIA nor the hydrology and preliminary design report do explain how these PMF values have been established. Kenyan national regulations now require the PMF to be applied in the design of reservoir dams. One might expect that the internationally accepted method of calculation would be referred to and that the relevant base data (e.g. the rainfall stations used for it, the Probable Maximum Precipitation (PMP) and the shape of the PMF hydrograph) would be reported in both the design report and the ESIA report. This has not been done[4].

Management of the dam requires skilled management and clear protocols. The management of the dam needs to be elaborated in the operation, maintenance and surveillance manual for the dam. This manual however is not a requirement of an ESIA.

It is recommended to:

- Provide information on earthquake magnitude and acceleration and justify to what extent these risks have influenced the design of the dam;
- Justify the PMF and explain whether it meets the recently approved Kenyan standard. Substantiate what influence this PMF has on the height, the robustness of the dam and the design of the spillway. Possible adjustments to the dam design and spillway need to be described and presented in the ESIA;
- Justify the PMF and explain how it meets the recently approved Kenyan standard. The PMF might have an influence on the height, the robustness of the dam and the design of the spillway. Possible adjustments to the dam design and spillway need to be described and presented in the ESIA;
- Describe the impacts of a worst-case scenario in case of a complete dam burst and preparation (including enforcement) of land use planning in and along the floodplain downstream of Bonyunyu dam.

Sediment load and lifetime of the reservoir

A correct calculation of the sediment load is important as it determines to a large extent the lifetime of the reservoir. The NCEA considers the information in the ESIA regarding the sediment load of the river flow to be inadequate. Sediment load computations have only been based on theoretical guidelines of Wallingford with partly estimated values. No field checks have been carried out nor have samples been taken during high flood discharges. Field checks are essential for a relatively small storage volume with a limited lifetime. There is a risk of an underestimate or an overestimate of the sediment load that may have a severe impact on the lifetime of this reservoir.

The sediment load can also influence the operation of the water treatment plant, the use of chemicals for flocculation and the taste of the water. It is therefore important that the sediment load is accurately assessed and mitigation measures to decrease the sediment loads should be described. During the mission it was confirmed by one of the consultants

[4] In the meeting on Friday 6 July, Dr. Oonge did clarify that a recent dam failure in Kenya with many casualties was the reason that in the new Kenyan national regulations the application of a PMF flood has been introduced as mandatory for all dams in Kenya.

(Eng. Dr. Oonge) that in the catchment the sediment loads have increased over the past decades. This is related to the land use changes and the development of a road network in the upstream part of the basin. A sedimentation calculation is provided but based on global empirical relationships, without any consideration of local evidence, data or information on land use changes over the last decades and possible changes over the future decades.

One of the opportunities to extend the lifetime of the reservoir is flushing of the sediment during high discharges. Seasonal flushing is mentioned in the ESIA but its purpose is not well justified. If flushing of sediment is envisaged, it would require a lower level bottom outlet or a (separate) larger gated outlet to be (possibly) effective. The presently designed outlet conduit might be used for release and (some) flushing of sediment that has accumulated very close to the outlet structure. As a sediment flushing device to really extend the life time of the reservoir this outlet is not expected to be effective.

It is recommended to:

- Provide additional (recent) data and analysis on the erosion in the catchment, sediment loads and risk for siltation of the reservoir, and put this in the context of recent and future land use changes;
- Mitigate the risk of changing hydrological regime due to changes in upstream watershed management, the ESIA should recognise the importance of this dependency on upstream water-related ecosystem services, and propose mitigation measures and/or report on planned initiatives by local authorities that relate to upstream watershed management (farmer´s practices and extension services, road infrastructural plans, forestry, etc);
- Justify the purpose of seasonal flushing and design an alternative outlet to enable seasonal flushing.

Environmental flow and downstream effects

The environmental flow and the downstream effects of the dam and reservoir during the phase of operation and management are not adequately assessed in the ESIA report.
A minimum environmental flow is required to secure the maintenance of the services provided by the water flow to the users (people and biodiversity) living downstream of the dam. The ESIA is not clear on how the environmental flow will be realised. During a meeting (dd 6 July) the consultant stated that according to calculations part of the required environmental minimum flow could emerge from leakage through the embankment. This is, however, not good practice and will probably be insufficient to meet the requirement.

It is recommended to:

- Describe how the total required minimal environmental flow is assessed and will be realised by making use of a controlled, gated outlet with sufficient capacity;
- Compare the total water abstraction of the project with total water use downstream of the dam and explain whether a significant impact can be expected or not on water availability of all downstream users (up till the shore of Lake Victoria).

When the dam and reservoir will be operational it is expected that the frequency and height of a peak flow of the Gucha river will become less. As a consequence it may be expected that people are encroaching the dry river flood plain. This development is undesirable, because of the significant impacts that may occur in the case of a peak flow in the event of extreme rainfall.

It is recommended to acknowledge the risk of flooding in the area downstream of the dam due to encroachment of people to the river. This area needs to be identified on a map. One of the measures could be to include this area in the respective county land use plan.

It is expected that the river downstream of the dam has lower sediment loads on average, as during low and average flows, part of the sediment will settle in the reservoir. This may have an effect on the scouring of bridge foundations and other works constructed in or near the river bed.

It is recommended that the ESIA acknowledges this potential impact and reflects on its relevance for this project, taking into account the presence of this type of infrastructural works directly downstream, if any.

Information on the occurrence and importance of fish (number and type of species and economic perspective) in this part of the Gucha is not described in the ESIA. In the meeting on Friday 6 July, Mr Oonge claimed that in the 1960s when he was living in this area, fish was swimming from Lake Victoria into the river. He did not specify the type of fish and at present there would be less fish in the river. If fish would be hatching in the upstream part of the river and would require fish ladders to be able to reach the upper reaches of the river, this needs to be assessed.

It is recommended to assess whether fish is hatching in the river section upstream of the dam and, if this is the case, the need for a fish ladder structure across the dam and its design.

Socio-economic aspects

The following socio-economic aspects are not or incompletely addressed in the ESIA: social and economic action plan, policy on employment, Resettlement Action Plan, grievance mechanism, health impact, economic feasibility / willingness to pay, effects of fencing of the reservoir nor cross-cutting gender policy.

The social and environmental mitigation and management plan does not meet the IFC performance standard.

The ESIA lacks a policy on employment which would include clear procedures for accident and injury, medical support, compensation as well as recruitment and minimum staff facilities and a grievance mechanism in line with IFC PS 1 and 2.

The ESIA does not provide information on the need for involuntary resettlement of land, loss of crops and houses and households. During the visit to the site the NCEA has been informed that involuntary resettlement of about 50 households is required and therefore a Resettlement Action Plan (RAP) is under preparation.

The impacts of the reservoir on waterborne diseases, in particular the expected spread of malaria during the dry season, is not adequately described in the ESIA.

The NCEA has been informed during the site visit that (part of) the reservoir will be fenced off to avoid people and cattle drowning and to avoid the use of the water for other purposes such as irrigation, use by cattle and tourism. This is not described in the ESIA.

Although the economic feasibility of the project is not part of the ESIA study, the NCEA noticed that the willingness of the general public to pay for water has not yet been assessed. It is expected that all 528.000 people will get much better access to drinking water but at what cost is not yet published in public documents. Moreover, people who are not willing or able to pay for drinking water will most likely want to continue to collect water from the river.

It is recommended to:

- Develop a policy on employment that meets the requirements according to IFC PS 2;
- Supplement the environmental and social management plan in order to meet the IFC PS 1;
- Develop the resettlement action plan. The guidelines on involuntary resettlement provided by the IFC need to be followed in order to avoid unrealistic expectations, ground speculation, corruption and conflict. The development of a grievance mechanism should be elaborated in the RAP. The RAP needs to become a public document and should be part of the ESIA study;
- The impact of water borne diseases and in particular malaria and mitigating measures need to be described;
- The use of a fence to protect (part of) the reservoir from use by people and cattle needs to be described as well as its impact on access to water; and community access to and across flooded areas;
- The willingness to pay for drinking water needs to be clear. Possibly use can be made of willingness to pay in comparable areas in Kenya where drinking water already has been provided. In the NCEA's view this is important because the economic feasibility is based upon the assumption that all people will pay. Moreover, the people who are not willing to pay most likely will want to continue to take their domestic water directly from the river. The impact this may have needs to be described in the ESIA.

The NCEA concludes that the ESIA does not provide sufficient information for informed decision making by RVO. In the next version of the ESIA it is recommended to include the supplemental information as well as the RAP, the hydrology report and the remedial of shortcomings that have been identified in the ESIA. The main shortcomings have been discussed in this chapter. All shortcomings are described in chapter 3 of this advice.

3. Detailed findings

IFC Performance Standards

The ESIA refers to IFC Performance standards (IFC PS) in tables 6.2.2 and 6.2.4. Other than referring to the IFC PS, no explanation is given as to what extent these have been followed in the ESIA. Meetings with the consultants and the proponent confirmed that IFC Performance Standards have not systematically been considered in the ESIA process.

The NCEA has screened the project according to the IFC Performance Standards and found that Performance Standards 1-6 are triggered and potentially 8 as a contingency. PS 7 does not seem to apply to this project.

The NCEA has reviewed the ESIA against each of the triggered IFC PSs. In the following sections, the objectives of the respective IFC PSs[5] are presented in a box followed by the shortcomings.

The NCEA recommends remedying all these shortcomings in the next version of the ESIA study.

In Annex 4 the NCEA provides comments and suggestions on the design of the project.

3.1 PS 1-Assessment and Management of Environmental and Social Risks and Impacts

Objectives PS 1:

- To identify and evaluate environmental and social risks and impacts of the project.
- To adopt a mitigation hierarchy to anticipate and avoid, or where avoidance is not possible, minimise and where residual impacts remain, compensate/offset for risks and impacts to workers, affected communities, and the environment.
- To promote improved environmental and social performance of clients through the effective use of management systems.
- To ensure that grievances from affected communities and external communications from other stakeholders are responded to and managed appropriately.
- To promote and provide means for adequate engagement with affected communities throughout the project cycle on issues that could potentially affect them and to ensure that relevant environmental and social information is disclosed and disseminated.

The size of the project and the significance of risks and impacts is sufficient to justify a full scale ESIA. The NCEA judges the ESIA and ESMP as inadequate in fulfilling PS 1 requirements:

- The ESIA does not specify the number of households affected. Anecdotal information suggests 50 households with 280 structures affected. It is unknown how many project-affected people (PAPs) may be affected economically;
- The ESIA does not describe a project organisational structure;

[5] For a full description and explanation of the IFC Performance Standards: www.ifc.org.

- The ESIA lacks a full list of stakeholders, including identification and consideration of their respective interests in the project and capacity to deliver on roles assigned;
- The ESIA refers to 'representatives' without explaining who they are, who they represent or their mandate e.g.: 'Dam Committee';
- The ESIA ignores the (undated) Institutional and Organisational Development Plan (Assessment of LVSWSB and GWSC) by SNV which indicates the need for considerable uplift in capacity for these key stakeholders to support development projects in the Lake Victoria South catchment area;
- A greater part of the socio-economic data relates to beneficiaries rather than project-affected people (PAPs) and does not disaggregate the groups (e.g.: Section 4.6: Economic resource activities) nor identify, and therefore consider, the interests of, any vulnerable or disadvantaged members;
- The ESIA does not consider project-specific Grievance Mechanisms[6];
- There is no information as to how the questionnaires were delivered to the PAPs to enable them to understand and reply constructively, nor how information was disseminated regarding the acquisition and compensation for land. The Consultant informed the NCEA that 94% of those interviewed were literate but it is risky to assume that literacy equals comprehension;
- ESIA is silent on livelihoods, whereas the PS Guidelines specifies that loss of assets and/or means of livelihoods through economic replacement must be compensated;
- In the ESIA, section 8.2.6.8 mentions several mitigation measures related to "Water loss" during the project construction: "Creation of awareness on water resource management and conservation.", and "Introduce economic and financial initiatives towards water saving and responsible utilisation at all consumer points.". No responsible authorities or concrete steps are identified in this aspect;
- The ESIA and the project do not follow the practice promoted by the World Bank in their procedures OP 4.37 and BP 4.37 "Safety of Dams" about guidance of large dam projects. It is recommended that in the subsequent phases of this project the WB procedures be followed;
- The ESIA does not provide sufficient information on the sediment load of the river flow. Only theoretical guidelines have been used. Adequate data from field checks is needed to assess the lifetime of the reservoir;
- The ESIA mentions the objective to provide drinking water for over 500.000 people in Nyamira and Kisii county. The ESIA however does not provide evidence whether the required amount of water will be available during dry years because essential data are lacking on the flow regime. This data should be collected and addressed in the ESIA and substantiate different alternatives in design and water provision;
- The ESIA does not address the impact of fencing of the dam site. During construction but also after completion of the dam component it is advised to maintain fencing. The ESIA should describe the perimeter in which the fence is planned and consult with PAPs about land use restrictions e.g. habitation and cattle would be forbidden within the perimeter; access across the flooded area would be closed.

[6] Recommended resources: Addressing Grievance from Project Affected Communities. Guidance for Projects and Communities on Designing Grievance Mechanisms. Good Practice Note September 2009. www.ifc.org CAO Grievance Mechanism Toolkit: www.cao-grm.org.

3.2 PS 2 - Labour & Working Conditions

Objectives PS 2:
- To promote the fair treatment, non-discrimination, and equal opportunity of workers.
- To establish, maintain, and improve the worker-management relationship.
- To promote compliance with national employment and labour laws.
- To protect workers, including vulnerable categories of workers such as children, migrant workers, workers engaged by third parties, and workers in the client's supply chain.
- To promote safe and healthy working conditions, and the health of workers.
- To avoid the use of forced labour.

The project will mobilise a workforce that warrants careful impact and risk assessment with attendant policies on human resources (recruitment, welfare, protection), child labour and gender, and which will relate to local legislation and regulations.

- Number of potential employees required at each of the project phases is unknown. The list in Inception Report Annex 12 is not incorporated or referred to in the ESIA and is inconsistent with Inception Report Section 8.4. The Project Proponent and Consultant seemed unaware of this data;
- The ESIA devolves responsibility for a number of management and mitigation measures e.g. by referring to the Workers Compensation Act, rather than specifying procedures which incorporate the regulations set within the Act;
- There is no statement/procedure regarding training and recruitment of local labour. Numbers are not stated in the ESIA, but meetings suggested 40% labour force will be drawn from the local community. What training methodology is in place to enhance their capacity, so they can secure other jobs later? This should be addressed in the ESIA.

3.3 PS 3 - Resource efficiency & Pollution prevention

Objectives PS 3:
- To avoid or minimise adverse impacts on human health and the environment by avoiding or minimizing pollution from project activities.
- To promote more sustainable use of resources, including energy and water.
- To reduce project-related GHG emissions.

The project will make use of natural resources like, water, sand clay and will use energy.

- The ESIA does not refer to the sources (borrow areas and quarries) of construction materials for construction of the dam, probably clay, filter materials and slope protection materials to be excavated near the proposed dam site. The quarries and borrow area may require more expropriation than presently envisaged;
- For construction of the dam a large amount of topsoil and subsoil will have to be excavated (25.000 m3 soil and weathered rock). It is suggested one could attempt to make work with work, e.g. by using the excavated materials for landfill to prepare a flood free platform at the locations of the water treatment plant and/or the hydropower plant;

- The ESIA should further specify what is referred to in 8.2.6.9 Climate change issues: "evaluate opportunities to removal of vegetation to reduce methane emission due to degradation of flooded biomass";
- The ESIA mentions no external threats from biomass. The reservoir should be protected from invading biomass like water hyacinth or other water pests. Invasion of biomass could cause an increase in evaporation and affect the water availability and capacity of the reservoir.

3.4 PS 4 – Community Health, Safety & Security

Objectives PS 4:

- To anticipate and avoid adverse impacts on the health and safety of the affected community during the project life from both routine and non-routine circumstances.
- To ensure that the safeguarding of personnel and property is carried out in accordance with relevant human rights principles and in a manner, that avoids or minimises risks to the affected communities.

This project will have significant impact outside the project boundaries on people living and maintaining livelihoods in the zone of influence.

- The construction of a dam requires procedures and measures for safety for the population living downstream of the dam. The required information (seismicity, risk and magnitude of earthquakes; inadequate risk of overtopping) is not addressed in the ESIA. This information should be complemented;
- The impacts of the reservoir on water-borne diseases, in particular the spread of malaria during the dry season, is not adequately described in the ESIA;
- The ESIA makes allowances for HIV treatment for workers but devolves responsibility to the Contractor whose contract is for 2 years. Although the ESIA suggests the negative impact is 'irreversible' (i.e. long term) it does not suggest mitigation long-term post construction;
- Medical screening at recruitment determines the suitability of the worker for specific tasks and thereby reduces risk of injury;
- Public Health Services (devolved function of the County Government) should assist in the process of identifying as well as assessing project-related risks and costing mitigation measures e.g. from the large body of water in the reservoir: i) swimming lessons; ii) fishing; iii) waste management / disposal; from contaminated air emissions; traffic congestion and dust. This project will have significant impact outside the project boundaries on people living and maintaining livelihoods in the zone of influence;
- PAPs are not aware of the costs involved in installing or use of a private water connection;
- What risks are associated with either private or public security personnel? And how will grievances about their arrangements and behaviour be addressed? This is not addressed in the ESIA;
- The ESIA is silent on risks associated with transport, delivery, use and impact on the community of explosives e.g. possible damage to structures, impacts on livestock and fear among the PAPs themselves;

- The ESIA makes no reference to significant conflict in the community last year which resulted in houses being burned down and a man shot. There is no mention of these events or description how these were handled; risks of future occurrences; and how repercussions will be mitigated in order to secure the safety of the community.

3.5 PS 5 – Land Acquisition & Involuntary Resettlement

Objectives PS 5:

- To avoid and, when avoidance is not possible, minimise displacement by exploring alternative project designs.
- To avoid forced eviction.
- To anticipate and avoid or, where avoidance is not possible, minimise adverse social and economic impacts from land acquisition or restrictions on land use by (i) providing compensation for loss of assets at replacement cost and (ii) ensuring that resettlement activities are implemented with appropriate disclosure of information, consultation, and the informed participation of those affected.
- To improve, or restore, the livelihoods and standards of living of displaced persons.
- To improve living conditions among physically displaced persons through the provision of adequate housing with security of tenure at resettlement sites.

As the project entails both physical and economic displacement, it will require in-depth consultation with PAPs and establishment of a range of grievance mechanisms to address and seek to resolve disputes quickly. This includes PAPs who may not have formal rights, such as illegal squatters and farmers. It will involve participative land and resource mapping (referring to UN Free Prior Informed Consent principles) and assessment of effects: e.g. on houses, stores, graves.

- No RAP has been presented;
- There is an overriding assumption that most land for the project will be public land and therefore no compensation is needed. Nevertheless, a large proportion (exact size unknown) of the population is apparently dependent on subsistence farming and has been occupying public land to this end for generations. They will have certain rights that need to be assessed. A Land Use Plan included in the ESIA is necessary to understand this better;
- No consistent data on how much land needs to be acquired or borrowed for the project. Early reports refer to 5 households; the consultant reports 50 households with 280 structures (permanent and temporary);
- Land for the Contractor's campsite; borrowed for quarries and laying pipelines; acquired for additional access roads and water kiosks, is not shown on maps, identified in the ESIA text or accounted for in compensation;
- The ESIA (and/or RAP) will list each parcel of land affected and the status of tenure of the occupier;
- PAPs were not clear as to the exact layout of the dam and reservoir; and which land would be acquired; or how much land, structures and crops will be compensated, whereas both a RAP and ESIA are intended to be participative processes (referring to UN Free Prior Informed Consent principles);
- There is no assessment of loss of livelihoods / economic displacement on project site or impacted upstream and downstream activity;

- No description of compensation requirements and procedures, nor responsibilities and attendant grievance mechanism;
- County Office emphasises need for PAPs to get registered Land Title in order to prove ownership. No project-specific assistance is being offered in order to expedite the process or relieve lower-income groups of the cost of registration, nor address PAPs with customary or squatters' rights;
- No explanation as to how information was disseminated to PAPs regarding the degrees of acquisition and compensation for land. The project Consultant informed the NCEA that 94% of those interviewed were literate. Nevertheless, it is risky to assume that literacy equals comprehension;
- Livelihood restoration is not considered: e.g. loss of crops or access to markets, health of livestock during periods of blasting, excessive dust damaging pasture[7].

3.6 PS 6 – Biodiversity Conservation & Sustainable Management of Living Natural Resources

Objectives PS 6:
- To protect and conserve biodiversity.
- To maintain the benefits from ecosystem services.
- To promote the sustainable management of living natural resources through the adoption of practices that integrate conservation needs and development priorities.

The construction of the Bonyunya dam implies a (possible) disruptive component of the ecosystem in the project area that should be addressed, and possible effects should be met with proposed mitigation measures.

- The ESIA does not refer to the possible need of fish ladders or fish passes in the outlet works of the dam. It is necessary that the matter of hatching of fish in the river section upstream of the dam site be investigated and that the possible need of a fish ladder structure across the dam be ascertained;
- The ESIA mentions as one of the mitigation measures to reduce risks related to sedimentation "encouragement of re-afforestation and improved farming systems". This should be further specified;
- The ESIA mentions: "There should be a progressive catchment management plan targeting Gucha River sub-basins. In this regard, involvement of the communities, landowners and relevant authorities will be necessary". However, no concrete steps are suggested. And neither are responsible authorities assigned to this planning;
- The ESIA does not refer to any downstream impacts that may occur, especially after project construction and during operation of the reservoir;
- The environmental flow and the downstream effects of the dam and reservoir during the phase of operation and management are not adequately assessed in the ESIA report;

[7] Recommended resource: Involuntary Resettlement Sourcebook – Planning and Implementation in Development Projects: www.documents.worldbank.org.

- A minimum environmental flow is required to secure the maintenance of the services provided by the water flow to the users (people and biodiversity) living downstream of the dam. The ESIA is not clear on how the environmental flow will be realised;
- The ESIA includes no reference to the stage of the first filling of the reservoir. This is a critical test of a dam and one of its dangerous moments. This stage should be accompanied with special care e.g. continuous observations and measurements. Assessment of the effects downstream related to the (initial) change in water flow during this stage should be included and mitigation measures explained;
- The ESIA does not specify the land use of the strip along the reservoir between Max Water Level (MWL) and Full Supply Level (FSL). This might be used for selected agriculture purposes (e.g. grass) provided that this would not increase the inflow of sediments or organic matter, e.g. dung. If farmers would be allowed to grow grass that might lower the necessary budget for periodical clearing of the empty strip;
- The water supply project will increase water consumption in the area and thus have an impact on water resources availability downstream. This should be considered in a water resources assessment at the basin level and/or in a river basin management plan. This is a public responsibility and should be taken care of by the responsible authority WRMA, especially as this should also inform the decision on the abstraction license.

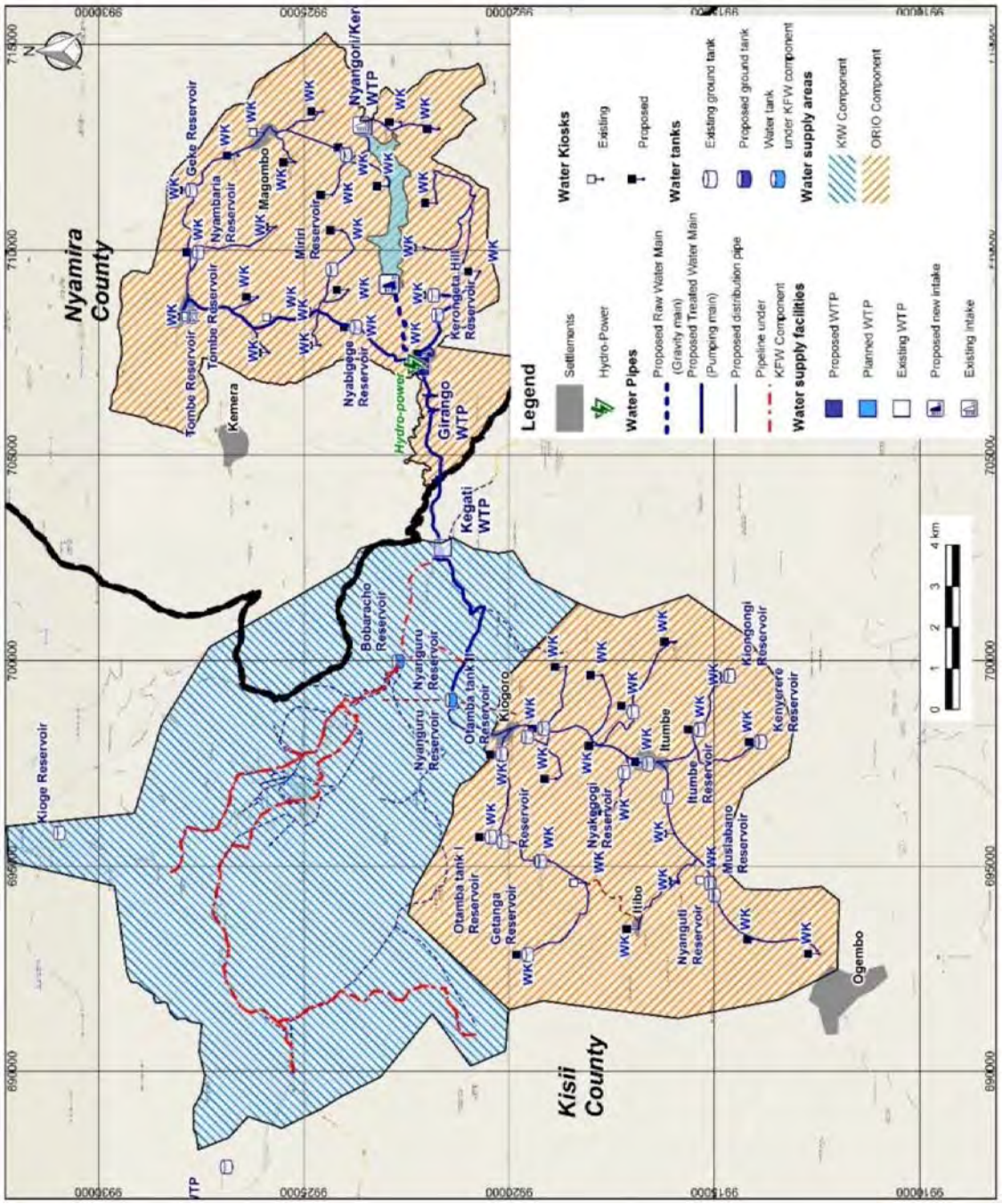
3.7 PS 8 – Cultural Heritage

Objectives PS 8:
- To protect cultural heritage from the adverse impacts of project activities and support its preservation.
- To promote the equitable sharing of benefits from the use of cultural heritage.

Although not triggered in the ESIA, and with no cultural sites known in the project area at this point, an allocation of budget to 'cultural sites chance finds' is included in the ESIA (Section 9 Environmental Mitigation Cost Estimates Item 14)

- A 'chance find' procedure must support the budget allocation or require one to be developed by the contractor. At this it is not clear who is responsible and who will have to pay the allocation once a cultural heritage is found. This should be clarified.

Annex 1: Map Kisii-Nyamira Water Supply & Sanitation Project



Annex 2: Composition of the Working group and project information

Proposed activity

This project is known as Kisii-Nyamira Water Supply & Sanitation Project. The main objective of this project is aimed at improving the access to water, improving sanitation and health, generation of electricity and economic empowerment for the Kisii and Nyamira people at the end of the project period. The construction of the Bonyunyu Dam as well as a distribution network are therefore essential parts of this project.

The Netherlands Enterprise Agency (Rijksdienst voor Ondernemend Nederland – RVO) is ready to provide a grant to support the execution of this project. However, RVO requested to execute an Environmental and Social Impact Assessment that meets international good practice standards. Therefore, the IFC performance standards are used as a reference framework and the Netherlands Commission for Environmental Assessment has been requested to secure that these standards are met.

A working group of experts of the Netherlands Commission for Environmental Assessment (the NCEA) has been composed and they have visited the project site and met the proponent and relevant actors.

Project number: 7270

Composition of the working group of the Commission for ESIA

Advisory report:

- Ms T. van Gool (Tanya) – Chair & former Ambassador in Kenya
- Mr J. Timmerman (Jan) – Expert Civil engineering & Dams
- Mr J. Hunink (Johannes) – Expert Hydrology and Ecology
- Ms B. Brainch (Brenda) – Expert Conflict Management & Resettlement
- Mr A.J Kolhoff (Arend) – Technical secretary and expert on EIA and environmental issues
- Mr G.A. Hendriks (Giel) – Technical secretary

Annex 3: Programme & Planning Working Group

Week / date	ACTIVITY	PARTICIPANTS
26 – Preparations		
Thu 21/6	• Sending out ESIA-report & other relevant project documents to Working group	• Working group
Wed 27/6	• 8.30h – 10h 1st Working group Meeting – discussion ESIA-report	• Working group (Via Skype Ms Brainch & Mr Hunink)
Sun 1/7	• Travel to the Netherlands	• Mr Hunink: Spain-Eindhoven
Sun 1/7	• Travel to Nairobi **KL 565** – Dep.12.55h Arr. 21.50h	• Mr Kolhoff & Mr Hendriks
27 – Site visit		
Mon 2/7	• Travel to Nairobi (AMS -> NAI) **KL 565** – Dep. 12.55h Arr. 21.50h	• Working group (except Ms Brenda Brainch)
Mon 2/7	• Stay in Hilton Nairobi Hotel	• Working group (except Ms Brenda Brainch)
Tue 3/7	• Travel to Kisumu (NAI -> KIS) **KQ 654** – Dep. 9.20h Arr. 10.10h • Visit – Headquarters Lake Victoria South Water Services Board • Travel to Kisii by car	• Working group & Ms Petronilla Ogut (CEO LVSWSB) • +GAUFF (Yvonne Meyer & Matthias Obermann) & BAM International (Mark Huyzer)
Tue 3/7	• Stay over Itibo Resort Kisii	• Working group
Wed 4/7	• Meeting with the Deputy-Governor of Nyamira: Hon. Amos Nyaribo • Site Visit	• Working group + LVSWSB delegate + + GAUFF (Yvonne Meyer & Matthias Obermann) & BAM International (Mark Huyzer)
Wed 4/7	• Stay over Itibo Resort Kisii	• Working group
Thu5/7	• Meeting with the Deputy-Governor of Kisii: Hon. Joash Maangi • Meeting with NEMA representatives • Meeting with County council members • Afternoon: Meeting with LVSWSB (de-briefing) + GAUFF representatives & BAM International • Travel to Nairobi (KIS →NAI) **KQ 671** – Dep. 18.40h Arr. 19.30h	• Working group + LVSWSB delegate + GAUFF (Yvonne Meyer & Matthias Obermann) & BAM International (Mark Huyzer)
Thu 5/7	• Stay over Hilton Nairobi Hotel	• Working group

Fri 6/7	• Meeting with Jeen Kootstra (SNV) • 11.00h Meeting with Dutch Embassy (debriefing) • Visit NEMA office Nairobi • Meeting with Eng. Dr. Oonge & GAUFF representatives Yvonne Meyer & Matthias Obermann • Travel to the Netherlands **KL566** → Dep. 23.50h Arr. 08.15h	• Working group • Working group with Noeke Ruiter & Sanne Willems • Mr Kolhoff & Mr Hendriks • Mr Hunink & Mr Timmerman • Working group (except Ms Brenda Brainch)
28-30 - Reporting		
	• Input for Advisory Report on ESIA • Consultation meeting (skype) • Consultation meeting	• Working group • Working group • Working group and Netherlands Enterprise Agency (NEA/RVO)

Annex 4: Comments and suggestions on the design of the project

In this annex additional comments and suggestions on primarily the project design are presented. Most of these issues have been discussed during a meeting that took place on 6 July, with members of the working group and the consortium responsible for the preparation of the ESIA and the preliminary design of the project. The consortium has asked the NCEA whether these comments could be made available, but it is important to emphasise that according to the NCEA these suggestions are no requirement for the next version of the ESIA in order to meet the IFC PSs.

ESIA report

The ESIA report comprises confusing terminology in respect of hydraulic engineering and water levels. It is suggested to clearly define the dam and reservoir related terminology in a GLOSSARY or in the section with acronyms and abbreviations and to use the selected expressions accordingly in a consequent manner. For example, in para 2.2.6.1 the report is often using the word “dam” while not distinguishing between the “dam” and the “reservoir” which may be rather confusing. The same applies to the expression “volume of water” while from the context it appears that “discharge” (m3/s) would better express the phenomenon.

P 2-9 Fig 2-3 (and other figures and drawings, e.g. ANNEX 4 Topographical Survey of the proposed sites Dwg no. KSI/WS/DSK/2.0): The location and the outline design of the intake as well as the spillway structure in or near the dam has not been clearly presented in the report. The dam is one of the most dangerous components of the project if not properly designed, constructed or maintained. A more accurate layout is required to be able to assess the risk of such structure in or near the dam body. One would expect the location of the intake tower to be at least 50 m u/s of the crest of the dam. That seems to be not the case or at least it is not visible.

P 2-10 Fig 2-4 Typical Embankment Section: The first impression is that this outline design presents a conservative design (subject to further analysis with respect to the applicable magnitude earthquake, the release capacity of the outlet works and other considerations). Some questions remain:

- What would be the function of the fine filter underneath the upstream cofferdam? The upstream cofferdam is intended to safeguard the key trench against the inflow of flood water from the river. A filter underneath the cofferdam will facilitate conveyance of water towards the key trench, especially during flood conditions, which could cause huge damage during construction.
- Often a downstream cofferdam is also required but that one would not form part of the (future) dam body itself. A d/s cofferdam will possibly be presented in the overall design but in the ESIA report no downstream cofferdam has been mentioned or has been shown.
- The usual presentation of hydraulic structures (incl. this dam section) is with the reservoir on the left side of the section (on drawings the water should be flowing from left to right).

- What is the meaning of "Top Water Level" on the typical section? Is it FSL (Full Supply Level) or Maximum Water Level (MWL) or Normal Water Level (NWL) or Design Flood Water Level and what would be its frequency of occurrence? Explain these concepts and their importance and relation.

(NOTE: In the meeting in the Gauff office on Friday 6 July 2018 the Gauff Dam Advisor Eng. Dr. Zablon Isaboke Oonge commented that on Figure 2-4 the filter underneath the cofferdam is a mistake)

P 2-10 River Diversion System: This terminology is not clear, it is suggested to use Temporary River Diversion Conduit because here only the temporary river diversion conduit is dealt with. In general, the spillway structure, fish ladder (if needed?) and bottom outlet (not applied here) form also part of the river diversion system.

During construction of the dam body the concrete conduit must divert river flow from upstream of the cofferdam towards a location downstream of the dam as well as the downstream cofferdam. After completion of the dam the concrete conduit will be used to accommodate the Raw Water Main steel pipe. Because of the importance of the above structural components it is suggested that the ESIA report provides a view of the alignment of the diversion conduit together with the adjacent structures. That view could also answer questions like:

- Will the conduit intersect the dam body, or will it be located in the abutment outside the dam body?
- Where to place the intake tower and where the conduit? (See also P 2-15)
- Will the upstream cofferdam be placed on the riverbed or with a (small) key excavated in order to prevent excessive leakage into the construction pit during excavation of the deep central key under the main dam?
- Will the outlet of the diversion conduit be located at such location downstream of a (possible) downstream cofferdam that turbulent discharges will not affect the d/s toe of the (possible) d/s cofferdam? (It would be helpful to know if the d/s end of the conduit will discharge on a location where firm bedrock would prevent deep erosion).

The ESIA report does not mention a downstream cofferdam to keep the construction pit for the central key trench dry. The location where the cofferdam will be build should be indicated, likely the downstream cofferdam could be located downstream of the downstream toe of the main dam. That may mean that the length of the River Diversion Conduit would have to exceed the 136 m length mentioned on P 2-15. Hence, it is important to show a clear picture of the arrangement of the components as well as the individual components (Draw off System: the intake tower has 3 Intake levels, the highest one not at 1384 m but at 1836 m.).

P 2-11: Dam Access Road: Dam problems typically occur during high flood conditions after heavy rainfall. Heavy rainfall is also affecting the quality of gravel roads and may cause problems in reaching the dam site with trucks if and when required. It is suggested to specify (and later on design) the access road to the dam to be an all-weather road as to be sure that the dam can be reached by emergency personnel, equipment and trucks with repair material under all conditions.

P 2-11 item 2): For the design of the spillway one would expect a graph presenting the shape of the design flood hydrograph into the reservoir, on a scale that would show the variation of the (hourly) discharges over a period of one or two days.

P 2-12: What is the intention of mentioning the 4 discharge formulas of a Morning Glory Spillway without units and without values, while this type has not been selected for application. For the other two types, including the selected Side Channel Spillway, the discharge formulas have not been noted. Explain why this is not incorporated or clarify which method is used.

P 2-13: It is suggested to present a typical (preliminary design) layout of the Side Channel Spillway in order to show the working mode of the structure and to indicate how much additional land (if any) would need to be acquired for construction of such type of spillway.

P 2-13 3rd Last paragraph: the choice of a side channel spillway may affect land acquisition. Assuming that land acquisition (and fencing) is intended to be carried out along the 1840m contour, the space available within that 1840m contour may be sufficient to construct the side channel spillway. This is to be confirmed but not yet visible on the various figures and drawings.

P 2-14: Use “River Diversion Works” instead “Flow Diversion to WTP” or “Draw Off Diversion” or similar to clearly distinguish the function of each of the structural components of the project.

Explain why cavitation would occur if the conduit were to flow full? A conduit flowing full would experience more friction and thus lower flow velocities with less cavitation capacity than in case an open water level in the conduit would be pursued. Or maybe, the ESIA report intends to mention water hammer effects caused by changing flow conditions in the conduit? Water hammer indeed could easily occur in a full flowing conduit.

P 2-15, just below Fig 2-6: The diversion conduit is reported to be designed and be placed alongside the river. Clarify if the conduit will be founded on uncompacted natural soil or dug into the abutment of the riverbank (difference: possible leakage underneath the structure) or on excavated and recompacted soil till the bottom of the key trench invert level.

P 2-16: Assess whether a deeper excavation or foundation treatment is required for foundation of the intake tower. Or will soil improvement be sufficient to ensure stability of the tower? Explain the meaning of “Top water level”.

P 2-17, fig 2-8 Alignment of the Water Raw Main: shift of alignment from the Right Bank side to the Left Bank side across the river channel: will this be done by burying the pipes, by making an aqueduct or on top of the toe of the dam? The alignment of the water raw main shows sharp bends, which are not favourable for the flow conditions in the pressure pipes (more friction) and for the stability of the pipes if not properly secured at bends.

P 2-18: The Water Treatment Works (WTW) shall be located above Maximum Flood Water Level in the river, with frequency of 1:100 or 1: 1,000 years (or any other guideline in the national standards or legislation for water management?).

In the ESIA report only selected geophysical profiles have been presented but geological profiles are lacking. Geological profiles are generally clearer in identifying pervious layers underneath or adjacent to the dam who could indicate the potential of seepage through the abutments of the dam.
The geophysical profiles in the ESIA report have been presented in coloured pictures but these are difficult to be read and compared since the outlines of structures have not been indicated on the profiles. It is suggested to schematise the most relevant profiles to make them more accessible.

To cope with future settlements of an earth dam crest, the final dam design drawings generally include a camber of the dam crest. The camber is an allowance above the crest of the dam for future settlement of the dam crest due to compression of the dam body and/or underground. A camber at the highest sections of a dam will be tapering off to zero at the abutments.
(NOTE: In the meeting on Friday 6 July Dr. Oonge confirmed that a camber will be included in de dam design)

In the ESIA report it is not mentioned that Emergency Preparedness Plans (EPP) and Emergency Response Plans (ERP) should be prepared for the dam and reservoir. These plans (including documentation, planning, organisation, funding, training and independent inspections) could be part of the necessary Operation, Maintenance and Surveillance Manuals (OM&S) that have to be prepared for dams and outlet works. Preliminary EPP, ERP and OM&S plans need to be provided to the funding agency before appraisal of the project and be refined and completed during project implementation.

Preliminary Design Report
The design report (2018-05-25) does not include an elaborate section about the geological conditions at the proposed dam location. That is quite unusual for a dam design report.

Slope stability calculations have been carried out under a range of conditions including under earthquake conditions. However, no earthquake accelerations have been reported in the report.

General observations: The titles of several tables do not clarify what subject the listed figures are expressing, especially where the titles are lacking units.

The steel penstock between the intake structure and the power station is a closed pressure pipeline. In this pressure pipe, water hammer may occur in case of sudden shut down of the turbines or the upstream control gates. Especially during flood releases and subsequent higher discharges and water velocities in the penstock, there will be a need for a special device, configuration or surge tank to cope with the pressure surges in the system. This should be taken into consideration.

In Annex 2 - Design criteria of the Preliminary Design Report: Only the design criteria for the water supply systems have been dealt with. For the dam, the reservoir and ancillary structure no such criteria have been reported. These criteria should be incorporated in the Preliminary Design Report for the dam and the reservoir as well.

Hydrology report

What is the definition of “top water level” and other expressions related to water levels and runoff in this report volume? One may use FSL, max design WL, 1:100 yr Flood Level and so on but these terms should be used consequently throughout the report and should not be changed in further chapters because this is highly confusing. Clearly define the terms used in the reports.

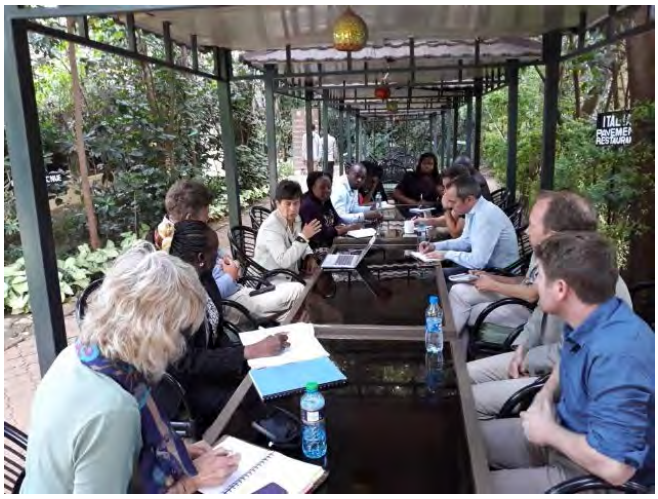
P 8-3: Run-off coefficients are dangerous figures to be used in dam related projects. In fact, these coefficients largely depend on the actual rainfall characteristics like duration and intensity. For instance, for a high rainfall depth of 200 mm/day the runoff coefficient on sloping terrain will be close to 1.0 but for 1 mm rain/day on flat terrain with tea plantations the runoff coefficient will likely be close to zero. For a water supply or irrigation system an average runoff coefficient may not be harmful but in a dam project we are dealing with dam safety aspects where short term maximum discharges are relevant.

P 8-6 para 8.2: On this page the PMF at the Bonyunyu Dam is claimed to have been computed as 710 m3/s but in the ESIA report a discharge of 1.400 m3/s has been adopted.

P 8-7 para 8.4: length of weir crest = 60 m for H=2.5 m (dam high flood WL 1837.5 msl)? The formula gives Q=440 m3/s instead of 710 m3/s. P 8.9 indicates 3.5 m + top WL). These figures seem to be inconsistent, or maybe insufficiently supported by text.

Annex 5a: Impressions of the project site

Annex 5b: Impressions of meetings



The working group shares its initial findings

Meeting with Kisii Deputy County Commissioner

Meeting with the press