Netherlands Commission for
Environmental Assessment

Quick Scan (Review) of the ESIA of the Kigali Waste Water Project

Memorandum by the NCEA

RWANDA

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Advice of the Secretariat

To	RDB
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From	The Netherlands Commission for Environmental Assessment (The NCEA)
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Subject	**Quick Scan (Review) of the ESIA of the Kigali Waste Water Project in Rwanda, March 2016**
	By: the Secretariat of the Netherlands Commission for Environmental Assessment – Ms Gwen van Boven (Technical Secretary) and Ms Bobbi Schijf and Mr Sjoerd Harkema (quality control), with expert input from Mr Willem van Starkenburg en Mr Roel Slootweg
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1. Introduction

The Rwanda Development Board (RDB) received an ESIA (Environmental and Social Impact Assessment) for the Kigali Waste Water Project dated March 2016. Waste water disposal in Kigali is currently by means of septic tanks and soakaways, or in some cases direct discharge to open watercourses. The project aims at developing a networked sewer system and waste water treatment plant in Gitikinyoni, Kigali, to be extended in phases, of which the ESIA covers the first two steps:

- in the first phase, chemically enhanced primary treatment and sludge processing to cope with 12.000 m3/year and 120.000 p.e. (population equivalent) from areas covering Kiyovu-Rugenge, Nyarugenge, Gitega and Muhima;
- a pilot secondary treatment step for 30.000 p.e.;
- the ultimate lay-out of the plant will be to cope with secondary treatment and sludge processing for 550.000 p.e., allowing for future connection of areas beyond those considered at present.

According to the ESIA, the promoter of the project is the Water and Sanitation Corporation (WASAC). The ESIA is prepared by Royal HaskoningDHV. The Government of Rwanda is seeking finance for the project through the European Investment Bank (EIB). Resettlement is to be financed by the GoR itself. Maintenance will be basedon cost recovery from connected buildings.

1.1 Approach to this Quick Scan

In January of this year, the RDB asked the Netherlands Commission for Environmental Assessment (NCEA) to assess the quality of the ToR for the ESIA. The NCEA published a scoping advice in the form of a Quick Scan in February 2016[1], which the RDB reports to have forwarded to the consultants preparing the ESIA, RoyalHaskoning DHV. On the 26th of April 2016, the RDB forwarded the ESIA report for review to the NCEA, requesting a review of its quality. On the 13th of May, the draft Resettlement Policy Framework (RPF) and the Stakeholder Engagement Plan (SEP) followed, as these are referred to in the ESIA.

This review advice is a so-called NCEA 'Advice of the secretariat' and has been prepared based on a desk review mostly. All members of the review team have visited the project site but time constraints did not allow for an in-depth verification of the documents and with stakeholders 'on the ground' in Kigali. For the purpose of this review, the NCEA engaged Willem van Starkenburg, the expert on civil engineering with a focus on waste water system/sewerage that was also involved during scoping, as well as Mr Roel Sootweg, ecologist and fresh water expert. Quality assurance was available at the NCEA's secretariat.

[1] *Quick Scan (Scoping) of the Terms of Reference for ESIA of the Kigali Waste Water Project in Rwanda, November 2015. By: the Secretariat of the Netherlands Commission for Environmental Assessment - Advice 2016-03, 18 February 2016.*

The NCEA does not express an opinion on the project itself, but focuses on the quality and completeness of the ESIA report.

In the following chapters, the NCEA first presents its overall conclusion on the current ESIA report (chapter 2). In chapter 3, some key observations on the overall quality and completeness of the ESIA have been provided. In chapter 4, the NCEA elaborates in more detail how specific aspects could be improved, by providing observations for each chapter of the ESIA.

2. Overall conclusion

At this stage in time, much remains unknown. Baseline data such as quantity and composition of the waste water that needs to be treated are estimates rather than measured, known data. It remains therefore unclear whether the present design will be the best answer to the problem, whether the installation will function as intended and whether it will not bring too severe impacts to the environment. The NCEA had already advised on this point in its scoping advice, which was clearly not taken into account. The authors of the ESIA seem to share these doubts, but do not answer these questions in the ESIA, as they could have. As a result, the current impact assessment, ESMP and monitoring plan, although listing relevant points, are insufficient to identify and manage risks related to the project.

Because of the limitations in information, the impact assessment remains qualitative and general and predictive more than certain. Regularly, the authors indicate uncertainties in the design and baseline data and therefore limiting their capacity to assess impacts.The authors refrain however from developing scenarios or technological alternatives that could be compared and for which impacts could be assessed and measures proposed, quantified and costed. Scenario development and comparison of alternatives is common ESIA practice and could have been done even given the current limitations in information.

To create an installation that functions as intended in practice and to find the best technological and most environment friendly solutions, and to get a full picture of the risks related to this project, and how they could be managed and contained, more preparatory work is needed. At this stage, taking a decision on this project would not be responsible.

- the NCEA recommends to first demand a more thorough, detailed, quantitative impact assessment, presenting and comparing different (technological, size) alternatives[2], allowing development of a true ESMP and monitoring plan.
- Then, once final design parameters and baseline information do become available, it will be necessary to assess in more detail the impacts to be expected, identify sound and quantifiable (with budget) mitigating measures, and come up with a final ESMP and monitoring plan, fit for implementation.

[2] *Please refer to the draft table of contents for environmental and social impact assessment for ESIA plants and collection systems, prepared by participants of an RDB-NCEA workshop in Kigali in Februari 2016. Ch 3.9 provides criteria for the comparison and evaluation of technological proposals for waste water treatment.*

3. Key observations

The above overall conclusion implies that the ESIA be redone. The following observations and recommendations are considered key to come to an ESIA of sufficient quality.

3.1 Influent

From the perspective of relevant policies, the rationale for a waste water treatment project in Kigali is well described in this ESIA. The choice for this particular project however, with this particular size and design, is not. It is stated in the ESIA (p.121) that '… influent flows and loads cannot be predicted at present'. This seems so crucial to the whole design of this project. If amount and composition of the influent are unknown, how are we to know whether this project will be the answer? How can impacts be assessed? How can effective mitigating measures be identified? The NCEA already recommended to study this in its scoping advice of February 2016[3], but this was not followed.

■ The NCEA repeats its recommendation to study, as soon as possible, the amount and composition of the influent, before proceeding with further design or even construction of the plant.

3.2 Project finances

The Government of Rwanda (GoR) is seeking a loan from the EIB to finance project related capital costs (p.13). The resettlement costs are to be covered by the GoR. It is not indicated whether this budget has been secured. Household connection costs and annual operational costs (maintenance, monitoring) are supposed to be recovered by connection and treatment fees to be paid by the users of the system. How this will be secured is not discussed in the ESIA. Without maintenance and monitoring the operations of the project will be at great risk. How (un)certain does this make the financial basis of this project? And of the measures proposed to mitigate environmental and social impacts? Risks are implied, among others due to lack of incentives to connect to the system (see also 4.5 of this advice).

■ The NCEA recommends to study and detail how financing of the different project components will be quaranteed, with specific attention to securing operational costs (maintenance, monitoring, implementation of ESMP). If financing cannot be guaranteed, consider technological solutions that require less operational capacity and mitigating measures.

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[3] *Quick Scan (Scoping) of the Terms of Reference for ESIA of the Kigali Waste Water Project in Rwanda, November 2015. By: the Secretariat of the Netherlands Commission for Environmental Assessment – Advice 2016-03, 18 February 2016.*

3.3 Institutional and operational capacity

A major reason for concern is the lack of an assessment of institutional capacity and additional training needs (recommended in the ESIA, page 162, but not done). This relates to institutional as well as technical capacity. This project is the first one of its kind in Rwanda.

- Operations, maintenance and monitoring all require skilled and trained staff, that are unlikely to be available from the start of the project. In the ESIA it is stated that the plant will be handed over after construction, while the organisational structure has yet to be decided. It is as yet unknown who will be the operator;
- Executing the resettlement process, is labour intense and requires dedicated and trained people to perform their tasks. The document states that "*WASAC has no experience yet in RAP implementation to EIB or WB standards and will need to establish a dedicated Resettlement Implementation Unit (RIU), where the RIU staff will need to be trained and supported throughout the project implementation*." This is a major reason for concern; it is unclear whether such training has been given so far;
- Given the limited experience with stakeholder engagement procedures in Rwanda this should be done before the start of the project and sufficiently trained staff should be available at the start of the project;

■ The NCEA recommends to develop a detailed capacity development programme that covers both institutional and operational aspects, and to ensure continuity in capacity and skills from the start of the project, through-out its construction, handover and operations.

3.4 Stakeholder engagement and Resettlement

Next to the ESIA report, a Stakeholder Engagement plan (SEP) and a draft Resettlement Policy Framework (RPF) have been prepared. The NCEA did not assess these in detail, due to time constraints and because of lack of specific expertise in this working group on resettlement issues. However, the following observations can be made:

The SEP describes past and future steps to ensure sufficient engagement of institutional and local stakeholders. The SEP is well written, and well documented with minutes of meetings and contact details of consulted people, allowing verification of the meetings and results. The results of the engagement to date are integrated into the ESIA at the level of ch 8 (social impact assesment). It remains unclear to what extent stakeholder concerns have been taken into account in the project design. All in all the SEP seems to be of sufficient quality, and if executed as presented, should provide sufficient basis for sufficient stakeholder engagement throughout preparation, construction and operations of the project.

The Draft RPF sets the legal structures (including lease or easement of land) for the project. Also the financial compensation is made clear. Detailed information from a household survey provide an estimated number of Project Affected People, both land owners, small business owners, tenants and employees of small businesses. Public consultation meetings have been held. It all looks well developed and documented, although it is noted that the Rwandan regulations are less favourable than others. Capacity for the implementation the resettlement process, however, is a major reason for concern, as indicated under 3.3.

3.5 Quality of Technical content

Main technical elements which were missing during scoping, and remain insufficiently treated in the ESIA, include the following:

- ***Baseline information*** is lacking, such as information on composition and quantity of waste water, the quality of treated water and the composition of produced sewage sludge. Without it, the impact assessment is hard to do;
- Without a clear ***description of the problem*** to be solved, it is impossible to know whether the proposed activity will provide the solution. Is the proposed size appropriate, are these the best technological solutions for this situation? This, again, was not clear during the scoping phase and remains unclear in the ESIA report;
- When baseline information is unknown, a comparison of ***alternatives*** is a way of anticipating different solutions for different situations. While location alternatives are well presented and compared, technological alternatives are not. Scenarios could have been developed, studied and compared, for example for differen sizes of the plant given different amounts of waste water to be treated[4]. Description of such alternatives will be useful to help design the best project in the best location. It is also required by the EIB;
- Current ***assessment of impacts***, ***proposed measures*** and ***ESMP/monitoring plan*** are insufficient. Relevant potential environmental problems are mentioned but not further analysed. This could have been done in a much more thorough manner.

■ The NCEA recommends to complement the ESIA for the Kigali Waste Water project on the points described above and using the detailed recommendations that will follow in chapter 4. This should preferably be done as early as possible so that the outcome could still be taken into account in the final design of the project;

■ Once final design parameters and baseline information do become available, it will be necessary to assess in more detail the impacts to be expected, identify sound and quantifiable (with budget) mitigating measures, and come up with a final ESMP, capacity building plan and monitoring plan, fit for implementation.

3.6 Presentation

Overall, figures, graphs and their legends are hard to read: very small, with small wording. This makes it hard to fully grasp the project location and design and specific impacts.

In several tables in the impact assessment chapters (7 and 8), in the ESMP and in Annex 1, impacts are presented and numbered, but numbering is inconsistent and not refering to a known source. This makes it hard to check completeness and consistency of the overall ESIA.

■ The NCEA recommends to include better readable illustrations throughout the ESIA report, allowing verification of information presented;

■ The NCEA further recommends to come up with one consistent way of presenting and numbering the impacts and proposed measures.

[4] Please refer to the draft table of contents for environmental and social impact assessment for ESIA plans and collection systems, prepared by participants of an RDB-NCEA workshop in Kigali in Februari 2016. Ch 3.9 provides criteria for the comparison and evaluation of technological proposals for WW treatment.

4. Observations per chapter of the ESIA

The previous observations and recommendations are considered key to come to an ESIA of sufficient quality. The following detailed recommendations will be useful against that background only.

As indicated above (ch 2), at this stage in time, much information is lacking that the NCEA considers crucial for the design and the ESIA of this project. This observation applies this entire chapter and is therefore not repeated in each paragraph.

The structure of this chapter follows the structure of the ESIA report.

4.1 Ch 1: Introduction

The rationale for a waste water treatment project in Kigali from the perspective of relevant policies is well described in this introductory chapter. The choice for this particular project, with this particular size and design, is not.

The project will be constructed in steps. The difference between stage 1 and 2 is unclear: in table 1 (p.12), both are similar. The expropriation of the necessary area will be done for the complete project (stages 1-4). The ESIA however covers the 1st 2 stages only (p.12). Why is this? Will the permit also be for these stages only and shall a new ESIA be made when the time comes?

Project financing is shortly described on p.13. The loan from the EIB will finance the project related capital costs. The Resettlement costs are to be covered by the Government of Rwanda. Household connection costs and annual operational costs are supposed to be recovered by connection and treatment feeds to be paid by the users of the system.
How (un)certain does this make the financial basis of this project? If involuntary resettlement is not duely compensated, this may lead to social unrest and resistance to the project. If the ESMP is not implemented, the project will result in unwanted environmental and social impacts. If maintenance and monitoring costs are not covered by a guaranteed budget, the overall project investment may not yield the desired results.

- The NCEA recommends a clear justification of size and design choices for the Kigali Waster water treatment project.
- The NCEA further recommends a sound financial projection of the project including ways to secure financing of operational costs for the lifetime of the project.

4.2 Ch 2: Project Context

It is clear that the quality of the rivers is such that there is a direct environmental and public health risk that needs to be solved. Levels of 20-35 mg BOD/l are comparable with the effluent of an average working WWTP (p. 17). Treatment of waste water is therefore needed. The choice for this particular (technical) solution however is not explained, nor does it

become clear why this size would be optimal. Would there be alternative options for size or technology? The rationale for the proposed project is lacking. Things to consider include:

- Quantity and composition of waste water that will need to be treated are unknown. The baseline data indicate the risk of insufficient discharge of waste water to the sewer because of the lack of drinking water. Clogging of the sewer can be the result, rendering the system ineffective.
- The project will be replacing the current system of decentralised, scattered systems or direct discharge into surface water. Its effectiveness will rely on phasing out of the old systems and connecting all users to the new sewer. Yet, the phasing out of latrine toilets and replacement with flushing toilets is not considered part of this project (p.17). Phasing out of sceptic tanks is not mentioned. Why not? If this will not be realised, the amount of treatable waste water may be different than projected, which would affect the effectiveness of the project.

■ In line with the previous recommendations, the NCEA recommends the inclusion of a clear project rationale for the Kigali Waster water treatment project, explaining choices in size and design and demonstrating why they would provide the best solution to the current waste water problem;

■ The NCEA also recommends the development and comparison of alternatives to allow comparison of options to decision makers (see also 3.5 and 4.9 of this advice).

4.3 Ch 3: Baseline data

Reliability of data

The most crucial point in any waste water project are the baseline data, such as: how much waste water will need to be treated, what will be it's composition? There are several reasons to doubt the reliability of the data presented:

- In this case, baseline data were collected from existing documents. Given the rapid developments in Kigali (and Rwanda for that matter) a discussion on age and validity of data would be needed. Some technical reports date back to 2008;
- Some data seem incorrect. Values on water quality in the river (table 3), to give an example, cannot be correct if one considers the relation between BOD and COD;
- Furthermore, the project is based on calculations and not on measurements. The value of the BOD is an example of a figure that is maybe not correct, as it is calculated using European values of BOD, which may not apply in Rwanda.

The consequence is that the plant will not have the right dimensions. The ESIA does not address this point of unreliability of the baseline data.

Amount of waste water

The amount of waste water is crucial for the design and size choices for the waste water treatment plant. The amount is currently unknown and is affected by several factors, such as:

- availability of enough drinking water is a pre requisite. The ESIA gives figures about prices of drinking water but not of the flow of drinking water and related waste water. There is no information of the affordability of water for the people;
- the availability of a flushing toilet, otherwise people are not able to discharge to the sewer. In this part of the ESIA no mitigating measures are summarized to abate the situation of having not enough waste water;

- see also Ch 4.5 of this advice, regarding the lack of incentives for existing, decentralised treatment systems to connect to the new system.

Phases 1 and 2 may be affected as the sewer will not function when the sludge becomes too thick, as a result, it will not reach the treatment plant. Also, the concentration will be much higher, which would require a different treatment solution. Next, required size and design choices for phases 3 and 4 will depend on the amount of waste water that has to be treated.

■ The NCEA recommends that a study be undertaken to find out how much waste water will be produced and if this waste water will reach the WWTP. Such a study would have to be done as soon as possible, because already in phases 1 and 2 the efficiency of the project will be influenced by the flow and concentration of waste water that will reach the treatment plant.

Water quality

The Water Quality (p. 42) of the Nyabugogo Rivers and tributaries is bad. However measurements are unreliable and irregular. A sound water monitoring system is currently lacking. It is recommendable to invest in this, as to show the environmental progress of the project. This should become part of one overall, comprehensive monitoring programme for the functioning of the sewer, the plant, the river, the surroundings and the implementation of the ESMP (see also 4.10), allowing adequate reactions when something goes wrong.

Environment

The baseline information in relation to biodiversity and environment is extremely limited. In general it is characterised by a listing of theoretical information without concrete conclusions of its relevance to the project.

- There is no information on the environmental services provided by the wetlands such as trapping of sediment, natural decomposition processes, temporal storage of floodwaters, fish (re-)production;
- Yet the text under flora (p.22) states that increased pollution and waste inhibits the wetland from functoning properly, without further explanation of what is meant;
- The overview of animal species is very limited and does not lead to any conclusion with respect to the project. So why include this information? Why include information on the biodiversity of Akagera park if nothing is done with this information?

4.4 Ch 4: Description of the project

This chapter in the ESIA gives a clear description of the proposed phases 1 and 2 of the project. Many details of the design remain unclear however. The chapter contains a number of “it is understood” statements, indicating design issues are still unresolved (e.g. buffer zone, pumping stations). Several photos are used with unreadable wording and legends making them useless as information source. In figure 41 (p.71) the lay-out of the WWTP is given. From this information it is not possible to understand how the plant will be constructed.

No alternatives for the project design are given although some suggestions are made in the ESIA on how to improve the design. An example is the use of biogas for power generation instead of storing and flaring it (p.73). Many more follow in chapter 7 and will be discussed at that level.

Operations
In 4.3.3 Operational Phase it is stated that the plant will be handed over after construction, while the organisational structure has yet to be decided. It is as yet unknown who will be the operator.

■ The NCEA recommends to start this discussion as soon as possible. It is a big plant, and there is no experience yet in Rwanda to work with such plants. It is recommended that the constructor maintains the plant during the first year together with the (future) staff.

Some other observations/questions:
- p. 70: until 2020 the population will likely decline with about 2-4%. Which population would this be? It is unlikely in the Rwandan context that the population, especially in urban areas, would decline (see also contradictory statements such as on p.85);
- p.70: in the 3rd par it is stated that the sewer system will require no pumping stations, and in the next par it "is understood that" there will one. Elsewhere in the document two pumping stations are mentioned. This is inconsistent;
- 4.3, table 10: this table lists activities during the construction phase but seems to be incomplete: there is no mention of activities related to resettlement, mitigation of environmental and social impacts, realisation of the connection of existing buidlings to the new centralised system?
- similarly table 11 listing activities in the operational phase also includes expansion of the project into stages 2, 3 and 4, yet no mention is made of a new ESIA or ESMP that would be required, nor of (recurring/new) construction related activities.

4.5 Ch 5: Other relevant developments in the area

In this chapter, some relevant developments and plans are mentioned, but it is unclear whether this chapter is complete:
- In 5.1. other water and waste water projects are listed, while other (sectoral) projects could also be relevant in terms of use of water, space and susceptability to impacts of the project.

Also, the consequences of other developments for the project are not well analysed:
- In 5.1. it is explained that Decentralized Wastewater Treatment is a compulsory activity for project developers of major new building projects. This results in many small treatment plants (at least 23, p.79). As a consequence of this policy, less waste water will be discharged on the sewer. The developers will already have paid for their decentralised treatment system and will therefore not have an incentive to connect to the new sewer. It is not discussed how this will be managed;
- In 5.2 the Kigali City Master Plan is discussed. This is highly relevant as many areas of the city will be re-assigned for different uses, housing and businesses will be resettled, and will be connected to the sewer system or not. The master plan has been detailed into a district master plan for Nyarugenge. However, details and consequences of that master plan for the project have not been provided.

■ The NCEA recommends to check in further detail which other developments exist or are being planned in the area of influence of the project. Consistency with other developments, plans and policies needs to be ensured.

4.6 Ch 6: Institutional setting, policies and standards

The chapter gives a good overview of the institutional setting, policies and standards. The different roles are clear. Of several institutional stakeholders, the relevance to the project is very clearly explained, while of others, especially near the end of the list on p.86, this is not the case. These should be omitted or their relevance should be clarified.

Under Consultants (p.87) it is mentioned that Atkins is preparing a feasibility study on this project, looking at the institutional, legal, financial and economic aspects of the project. The results can have a big impact on the project and will make clear who will maintain the works, and how the financing will be arranged.

In 6.2.3, tables provide a good overview of required permits and effluent standards that apply to the project. This is useful. Later on however (p.98) other aspects for which standards have been set are listed but the standards themselves (such as discharge limits) are not given. Same for design criteria.

■ The NCEA recommends the inclusion of relevant standards in the ESIA allowing for an easy assessment of impacts in relation to tresholds.

Throughout the chapter (and elsewhere in the document), mitigation measures are proposed here and there, without systematic numbering or summary at the end of the chapter(s). This makes it hard to ensure they will be taken up in the ESMP correctly.

■ The NCEA recommends the numbering of impacts and measures in a logical and consistent manner throughout the ESIA, up to the ESMP.

4.7 Ch 7: Environmental impact assessment

General observations
First, some general observations can be made.

Review
Despite the title of the chapter, its content does not as such provide an assessment of environmental impacts, but rather a review of the project design. For different aspects of the design, parameters and effectiveness of the design arediscussed after which in several cases, suggestions are done as to alternatives solutions. In a scattered and inconsistent way, this provides ingredients for techological alternatives, but is insufficient to allow comparison of pros and cons.

■ The NCEA recommends (as it did in its scoping advice) to include a proper analysis and comparison of alternatives for size and technology used in this project.

Impact assessment
At the end of the chapter, in 7.4, some significant environmental impacts are discussed, but in a qualitative and general manner only. The impacts are not assessed using the classification method proposed at the start of the chapter. Only in an annex to the ESIA, this

assessment can be found, but not using the color classification, without any justification of the conclusions drawn, and without specific details allowing calculation of their true impact and measures required to mitigate them. The impacts have been numbered but numbering does not refer to any known source and is inconsistent with earlier numbers used in the document. This makes it difficult to check whether this list is complete.

The issues that are mentioned in 7.4. are likely and logical consequences of this project and later on in the ESMP relevant suggestions for mitigation are given, albeit in a general and descriptive manner, and with little justification or explanation.

A 2009 ESIA is mentioned as a source of information (p.106). To what extent have these data been used, how did the project differ, have the data been updated or copied?

■ The NCEA recommends to dedicate this current chapter to a true environmental impact assessment, presenting in a logical order and using consistent numbering: identification of impacts, assessment of their importance, justification of this assessment, adequate mitigation measures.
■ The impact assessment, or at least a summary overview, should be presented in the chapter and not in an Annex to the ESIA. The overview should be presented in a table form using the color-methodology proposed (but not used) in the ESIA. Numbering should be consistently repeated here so that it can be used in the ESMP as well.

Area of influence
Definition of the area of influence (7.2): how was this decided and against which criteria? The description of area of influence is rather simplistic. It does not provide impact mechanisms and pathways. Fig 46 is not easy to read due to the small lettering but it seems that the confluence of the Nyabugogo and the Nyabarongo has not been included, while impacts may be expected there and activities in that area may be affected (Skol breweries, WASAC drinkwater treatment, sugarcane plantations and so on). These should be included now and not later as is suggested on p.107.

■ The NCEA recommends to extend the area of influence to be studied in this ESIA to include the confluence of the Nyabugogo and the Nyabarongo and some part further downstream, to justify this definition, and to describe the area properly.

Baseline data
Again it is stated in the ESIA (p.121) that '… influent flows and loads cannot be predicted at present'. This seems so crucial to the whole design of this project. If amount and composition of the influent are unknown, how are we to know whether this project will the answer? How can impacts be assessed?

■ the NCEA repeats its recommendation to study, as soon as possible, the amount and composition of the influent, before proceeding with further design or even construction of the plant.

Detailed observations
Secondly, some detailed observations can be made. in italics, recommendations are provided.

Review of design documents

The review of the design documents (p. 108) has some weak points:

- It is not discussed that the mean BOD-value is 533 mg/l[5]. This value is very high: normal municipal waste water has a BOD value of about 250 mg/l[6]. Either the value is not correct, or the chosen technology is not appropriate. *Verify the values for the BOD;*
- If the BOD is really that high, an alternative design would be expected. An anaerobic pre-treatment and a much smaller aerobic plant would be design options. In that case also the total amount of sewage sludge would be more than 50 % less. The sludge digestors would be big enough and also the sludge drying capacity would be enough. *It is recommended to study this alternative design;*
- The ESIA states that the surface of the drying beds may be insufficient. The evidence that this is the case is not provided. *Study whether the surface is sufficient, and if it is not, propose ways to mitigate this problem;*
- The review of the maturation pond does not take into account the retention time. The retention time is, together with the water temperature, the main parameter for the pasteurisation of the effluent. *Study the retention time and its appropriateness for pasteurisation of the effluent;*
- The ESIA gives a value for ammonia (table 22). All values in this table are calculations and not the result of measures. It is likely that what is mentioned here is ammonium-nitrigen and not the kjehldakl-nitrogen. On the basis of only the figure in this table it is not possible to state that the aeration capacity would have to be 25 % higher. *Check the type of ammonia indicated and provide measures instead of calculations*

Assessment of the maturation pond (table 24)

On p. 110/111 the maturation pond is reviewed. The review does not take into account the purpose of a maturation pond. The purpose of the maturation ponds remains unclear. With a normally functioning treatment plant, the treated effluent should be clean enough and would not require after treatment. One of the reasons is the removal of viruses. For that purpose only the retention time counts. The ESIA does not mention that. The design of the maturation ponds is unclear and therefore the retention time as well.

Study the required retention time and whether the maturation pond is big enough to ensure this retention time to effectively kill all viruses/pasteurisation, or whether the influent of the pond needs an extra pre-treatment (ozone or similar).

Also study the necessity of the maturation ponds. If they are needed for treatment purposes, construct them in such a way that they will function as such. If not, consider the option of no maturation ponds, or ponds without dikes (see also flooding, on the next page).

Assessment of the sludge line (table 25)

On p 111/ 112 the Assessment of the Sludge Line is summarized. Several design options are provided and need to be further studied, such as a heated digester or to apply mechanical systems to dry the sludge, which is not the best solution in all cases. To operate such a

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[5] *As the NCEA derives from table 1, on p. 12 of the ESIA report*

[6] *Marcos von Sperling; Carlos Augusto de Lemos Chernicharo (2005). Biological wastewater treatment in warm climate regions, vol. 1. IWA Publishing. p. 72. ISBN 978-1-84339-002-2*

system a skilled staff is necessary. *It is suggested to check in practice how the sludge drying beds are working out. When the capacity is not enough, other decisions can be made. Invest in skilled staff to operate the system.*

Reuse of sludge and wastewater (p.114)
As recommended in the scoping advice, the general idea is that sewage sludge with some levels of heavy metals is not suitable for use in agriculture. However, the ESIA does not give a table with limit values for the Rwandan situation (only EU). Also the presence of worm eggs in the sludge plays a role, but is not discussed.
It is advised to take the EU rules on the application of sewage sludge in agriculture.
The Reuse of Wastewater is an interesting option. *To avoid environmental problems it is a good option to study the reuse possibilities (page 114). In this respect, the ESIA differentiates correctly between crops for human consumption and other crops (other use).*

Assessment of the sewer connections (p.115)
The ESIA states that the success of the project will depend on full connection of all buildings in the sewer collection areas. The NCEA also warned about this in its scoping advice. The risk is that this will not be enforced. The proposed solution will not work without compensation for investments in waste water treatment already in place. *It is recommended to study ways of compensating existing investments in waste water treatment*

■ The NCEA recommends to invest in further study/assessment of the issues mentioned above in italics.

Flooding
The initial design foresees in a flooding frequency of three times a year (p. 40) of the wetlands along the Nyabugogo including the maturation ponds, thus letting the untreated effluent pass the wastewater treatment facility. The ESIA rightfully states that dillution of pollution is no solution, that a bypass would therefore not be advisable and proposes that the facility should work at all times (p.113), which is fully in line with good waste water management.
To avoid flooding, the construction of dikes along the river and drainage facilities on the Western part of the WWTP site are being proposed by the ESIA. A potential consequence of this adapted design would be a reduction in the surface area of wetlands available for the storage of floodwater. Depending on the water carrying capacity of the Nyabygogo along the WWTP this could result in:

- more flood water flowing to the lower lying flood plains – the impact of a 9.5 ha reduction in flood plain probably is minimal given the downstream flood storage capacity;
- the endikement of part of its floodplain could also result in a reduction of the wet cross-section of the river, since the maturation ponds lie in a very narrow section of the Nyabugogo valley i.e. creating a bottle-neck in the water flow, resulting in the damming up of water, leading to more serious floods upstream of the treatment facility. This is a more serious impact that needs to be assessed by a hydrologist.

A quick field visit on May 6th revealed that a WASAC water intake is located in the same wetland where the maturation ponds are planned, some 2.2 km downstream. Even though the actual intake is situated on the Nyabarongo some 1.100 m upstream of the confluence of

Nyabarongo and Nyabugogo, the annually reccuring floods in the wetland may also reach the WASAC water intake.
Google Earth shows the intake is at 1359 above MSL; the maturation ponds at 1365 m., without any visible barriers in between. So floods of the Nyabugogo, including those flushing over the maturation ponds, may easily reach the intake. Of course GE is not accurate, but since the WASAC intake is not mentioned at all in the document (e.g. in the tabel on page 38) it raises some concern.
Adaptation to climate change is hardly discussed in the ESIA. This is most relevant with respect to flooding, and should be taken into account in the design criteria for the entire project.

■ The NCEA recommends to study in greater detail the potential consequences of flooding, of endikement, and potential other solutions to mitigate flooding impacts. It recommends to take into account projects for climate change for this area. Considering the unclear purpose of the ponds, study also alternative options to their design (see also above).

Malaria related risks (p.117)
The information on malaria is very superficial, yet the risk that the occurrence of malaria will increase due to the project is significant. There is no information on the type of malaria, nor on the vectors occuring in Rwanda. Knowledge of the Anopheles species known to transmit malaria in Rwanda would provide more information on the preferred habitat of the individual *Anopheles* species. Many Anopheles species are known to only breed in clean, stagnant water, so breeding in a maturation pond of a wastewater facility may not automatically have to lead to an increase of breeding. Besides otherwise relevant mentioned measures (bednets and monitoring measures), the design can be changed in such a way that the water will keep streaming. The biological control of mosquito larveae by fish is not an easy task; much depends on the design of the ponds. More expert knowledge would be needed here, given the fact that people live nearby the facility.

■ The NCEA recommends the engagement of an expert to study the occurrence of malaria in Kigali and propose effective ways of mitigating potential adverse impacts of the project on the occurrence of malaria.

Odor and air pollution
According to the ESIA the emission of odors will be substantial when the WWTP is at full capacity. Several observations can be made in this respect:

- Normally, a well maintained plant will not give any odor emission. A skilled staff is very important in this respect. *It is advised to invest in (continued) training of staff for monitoring and maintenance;*
- Preventing odor emission by using active carbon is very unusual. It is expensive and requires high maintenance or will not work properly. *Study other options, such as frequently used methods of covering certain parts of the plant (inlet-works, pre-settler) and treatment of the air in compost filters;*
- Smell from sludge drying beds is possible. But when the sludge is digested in a proper way (that is part of the WWTP), smell will not occur. *Study options for sludge digestion without smell;*
- It is always good to avoid living very next to a treatment plant, but to resettle because of the plant seems unneccesary, provided the plant is well maintained.

Monitoring
Water Quality Monitoring (p. 117) is important to understand the working of the treatment plant and the influence of the effluent on the river. For a big plant like the Kigali Plant, a monitoring frequency of once a week on several points of the plant and on different parameters is normal practice. See further 4.10 of this advice.

4.8 Ch 8: Social impact assessment

In this chapter the social impacts are summarized. As far as can be judged it is complete and sufficient. See also Ch 3, Key observations. The main concern remains the capacity for implementation, as described in 3.3.

4.9 Ch 9: Analysis of alternatives

This chapter treats the alternative locations that have been proposed for this project and provides a multi-criteria analysis to justify the choice for the current location. This is well done and a useful help for decision makers.

The NCEA also recommended to consider alternative options for the size of the project and for technological solutions. This has not been done.

■ Given the argumentation provided in the previous pages, the NCEA recommends the development, analysis and comparison of alternatives for size and technology. Please refer to the draft table of contents for environmental and social impact assessment for ESIA plants and collection systems, prepared by participants of an RDB-NCEA workshop in Kigali in Februari 2016. Ch 3.9 provides criteria for the comparison and evaluation of technological proposals for waste water treatment.

4.10 Ch 10: Environmental and Social Management Plan

Apart from the earlier observed omissions or limitations on flooding risks and malaria risks, the ESMP treats most issues, though in a qualitative manner. The issues and mitigation measures are not provided in any detail, so further studies will be needed to have a more detailed understanding of the expected impact and to design the mitigation measures. P. 171/172 provides good summary of minimally required measures.

The ESMP does not have a consequent set-up. This chapter introduces new numbering refering to unknown phases and references (table 29 and onwards), yet is inconsistent in its use (table 30 uses no numbers at all, for example). Crucial elements such as training/capacity development, monitoring, and budgetting are mentioned but are dealt with insufficiently.

Training/capacity development
This project is the first one of its kind in Rwanda. A major reason for concern is the lack of an assessment of institutional capacity and additional training needs (see also 3.3). This relates to institutional as well as technical capacity. Among others:

- Operations, maintenance and monitoring all require skilled staff, that are unlikely to be available from the start of the project without proper and intensive training;
- Executing the resettlement process, is labour intense and requires dedicated and trained people to perform their tasks;
- Given the limited experience with stakeholder engagement procedures in Rwanda, sufficiently trained staff should be available at the start of the project.

Monitoring programme

A full, detailed monitoring programme needs to be set up covering all elements related to the functioning, impacts, and mitigation measures of the activity. At this stage, elements are proposed but a complete plan is not yet available.

Some specific observations regarding water qality monitoring:

- In table 29, an on-site laboratory is proposed for weekly measurements during the design and pre-construction phase. See alo 4.7 of this advice
- In table 31, OP3 Influent Water Quality during the operational phase: the monitoring would not only be to ensure that there is no industrial waste water in the system, but also to understand what amount of waste water is discharged to the WWTP.
- 10.7.3. Influent and effluent monitoring: the proposed frequencies seem sufficient
- However: 10.7.4. Water Quality Monitoring. It is stated that the river needs to be analysed every 3 months (p. 164). *The frequency of monitoring is far too low. It is suggested to monitor the river each 2 weeks.*

Budget

The budget provides estimates which cannot be assessed with the currently available information. Elements are missing, such as training and capacity building. Once the ESIA is performed up to standard, detailed and more realistic budgetting can be done.

4.11 Ch 11: Limitations and conclusions

No further observations.

4.12 Annex 1: Impact Table

As stated earlier, the NCEA feels that this impact table represents the core of the impact assessment and should therefore be included in the main text of the ESIA. *Recommendations on its presentation have already been provided in 4.7 of this advice.*

As to its contents, it is a long list that seems to include most important impacts, but described in a general manner and without explanation and justification of conclusions. This is important as two types of judgement have implicitely been given: first, on the importance of the impacts, and secondly, on the selection of impacts to be included in the ESIA itself, that are apparently considered most important and require mitigation measures, while others don't*. These choices need to be justified and criteria provided, to allow verification of the analysis and the selection.*