

Language: English

Original: English



**AFRICAN DEVELOPMENT  
BANK GROUP**

**PROJECT: NATCHIGAL HYDROPOWER PROJECT**

**COUNTRY: CAMEROON**

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**ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) SUMMARY**

*Date: August 2017*

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<b>Project Name:</b>	Nachtigal Hydropower Project.	<b>Project Number</b>	P-CM-F00-003
<b>Country:</b>	Cameroon	<b>Department</b>	PISD
<b>Division:</b>	PISD.1	<b>Project Category:</b>	1

## 1. Introduction

Growing energy demands and power shortages in the early 2000s, led the Government of Cameroon in 2006 to develop a long term Electricity Sector Development Plan (ESDP) for the period up to 2035. The ESDP is a technical, environmental and economic framework for the development of electricity production in Cameroon the development of thermal and hydropower plants.

Of the 54 sites identified as potential sites for hydropower, the Nachtigal site was identified as one of the priority sites in the overall development strategy. However, constructability of the Nachtigal Hydropower Dam was dependent on the construction of the Lom Pangar Dam located upstream of the Nachtigal site. The Lom Pangar dam is designed to regulate the flow of the Sanaga River by storing water in the rainy season and releasing it in the dry season. A target minimum flow of 650 m<sup>3</sup>/s in the Sanaga River is thus guaranteed even during low flow periods, with only slight modification of flow during high waters. This minimum flow will help ensure the operation of hydropower plants situated downstream on the Sanaga River (Song Loulou, Edea then Nachtigal). The first water releases to support Sanaga flow began December 2015

Work on the Nachtigal Hydropower Plant project started in 2006, but was put on hold till 2011 to enable sufficient progress on the Lom Pangar project. The Nachtigal Hydropower Project is being developed by the Nachtigal Hydro Power Company (“NHPC”), a Special Purpose Vehicle (SVP), whose shareholders were the Republic of Cameroon (30%), Electricité de France (EDF) (40%), the International Finance Cooperation (30%). RioTinto via its subsidiary in Cameroon, ALUCAM who were the original project proponents but left the project in 2016. The African Development Bank Group (AfDB) joined the project in 2014, providing 13% of the 1.05 billion EUR construction fund required for the project.

This ESIA summary illuminates the assessment and management plans designed by NHPC to ensure the project complies with both Cameroonian legislation, the AfDB’s ISS and international development partners E&S policy requirements.

## 2. Project Description, Location and Justification

### 2.1 Project description and components

The Nachtigal Project involves the designing, building and operation of a dam and hydroelectric power plant on the Sanaga River. The run-off river hydropower plant will generate 420 MW (7 60MW generators) of electricity and will also include 50km of 225 kV transmission lines from the project site to Nyom 2 in the north of Yaoundé, Cameroon.

The project includes a rolled concrete dam , 1400m wide and a maximum height of 14m, a reservoir of 421 ha in size, a 3.3km canal to transport water, a hydroelectric plant comprising of 7 turbines of 60MW (combined output of 420MW) and offices. The maximum design flow of the facility will be 980 m<sup>3</sup>/s. Water flow to the dam will be regulated upstream by the Mbakaou and Lom Pagnar dams with dry season flows peaking at 650m<sup>3</sup>/s. During the wet season, inflow will be well above the design flow of the facility, thus a run-of-the-river maximum operation flow will be used. During the dry season, two operational methods will be possible, i) Run-of-the-river operation where the facility instantaneously turbinning all the water inflow at a constant reservoir level and ii) Daily hydropeaking operation helps to provide maximum power to the grid during peak consumption hours by slightly deepening the reservoir, and limiting production during the rest of the day to replenish the hydraulic stock.

Construction is expected to start in early 2018 and commissioning of the last turbine is expected in 2022. Construction is organized in four separate engineering, procurement and construction (EPC) contractor tenders: (i) civil works (LOT GC), (ii) installation of electro-mechanical equipment (LOT EM1), (iii) construction of high and medium voltage transmission lines (LOT EM2), and (iv) construction of NHPC base camp (LOT CE).

The project's main components include:

- i. A roller compacted concrete dam on the Sanaga River, comprising of an overflow section with a total length of 1455 m and maximum height of 13.6 m, and a non-overflow section with a length of 553 m and a maximum height of 16 m to create a 27.8 million m<sup>3</sup> reservoir with a surface of 4.21 km<sup>2</sup> at normal operating level;
- ii. A headrace lined canal about 3.3 km long and 14m deep on average to transfer water to the hydroelectric power plant with a maximum flow rate of 980 m<sup>3</sup>/s corresponding to the design flow of the hydroelectric power plant equipment;

- iii. A hydroelectric power plant with an installed capacity of 420 MW (seven 60 MW Francis turbines able to operate either as a run of river plant or an intermediate peaking plant);
- iv. A secondary 4.5 MW power plant to generate electricity from the environmental flow (riparian release) to be discharged downstream of the dam;
- v. A double busbar 225 kV generation substation and a 50.3 km 225 kV double circuit transmission line equipped with two bundle conductors to transport the power produced from the power plant generation substation to the Nyom 2 connection substation;
- vi. Spoil disposal areas for the temporary storage of approximately 1.8 million m<sup>3</sup> of excavated material;
- vii. A quarry for the extraction of approximately 170,000 m<sup>3</sup> of laterite;
- viii. A concrete plant to produce approximately 130,000 m<sup>3</sup> of concrete;
- ix. 6.5 km of permanent roads to access the hydroelectric power plant and dam;
- x. A temporary construction base camp with capacity for up to 1,500 workers;
- xi. A 1 ha temporary landfill for the sorting, pre-treatment and disposal of non-hazardous solid waste generated by EPC contractors and NHPC offices and base camp.

## **2.2 Project location.**

The proposed site is on the Sanaga River at Nachtigal approximately 65km NE of Yaoundé, Cameroon as shown on Figure 1 and Figure 2. The Sanaga River is the largest river in Cameroon and obtains its waters from the Adamawa Plateau. Historically, flows of the Sanaga River and discharges at Nachtigal were regulated by the Bamendjin, Mape and Mbakaou dams that store water during the rainy season and release it during the dry season. Between December and May, discharge at Nachtigal is reduced to a minimum of 300 m<sup>3</sup>/s. It increases to between 1000 and 3500m<sup>3</sup>/s. Since December 2015, the Lom Pangar dam, constructed up stream of the Nachtigal site regulates the

flow of the Sanaga River ensuring the minimum flow rate of 650m<sup>3</sup>/s even during low flow periods in the dry season.

**FIGURE 1: Nachtigal Hydro Power Plant location**



Source: Artelia, (2017): ESIA Summary

**Figure 2: Aerial View of the Nachtigal Project Site**



*Source: Artelia,(2017): ESIA Summary*

### **2.3 Project Justification**

The proposed Nachtigal Hydropower Plant is justified on the basis of the need to address the critical energy challenges in Cameroon including increasing capacity to meet its needs for development. As part of Cameroon’s long term Electricity Sector Development Plan (ESDP) to increase capacity via thermal and hydropower, the Nachtigal site was identified as one of the highest priority sites for hydropower. The construction of the facility is aligned to the Government of Cameroon’s short to medium term strategy of increasing capacity and providing energy security via the valorisation of the hydropower potential of the Sanaga River. The facility will be part of a cascade of hydropower projects on the Sanaga River that together with other facilities will alleviate the energy crisis in Cameroon. The constructability of the project was dependent on the completion of the Lom Pangar project which was commissioned in 2016.

### **3. Policy, Legal and Administrative Framework**

The initial ESIA for this project was prepared in 2006, with supplementary studies undertaken between 2011 and 2017. The detailed legislative section is presented in Chapter 2 of the September 2011 ESIA.



The ESIA and supplementary studies were undertaken in line with applicable national and international legislation, policies and guidelines relevant to the construction of hydropower projects. These included Cameroonian legislation, international conventions and treaties Cameroon is signatory to, the AfDB Integrated Safeguards System, IFC Performance Standard and the World Bank.

### **3.1. Nation Legislation**

The main statutory instruments related to environmental management and impact assessments in Cameroon as applicable to the Nachtigal Hydropower Plant project are:

- ***Law No. 96/12 of 5 August 1996*** which sets out the legal framework for the management of the environment in Cameroon. The law includes provisions for the protection of the atmosphere, marine and continental waters, soils and sub soils, biodiversity and cultural heritage. It sets out requirements for impact assessments where projects or developments have the potential to impact the environment and advocates for a participatory and consultative approach involving local populations in decision making related to the environment.
  - Application Text for Law No 96/12 of 05 August 1996 include Decree No 2005/577 of 23 February 2005 setting the EIA preparation and processing modalities and the Ministry of Environment's (MINEP) Order of 08 March 2005 setting out the categories of operations that are subject to EIA studies.
- ***Law No 98/15 of 14 July 1998*** relating to establishments classified as dangerous, unhealthy or obnoxious in accordance with the principles of environmental management and public health protection. It sets out requirements for classified establishments to undertake risk assessments to prevent and control accidents. Application Text for the Law include:
  - Ministerial Order No 02/MINMEE/DMG/SDAMIC of 04 January 1994 (modifying Order No 13/MINMEE/DMG/SI of 19 April 1997) which sets out the nomenclature for establishments classified as dangerous, unhealthy or obnoxious including Class 1 and Class 2 establishments. Class 1 establishments, such as the Nachtigal Project are required to undertake risk assessments and put in place action plans to prevent and control accidents.
  - Decree No 99/818/PM of 09 November 1999 laying down the procedures for the establishment and operation of establishments classified dangerous, unhealthy or obnoxious.

- ***Law No 98/005 of 04 April 1998*** laying down regulations governing water resources and provisions to safeguard the principles of environmental management and public health protection. It also includes a list of substances prohibited from being discharged into surface or groundwater resources. The Law is accompanied by a number of Decrees relating to the implementation of the Law.
  
- ***Law No 2003/3 of 21 April 2003*** relating to phytosanitary protection. It stipulates that chemical treatments should be conducted with due respect for the agricultural good practices so that human and animal health and the environment be all protected.
  
- ***Law No 94/1 of 20 January 1994*** laying down forestry, wildlife and fisheries regulations, which seeks to protect and regulate the use of forests, wildlife and fishery resources. Clause 8 of the Law also sets out requirements for compensating local populations for loss of livelihoods from the use of forests, fauna and aquatic resources.
  - The Law is accompanied by Application Texts in a number of degrees setting out modalities for the implementation of the Law in relation to forest and fauna protection (Decree No 95/531 of 23 August 1995) and fauna (Decree No 95/466/PM of 20 July 1995).
  
- ***Ordinance No 74/1 of 06 July 1974*** defining the land tenure regime in Cameroon. It includes definitions for land classified as public or private land.
  
- ***Law No 85/9 of 4 July 1985*** laying down procedures governing expropriation for public purposes and the conditions for compensation;
  - Decree No. 2003/418 PM of 25 February 2003 setting out compensation tariffs for agricultural produce where there is the need to expropriate land for public purposes.
  - Ministerial Order No 00332/Y/15/MINUH/DC00 of 20 November 1987 setting out the procedure for estimating the market value of a property for the purposes compensation when land is expropriated for public purposes of expropriate for public purposes.



### 3.2 International Conventions

Cameroon is also signatory to several international conventions and treaties, applicable to the project.

These include the following:

- ***Convention on biological diversity, Nairobi, 22 May 1992, ratified by Cameroon in 1994*** on the conservation of biological diversity, the sustainable use of the components of biological diversity and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.
- ***Washington Convention on International Trade in Endangered Species of Wild Fauna and Flora (1973), acceded by Cameroon on 05/06/1981*** which aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival. It includes list of all species threatened with extinction which may be affected by trade. It also includes a list of all species which although not necessarily now threatened with extinction may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with their survival.
- ***Rotterdam convention on the prior informed consent procedure for certain hazardous chemicals and pesticides in international trade, 10 September 1998, ratified by Cameroon in 2002.*** The Convention includes a list of severely restricted chemicals and hazardous pesticide formulations restricted in international trade. Each Party signatory to the Convention shall establish national registers and data bases including safety information for chemicals and promote industry initiatives on chemical safety.
- ***Convention concerning the protection of the world cultural and national Heritage (World Heritage Convention), Paris, 16 November 1972, ratified by Cameroon in 1982*** aimed at preventing the loss of cultural heritage with respect to project development
- ***United Nations Framework Convention on Climate Change (UNFCCC or FCCC) 1992*** which aims to reduce atmospheric concentrations of greenhouse gases with the goal of preventing dangerous anthropogenic interference with Earth's climate system. The commitments of this convention have previously been superseded and most recently by the Paris Conference of Parties (COP21) Agreement which was ratified by Cameroon on 29 July 2016.

### **3.3. The African Development Bank Integrated Safeguards System and Operational Safeguards**

The project has been assigned a category 1 by the African Development bank in line with the guidelines within the bank's Environmental and Social Assessment Procedure for all power generating plants exceeding a generating capacity threshold of 30MW. Consequently, Operational Safeguards (OS)1 on Environmental Assessment has been triggered because the component activities have the potential to generate significant environmental and social impacts to identified receptors within its area of influence which if not well managed can lead to disruption of ecosystem services for the community. Operational Safeguard (OS2) has also been triggered because it has economically displaced over 1000 sand miners and fishermen. OS 4 on Pollution Prevention and Hazardous Substances is triggered since construction will involve use of fuels and possibly some hazardous materials. OS 5 on Labor, Working Conditions, Occupational Health and Safety is applicable since the construction will involve a significant number of construction workers.

### **3.4. The IFC Performance Standards**

The IFC performance standards are also applicable to the project. These include PS1 (Assessment and Management of Environmental and Social Risks and Impacts), PS2 (Labor and Working Conditions), PS3 (Resource Efficiency and Pollution Prevention), PS4 (Community Health, Safety and Security), PS5 (Land Acquisition and Involuntary Resettlement), PS6 (Biodiversity Conservation and Sustainable Management of Living Natural Resources) and PS8 (Cultural Heritage). PS7 (indigenous people) was not considered to be applicable as indigenous people have not been identified in the project area of influence.

The World Bank's Commission on Dams guidance document 'Dams and Development: A New Framework for Decision-Making, dated November 2000' was also considered as part of the ESIA.

Based on the review of the project documents, it is considered that the ESIA process is in line with the AfDB's ISS.

## **4. Description of the Project Environment**

### **4.1 Climate and Air Quality**

The climatic conditions around Nachtigal are mainly equatorial with two rainy seasons and two dry seasons of unequal duration. A meteorological station has been installed at the project site (base camp) to routinely monitor climatic conditions including precipitation, wind speed, humidity and temperature.

Air quality in the project area has been assessed to be generally good with the main sources of air pollution identified as intermittent and irregular bush fires and road traffic, particularly in the dry season. Baseline studies undertaken in 2014 included one-time measurements (day and night) of ambient air quality at 4 locations in 3 villages around the project area, construction camps, villages and roads. Measurements were undertaken for sulphur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>), carbon monoxide (CO), ozone (O<sub>3</sub>), volatile organic compounds (VOCs), dust suspensions lower than 10 microns (PM<sub>10</sub>) and dust suspensions lower than 2.5 microns (PM<sub>2.5</sub>). Compared to national and international standards (WHO and USEPA), the results obtained showed that the reported concentrations of gaseous pollutants were below assessment limits, reflecting a lack of pollution from stationary sources (industry, urbanization, fuel operating units, etc. Elevated PM<sub>10</sub> (dust) were identified due to unpaved roads, local traffic (on National Road No. 1) and domestic activities such as the use of firewood, slash and burn agriculture and bush fires.

### **4.2 Geomorphology/Geology/Hydrogeology**

Cameroon has a wide range of landscapes including coastal low lands, plateaus and highlands. The Project area including the dam, hydropower plant and associated facilities as well as the transmission line corridor is located in the eastern part of the southern plateau in Cameroon, with topographic levels varying between 650 and 850m above sea level. The Sanaga River on which the project is situated is at an altitude of 700m with a variety of relief formations.

The geology of the project area is mainly made up of Precambrian Basement rocks consisting of variable deposits of metamorphic rocks such as migmatites, diadysites, embrechites, biotite anatexite and pyroxenes. Shallow soils mainly consist of red brown ferrous clayey soils which are created from alterations of the underlying metamorphic rocks. Due to their clayey nature, the shallow soils are locally mined for use as a construction material (laterite). Alluvial deposits are present along the banks of the Sanaga River.

Groundwater is typically present in fractured crystalline metamorphic basement rocks including micaschistes, gneiss and granite. The aquiferous formations are overlain by relatively impermeable and clayey laterite formations. Shallow groundwater levels typically vary between 1 -16meters below ground level. Groundwater samples analyses for a range of potential contaminants identified elevated faecal coliforms in some of the water samples collected from abstraction wells.

### **4.3 Surface Water**

The Nachtigal project is located on the Sanaga River which as a total catchment area of 129,000km<sup>2</sup> (a quarter of the total watershed in Cameroon). The River is 918km long with flow rates reaching 2,100m<sup>3</sup>/s. The flow of the Sanaga River and its tributaries have historically been regulated by the dams and reservoirs at Mapé, Mbakaou, Bamendjin, and more recently the Lom Pangar dam. The commissioning of the Lom Pangar reservoir (upstream of Nachtigal) has significantly altered the hydrology and flow regions of the Sanaga River, such that at Nachtigal there are now two clearly defined seasons, namely a dry season when flows are regulated to 650 m<sup>3</sup>/s by water retention at Lom Pangar and Mbakaou and a rainy season when water flows are above the design capacity of 980m<sup>3</sup>/s. The Sanaga River and its tributaries are a main source of water for the surrounding villages.

Surface water samples analysed for a range of potential contaminants identified did not identify significantly elevated contaminants in surface water. However, sediment samples obtained from the Sanaga River reported the presence of toluene, mineral oils and residual pesticides. The main sources of surface water contamination were identified as the use of pesticides and herbicides in agriculture, transport and upstream industrial discharges from sugar manufacturing plants and distilleries.

### **4.4 Sediment Transport**

The sands of the Sanaga River represent the main source of sand supply in Yaoundé (for construction activities); extraction activities generate significant revenues for municipalities where the quarries are located. Extraction is mainly done traditionally, using canoes, buckets and divers to collect the same from the river bed. The artisanal sand mining sector employs many people from villages living closest to the river, but also from various regions of Cameroon, sometimes neighbouring countries. Significant sediments in the Sanaga River can also fill the reservoir, wear down generators and reduce the performance of the hydropower plant.

Detailed studies including a literature review, field visits for data collection and sediment transport modelling have been undertaken. The study showed that natural sediment transport was estimated as 600 000 m<sup>3</sup>/year for the

Sanaga upstream of the confluence with the Mbam and 350 000 m<sup>3</sup>/year for the Mbam upstream of the confluence. It was estimated that in 2013, 950,000 m<sup>3</sup>/year of sand was extracted from the Sanaga and Mbam Rivers in the vicinity of the Project Area. The projected volumes mined are expected to increase due to increased demand, development of the road network and improved mining techniques. Sediment transport modelling was undertaken to assess potential impacts of sediment transport on the overall performance of the reservoir and dam.

#### **4.5 Green House Gases**

An assessment was undertaken to estimate the contribution that the project could make to greenhouse gas emissions largely from decaying vegetation submerged in the reservoir, and site preparation works including clearing the rights of way. The approaches considered included comparing the GHG emissions with hydropower projects (Nam Leuk Hydropower Project in the Loa People's Democratic Republic as well as the Petit Saut hydropower project in Guyane) of a similar size to Nachtigal and also comparing the projected emissions against a thermal power plant of a similar output to Nachtigal. A thermal power plant of the same capacity as the Nachtigal plant would emit about 1.92 million tons of equivalent CO<sub>2</sub> greenhouse gases per year (for a producible of 2 850GWh) contributing to global warming. This emission is avoided by the generation of hydropower. It has been estimated at 390 000 tons equivalent of CO<sub>2</sub> from decaying vegetation submerged in the reservoir and from site clearance works at the start of the project.

#### **4.6 Noise**

Baseline ambient noise surveys have been undertaken around the villages that would be affected by the construction works of the project. These consisted of one time noise measurements in dB (A) (day and night) of noise levels experienced at 4 points in three villages located close to the work areas, facilities (contractor's camp and construction sites) and roads. The project area is in a rural setting and background noise is dominated by sources of nature, motorcycles and cars. Houses are generally over 100 meters from very quiet roads and/or railway lines, and are not frequently over flown by planes. Ambient noise levels are generally low and varied between 30 and 32.5 dB(A) and area lower than WHO guideline values.

#### **4.7 Flora and Vegetation**

The project area is located in the semi-deciduous Guinea-Congolese rainforest which is a transition zone between forest and savannah. Vegetative cover is mainly defined by forest galleries along the river and shrubby savannah

maintained as a result of bush fires and logging. Strips of forests have been cleared for agricultural purposes. There are no protected areas in the study area. Inventories conducted in the impacted zones (construction areas, flooded zone) revealed a total of 366 plant species, of which 15 are tree species with commercial value and nearly 155 species, not endemic to the study area, are used locally in traditional medicines and other traditional uses (non-timber forest products). No plant species are protected by the Cameroonian legislation. However several species are endangered or critically endangered according to the IUCN i.e. *Ledermanniella sanagaensis* (aquatic), CR; *Ledermanniella thalloïdea* (aquatic), EN; *Marsdenia abyssinica* (riparian/semi-aquatic), CR; *Hymenodictyon pachyantha* (terrestrial), EN; *Ledermanniella sanagaensis* which is endemic to the Nachtigal falls (Project location) and *L. thalloïdea* which is endemic to the Sanaga watershed.

#### **4.8 Fauna and Wildlife**

The area is not considered as a major migratory route for birds and no migration corridor has been identified along the future transmission line route. However, several protected bird species (Cameroonian wildlife legislation) are present in the project area as well as one species that is endangered (IUCN Red List). A total of 34 wildlife and 122 bird species were identified in the Project Area, with several protected under the Cameroonian wildlife legislation or are listed as endangered or critically endangered on the IUCN Red list. These are summarised in Section 3.1.3.2 of the 2017 ESIA Update Summary (Artelia, 2017).

#### **4.9 Fishes**

A detailed inventory of the fish populations has been undertaken in the Project Area. The inventory revealed that 65 species belonging to 16 families were present, of which 9 are indeterminate or new to science and 24 species endemic to the Sanaga. Additionally, a literature review showed that 21 additional species have been recorded in the project area, although they have not been inventoried by catches. Based on the literature review and field surveys undertaken, there are up to 86 species (from 18 families) reported in the Project area. In terms of species richness, the identified families included *Cyprinidae* (17), *Mormyridae* (14), *Clariidae* (6), *Alestidae* (5), *Claroteidae* (5), *Cichlidae* (4), *Mochokidae* (3), *Schilbeidae* (2) and *Mastacembelidae* (2). The other 7 families (*Amphiliidae*, *Arapaimidae*, *Bagridae*, *Channidae*, *Distichodontidae*, *Hepsetidae* and *Latidae*) recorded respectively only one species. In terms of the status of species conservation, most species are classified under the "least concern" (LC) category of IUCN and four species are currently classified as vulnerable, threatened or near-threatened or endangered.

#### **4.10 Socio-Economic and Cultural Environment**

The dam construction component (dam, reservoir, power plant, borrow pit and buildings) of the project, a total of four villages are directly affected by the project i.e Minkouma and Ndokoa-Ekombitié in the Haute Sanaga Department; Ndji in the Lékié; Bindandjengue in both the Haute Sanaga Division and Bam and Kim Division. The total population of the four villages based on extrapolations from the National Census data is 1,470 people. The project site is located on land which is on the boundaries of between the Beti ethnic group in the Central Region and the Mvoute (Babouté) ethnic group of the Eastern Region of Cameroon. Migrant population in the project area who are mostly fishermen include people from Mali, northern Cameroon as well as people from the Tikar and Gbaya ethnic group in Southern Cameroon. There are also migrants involved in businesses and agriculture. Detailed socio-economic surveys were undertaken to establish baseline socio-economic conditions around the project area of influence. A total of 147 project affected people (PAP) from four villages will be affected by land loss (agriculture). Their resettlement – in a new residential house (physical resettlement) or of their economic activities (economic resettlement) – implies the replacement of agricultural land and for two households the replacement of their dwelling. 117 fishermen were identified, with about 50% of them practicing their activity in the area that will be occupied by the feeding channel between the dam and actual power plant, where the river is most affected by the Project. In total 83 people (mostly women) were surveyed as being engaged in fish smoking and fish trade

A total of 25 villages are affected by the powerline route, including 2 which will be affected by the permanent basecamp site. The villages are mainly located in the Lékié Division with a few villages in Mefou & Afamba, in the Mfoundi Division. The main economic activities in these areas are agriculture based on cocoa and food crops, mainly tubers with some market gardening, small scale animal husbandry, except for a few main fowl producers, small scale businesses and craftsmen. Based on the 2005 census, the population is estimated at 22,000 people. The main ethnic group along the transmission line are the Beti, Eton and Ewondo. The proximity of the area to Yaoundé attracts many migrants from other parts of Cameroon. As part of the baseline surveys undertaken, along the transmission line, a total of 565 PAPs in 25 villages are affected by temporary or permanent loss of crops and land, including three households that will lose their permanent residence and will be resettled. Around the permanent basecamp in Batchenga, 207 PAPs in two villages are affected by loss of crops and land, as well as one improved national source.

Several sacred sites, trees and forests have been identified in the villages within the Project Area of Influence. Archaeological sites of interest have also been identified at Ndjoré, Ndokoa (Mbandjock sub division) and Nkometou (Nkometou II sub division).



The industrial activities associated with the construction and operation of the Nachtigal Hydropower Plant will in the influx of manpower to the project area including a high number of job seekers, suppliers of goods and services, as well as other opportunistic entrepreneurs hoping to take advantage of the economic benefits expected from the project. In order to effectively manage environmental and social impacts associated with an increased influx of people into the project area, a Social Influx Management Plan was developed including environmental mitigation measures (Egis International, 2015).

The dominant form of land ownership is community ownership (customary land tenure) where the traditional local leaders serve as trustees and land administrators. Individual families receive rights to use the land and ownership of the land is generally hereditary being transferred from father to son. Women typically have access to parts of land on the dead of the head of the household but the size of the land they can inherit is relatively smaller when compared to the size men can inherit. Locally, people are employed in agriculture (small scale farming as well as large scale farming of cacao, coffee), fishing, hunting and gathering of non-timber forest products, artisanal sand mining. Others also work as business men and women.

#### **4.11 Health Assessment**

Baseline health assessments undertaken in the project area have included an assessment of access to health care facilities and wellbeing of the population. Surveys showed that though there are several health care facilities within the Project Area of Influence, over 70% of people in the project area do not have access to the medical centres due to lack of finances and lack of suitable medication in the facilities.

The nutritional status of the population was assessed as being generally good, with isolated cases of malnutrition attributed to poor eating habits including prolonged eating of cassava. Sufficient food is produced to feed the location population. However, the purchasing power is weak and the majority of local produce is marketed in Yaoundé.

Common diseases include water borne diseases transmitted by vectors (malaria, onchocerciasis, schistosomiasis, yellow fever) as well as typhoid, amoebas, diarrhoea and gastro-enteritis. Other diseases include respiratory tract infections and sexually transmitted diseases including HIV/AIDS. A limited cholera outbreak was reported in the urban areas of Nkolondom village. The Project is located in an area which has endemic fileriasis.

Water supply is mainly from the Sanaga River, hand dug wells and boreholes abstracting water from the underlying aquifers. There are several schools (nursery, primary and secondary) in the project area.

## **5. Project Alternatives**

Electricity Sector Development Plan (ESDP2030) estimates that due growing demands for energy to sustain economic growth and development, Cameroon would need up to 1950MW (11 TWh) of low voltage energy to sustain the population growth of the country. It will also need between 450 – 3000MW of high voltage energy for industrial development. An assessment available alternatives for the project was undertaken in relation to addressing the energy crisis in Cameroon and providing a reliable and stable source of electricity. The project alternatives were assessed in terms of project location, type (i.e hydropower or thermal power plants), environmental and social constraints, and construction and operation costs.

Hydropower is the main source of electricity in Cameroon and the development of hydropower plants along the Sanaga River has been identified as a strategy to alleviating the energy crisis in Cameroon. The Nachtigal site is one amongst many interrelated hydropower projects on the Sanga River and compared to other locations, was assessed as having the highest productivity potential and given its location and the height of the Nachtigal Falls, will be cheaper to construct and operate. Alternative sources of energy such as thermal power plants are more expensive to build and generate greenhouse gases. Development of the Nachtigal site will enable Cameroon to meet its growing energy demands with a potential to export energy to neighbouring countries.

## **6. Potential Impacts and Mitigation/Enhancement Measures**

A detailed ESIA, identifying potential impacts of the project during the pre-construction, construction and operational phase of the project has been undertaken. Where significant impacts have been identified suitable mitigation measures have been proposed and documented in ESMP as a compliance obligation for the project proponents.

### **6.1 Positive Impacts**

Implementing mitigation measures for the identified impacts will result in some positive impacts for the communities. Socio-economic benefits for the population will include the creation of jobs for the local population; improved road infrastructure and opening up of the area; and improved living conditions. During the construction phase, 1500m temporary jobs will be created and during the operational phase 75 jobs (including 50 operators) will

be created in Batchenga and together with the head office of the operator in Batchenga will provide positive impacts to the local economy. The creation of a reservoir of more than 400 ha could also foster the development of species such as the Clarias (Clarotidae) or Capitaine (Lates niloticus, Centropomideae) as well as encourage the development of recreational activities such as sports fishing.

It has been estimated that the Project will result in the in the creation of 390,000tons equivalent of CO<sub>2</sub> (principally during the site preparation phase) which is significantly less than the 1.92 million tonnes equivalent of CO<sub>2</sub> and greenhouse gases that will be generated by a thermal power plant of the same capability.

## **6.2 Negative Impacts**

The social impacts of the project will include the physical and economic displacement including loss of agricultural land, livelihood activities including fishing and hunting, loss of cultural resources and the potential destruction of archaeological resources during excavation and grading, public health impacts due the presence of 1500 workers at peak construction periods and safety risks related to accidents and injuries. The environmental impacts of the project include habitat loss for flora, fauna and avifauna, loss of associated ecosystem services for the population and potential pollution of water bodies from the construction related discharges. A selection of specific environmental and social impacts detailed in the ESIA are listed below.

- The 417ha reservoir will require flooding an additional 157ha of land including 80 ha of secondary forest, 32 ha of cocoa farms, 4 ha of other crops and 66 ha of shrubby savannah. Additionally, the location of the dam, the in-flow canal, the out-flow canal, the plant and construction camps will result in the loss of 159ha of existing land uses. Land clearing and temporary use for site facilities and temporary access will result in the loss of 134ha of existing land uses. Only 2 houses will be affected by the construction of the hydropower plant. The transmission line corridor has been designed to include a 50m right of way and the construction of the transmission lines will result in the loss of 3 houses as well as agricultural land. The project will result in the inward migration people in search of work. Flooding of the reservoir will also result in the displacement of sand miners who would need to be relocated. The entire project will result in the significant loss of agricultural land.
- The construction of the dam will have a direct impact on fish movement and their habitat including habitat loss, restriction of fish movement downstream, especially during spawning seasons which could affect fish abundance and distribution. However, the number and size of fish that thrive in calmer waters (e.g. Cichlidae and Osteoglossidae (Heterotis, locally called "kanga")) could increase. There is the

additional risks of overfishing during the construction phase of the project which could result in population decline.

- There are limited endemic or protected species in the project area of influence and the project will result in the temporary loss of vegetation as all sites used temporarily will be revegetated. The main impacts on terrestrial wildlife and avifauna will be habitat loss.
- As part of the creation of the reservoir, could result in the creating of algal blooms coupled with increased organic loads from upstream sources could pollute the waters for downstream users. In addition, decaying organic matter in areas which have been flooded without prior clearing of vegetation could result in the creating of methane and greenhouse gases.
- A catastrophic dam failure event could have significant impact on downstream resources.

### 6.3 Cumulative impacts

**Table 2. Cumulative impacts of the Nachtigal project**

Sector	Short/Medium-term impacts	Long-term impacts
<b>Hydrology of the Sanaga</b>	No impact resulting from Nachtigal during the construction period	<ul style="list-style-type: none"> <li>• Limited impact downstream (low to moderate gradient) resulting from hydropeaking during the dry season in Nachtigal.</li> <li>• Major impact resulting from Lom Pangar water discharges to regulate flows. Nachtigal does not change the impact of Lom Pangar.</li> </ul>
<b>Hydrodynamics of the Sanaga</b>	No significant impact resulting from Nachtigal during the construction period	<ul style="list-style-type: none"> <li>• Decreased intake of sediments downstream of Nachtigal and in the estuary</li> </ul>
<b>Water quality of the Sanaga</b>	One-time and very limited risk of discharge of hazardous materials (primarily hydrocarbons) during construction	<ul style="list-style-type: none"> <li>• No additional impact from Nachtigal, given the small size of the reservoir and its rapid renewal</li> <li>• High impact of Lom Pangar that drowns 540 km<sup>2</sup> of uncleared forest and savannah before impoundment; risk of organic load of the water.</li> </ul>
<b>Fish / aquatic life</b>	The Nachtigal dam will hamper migration at the end of its construction, but it is quantitatively difficult to assess because of lack of knowledge of migratory phenomena specific to the species concerned.	<ul style="list-style-type: none"> <li>• The construction of other dams (currently planned) on the Sanaga River could have cumulative impacts on fish distribution and migration. A watershed-level study is needed to address these issues.</li> <li>• The poor quality of water released by Lom Pangar can alter the overall distribution of species in the basin, migrant individuals either downstream (towards Nachtigal) or to the tributaries to escape deoxygenated waters</li> <li>• The reservoir of Nachtigal provides a stable volume suitable for the development of species of calm waters, which can compensate for partial drying up of 3.3 km branch during the dry season downstream of the dam. In addition, water downstream the Nachtigal dam will be re-oxygenated.</li> </ul>

<b>Artisanal fishing</b>	The construction period could lead to fishing pressure in the area of the Sanaga that is higher than normal due to the higher demand from hired manpower. However, the Project intends to take restoration management measures to minimize this impact.	<ul style="list-style-type: none"> <li>• The reservoir may attract more fishermen than production can bear (estimated at 18 fishermen).</li> <li>• Furthermore, fishing may decline in the entire Sanaga because of alterations of water due to Lom Pangar.</li> </ul>
<b>Forestry</b>	Limited risk during construction if measures of the Environmental and Social Management Plan are properly implemented.	<ul style="list-style-type: none"> <li>• Regional development induced by Nachtigal can accelerate pressure on secondary forest. It is observed that the forest may disappear to give way to agricultural development.</li> </ul>
<b>Biodiversity</b>	Limited risk during construction if measures of the Environmental and Social Management Plan are properly implemented: hunting and poaching prohibited for workers, meat supply to limit pressure on bushmeat; the result will depend on the ability to control the spontaneous population in the area.	<ul style="list-style-type: none"> <li>• Socio-economic development of nearby agglomerations started during construction could be perpetuated, engendering increased demographic pressure on the biodiversity of the region.</li> </ul>
<b>Urban development</b>	Limited impact around construction sites if recruitment is made mainly among the local population as recommended by the impact assessment and if measures for the management of spontaneous migration are implemented.	<ul style="list-style-type: none"> <li>• Probably limited, the Nachtigal project does not generate activities on the site. The village of the operator will have only a few dozen operators</li> </ul>
<b>Social and economic development</b>	The concentration of salaried workers will accelerate local socio economic development during construction through the development of downstream activities (trade, market gardening, etc.).	<ul style="list-style-type: none"> <li>• Training and awareness programs on hygiene, health and environmental management provided to workers during construction should help local people to improve on all these aspects in the future. The possibility of transferring the controlled release put in place during construction could serve as blueprint and accelerator to better environmental management in the region.</li> </ul>
<b>Industry</b>	The industrial and transport sectors in Cameroon will be stimulated during the construction of Nachtigal Dam.	<ul style="list-style-type: none"> <li>• In the medium and long term, the industrial sector of Cameroon and its GDP will directly benefit from increased energy supply.</li> </ul>
<b>Land pressure and social influxes</b>	Land pressure and social influxes will increase around Batchenga, due to Nachtigal project, road and drinking water projects.	<ul style="list-style-type: none"> <li>• In the medium and long term, Nachtigal's impact is limited.</li> </ul>

## 7. Environmental and Social Management Plan (ESMP)

An ESMP for the project has been written to incorporate all phases of the project with mitigation measures for the identified impacts. The ESMP will be applicable for 10 year period covering the pre-construction period (1 year), construction period (5 years) and operational period (4 years). The pre-construction period covers all the mobilisation phase as well as the additional baseline studies to be undertaken to generate data against which performance monitoring will be undertaken during the construction and operational phases. An addendum to the

ESMP will be prepared at least five years to the end of the operational phase of the project. This addendum will cover the Environmental and Social risks mitigation during the decommissioning phase of the project.

Additional, specific documents prepared to address specific types of social and environmental impacts including the Social Influx Management Plan, Complaints Management Procedure, Resettlement Action Plan (RAP) for the dam construction component (dam, reservoir, power plant, borrow pit and buildings) of the project, Resettlement Action Plan (RAP) for the transmission line from Nachtigal to Yaoundé and the permanent base camp near Batchenga, Biodiversity Action Plan (including Ecosystem Services), Biodiversity Action Plan for Fisheries including a Conservation Plan for *Ledermanniella sanagaensis* et *Ledermanniella thalloidea*, a Compensation Management Plan for artisanal sand miners affected by the project.

The total estimated budget for the implementation of the ESMP over the 10 year period is €47,750,000 EUROS. The detailed breakdown of the estimated costs is presented in Table 2 below.

**Table 3: Estimated Budgets for Implementing the ESMP and associated Management Plans**

<b>Plans</b>	<b>Budget FCFA</b>	<b>Budget Euros</b>
<b>Total Costs for Implementing the ESMP</b>	<b>9,457,480,830.00 FCFA</b>	<b>€ 14,517,837.00</b>
<b>Other Management Plan</b>		
Archaeology Management Plan	<b>470,977,126.00 FCFA</b>	€ 718,000.00
Complaints Management Plan	<b>165,957,121.00 FCFA</b>	€ 253,000.00
Resettlement Action Plan (RAP) for the dam construction component (dam, reservoir, power plant, borrow pit and buildings) of the project	<b>2,007,556,399.00 FCFA</b>	€ 3,060,500.00
Resettlement Action Plan (RAP) for the Project Component the transmission lines from Nachtigal to Yaounde and the permanent base camp near Batchenga	<b>2,092,502,830.00 FCFA</b>	€ 3,190,000.00
Biodiversity Action Plan (including Ecosystem Services)	<b>7,044,978,180.00 FCFA</b>	€ 10,740,000.00
Compensation for physical and economic displacement	<b>7,930,848,109.00 FCFA</b>	€ 12,090,500.00

<b>Plans</b>	<b>Budget FCFA</b>	<b>Budget Euros</b>
Compensation Management Plan for artisanal sand miners affected by the project.	<b>3,830,788,880.00 FCFA</b>	€ 5,840,000.00
Economic Development Action Plan	<b>3,673,359,200.00 FCFA</b>	€ 5,600,000.00
<i>TOTAL COST for Implementing all Management Plans (excluding the ESMP)</i>	<b>27,216,967,845.00 FCFA</b>	€ 41,492,000.00
<b>Total Costs for Implementing the ESMP et all other action plans</b>	<b>28,743,600,566.00 FCFA</b>	€ 43,919,337.00
<b>Total Costs for Implementing the ESMP et all other action plans including a 10% contingency budget</b>	<b>31,257,184,272.00 FCFA</b>	€ 47,751,270.00

## **8. Public Consultations and Public Disclosure**

Consultation is an integral part of every phase in the EIA implementation. This involved information dissemination and interactions/dialogues with the various stakeholders in the proposed project area including professionals in relevant fields of engineering, science, health, and environmental issues. This was used to intimate them of the proposed project and associated activities, solicit/articulate their views, concerns and expectations on pertinent issues of environmental, social and health concern for integration into the impact prediction, assessment, evaluation and mitigation. As part of the ESIA undertaken in 2006 and 2011 as well as during subsequent technical studies between 2013 and 2017, public consultation has been undertaken to obtain baseline conditions, identify impacts and mitigation measures which were incorporated into the impact assessment process.

## **9. Conclusion**

Evaluation of ESIA data found that the project is environmentally feasible and will not cause serious effect to the environment, provided that the existing and proposed mitigation and compensation measures are implemented. The ESMP developed would ensure that the procedures for managing the possible impacts of the proposed project as well as for implementing the environmental and social commitments made are developed and maintained throughout the project cycle. The proposed project is considered to offer substantial net potential and associated benefits and to be environmentally sustainable. The project will have significant beneficial impacts on the socio-economic life of the host communities and will contribute towards alleviating the energy crisis in Cameroon.



## 10. Contacts and References

### Contacts

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### References

Several documents were reviewed during the preparation of this ESIA Summary. These are presented in Annex 1 below.

#### Appendix 1: List of studies reviewed during the preparation of this ESIA Summary

No	Year	Reference	Description
1	2006	<i>TECSULT et SOGREAH (2016). Projet d'aménagement hydroélectrique de Nachtigal – Cameroun. Etude d'Impact environnemental. Ref. 05-14566. Rapport Final pour la Compagnie camerounaise de l'aluminium (ALUCAM). Novembre 2006.</i>	The first ESIA on the site undertaken on behalf of the Project Proponent ALUCAM (Rio Tinto) assessed potential impacts associated with the construction of hydropower plant and transmission lines. The Terms of Reference (TOR) (Annex 1) for the ESIA studies were approved by the Government of Cameroon on 18 May 2006 and the ESIA study completed in November 2006 included environmental and social baseline studies (Chapter 6 and Annex 3), a summary of potential impacts (Chapter 6.15), an assessment of the impact significance for the pre-construction, construction and operational phases of the development (Chapter 7) and an outline ESMP (Chapter 9) with recommendations for additional environmental and social studies and the development of a more detailed and robust ESMP.
2	2011	<i>AECOM et SOGREAH (2011). Projet hydroélectrique de Nachtigal. Mise à jour de l'étude d'impact environnemental et social. Ref. 05-21513. Rapport Final pour la Compagnie camerounaise de l'aluminium (ALUCAM). Septembre 2011.</i>	The ESIA was prepared as an update of the 2006 ESIA, considering changes in the environmental and social setting around the project area as well as technical changes to some of the project components. The ESIA was undertaken based on approved TOR (Annex 1) and was structured in the same format as the 2006 ESIA.

No	Year	Reference	Description
3	2014	EDF (2014) Projet hydroélectrique de Nachtigal Amont. Addendum à l'Etude d'Impact Environnemental et Social de Septembre 2011. No 300.10. Etude environnemental complémentaires : Etat initial de la qualité de l'air. Ref IH-NACHT-DEVV-RAPP-ES.00004A. Un rapport pour EDF, IFC, Rio Tinto Alcan and le Gouvernement du Cameroun.	Baseline Study – Air Quality
4	2014	EDF (2014) Projet hydroélectrique de Nachtigal Amont. Addendum à l'Etude d'Impact Environnemental et Social de Septembre 2011. No 300.11. Etude environnemental complémentaires : Etat initial de la du bruit. Ref IH-NACHT-DEVV-RAPP-ES.00005A. Un rapport pour EDF, IFC, Rio Tinto Alcan and le Gouvernement du Cameroun.	Baseline Study - Noise
5	2014	EDF (2014) Projet hydroélectrique de Nachtigal Amont. Addendum à l'Etude d'Impact Environnemental et Social de Septembre 2011. No 300.17. Etude environnemental complémentaires : Etude biodiversité. Ref IH-NACHT-DEVV-RAPP-ES.00005A. Daté 20/11/2014. Un rapport pour EDF, IFC, Rio Tinto Alcan and le Gouvernement du Cameroun.	Baseline Study – Biodiversity (flora and fauna)
6	2015	EDF (2015) Projet hydroélectrique de Nachtigal Amont. Addendum à l'Etude d'Impact Environnemental et Social de Septembre 2011. No 300.18. Etude environnemental complémentaires : Etude inventaires piscicoles (état initial du peuplement piscicole) Ref IH-NACHT-DEVV-RAPP-ES.00007A. Daté 03/04/2015. Un rapport pour EDF, IFC, Rio Tinto Alcan and le Gouvernement du Cameroun.	Baseline Study – Fisheries
7	2015	EDF (2015) Projet hydroélectrique de Nachtigal Amont. Addendum à l'Etude d'Impact Environnemental et Social de Septembre 2011. No 300.18. Etude environnemental complémentaires : Etude inventaires piscicoles (état initial du peuplement piscicole) Ref IH-NACHT-DEVV-RAPP-ES.00007A. Daté 03/04/2015. Un rapport pour EDF, IFC, Rio Tinto Alcan and le Gouvernement du Cameroun.	Baseline Study – Fisheries
8	2015	EDF (2015) Projet hydroélectrique de Nachtigal Amont. Addendum à l'Etude d'Impact Environnemental et Social de Septembre 2011. No 300.18. Etude environnemental complémentaires Synthèse de l'impact du Projet Hydroélectrique de Nachtigal Amont sur le peuplement piscicole. Ref IH-NACHT-DEVV-RAPP-ES.00032A. Daté 18/11/2015. Un rapport pour EDF, IFC, Rio Tinto Alcan and le Gouvernement du Cameroun.	Assessment of impacts of the Nachtigal project on fisheries and fish populations
9	2015	Egis International (2015). Projet Hydroélectrique de Nachtigal. Plan de Gestion des Afflux Sociaux. Rapport Final. Ref. CSL140204S Date 25/09/2015. Un rapport pour EDF Cameroun SA and la République du Cameroun.	Social Influx Management Plan
10	2015	EDF (2015). <i>Projet Hydroélectrique de Nachtigal Amont. Mécanisme de gestion des requêtes et des plaintes.</i> 15/10/2015. Un rapport pour EDF, IFC,	Complaints Management Procedure

No	Year	Reference	Description
		<i>Rio Tinto Alcan and le Gouvernement du Cameroun.</i>	
11	2015	Lino, M., Schaeren, G. et Barus, C. (2015). Aménagement Hydroélectrique De Nachtigal. PANEL TECHNIQUE Revue de l'APD provisoire. Date 31/03/2017. Un rapport pour EDF, IFC, le Gouvernement du Cameroun.	Technical and Constructability Studies
12	2016	Artelia (2016). Projet Hydroélectrique de Nachtigal Amont. Mise à jour de L'EIES de 2011 sur les nouveaux aspects du projet : Centre Technique D'enfouissement Des Déchets, Activités D'extraction / Carrière De Latérite and Rejet De La Centrale De Traitement Des Eaux. Ref 8541191 daté 17/11/2016. Un rapport pour EDF.	<p>An assessment of environmental impacts associated with the following new components of the project :</p> <ul style="list-style-type: none"> <li>• Waste Management Centre (based on the waste hierarchy) to manage waste streams during all phases of the project</li> <li>• Water Treatment Plant for the facility</li> <li>• Description of the laterite quarrying and storage areas</li> </ul> <p>The identified environmental mitigation measures were integrated into the project ESMP.</p>
13	2016	<i>IRD (2016) Etude Archéologique Complémentaire A L'Etude D'impact Environnemental Et Social Du Projet De Construction Du Barrage De Nachtigal-Amont. Un rapport pour EDF, IFC, le Gouvernement du Cameroun. 17/06/2016</i>	Baseline study – Archaeology
14	2016	Groupe d'Études des Populations Forestières Équatoriales et ENDA International Sarl (2016).Construction Barrage Nachtigal Amont. Plan d'Action de Réinstallation et d'indemnisation (PAR)	Resettlement Action Plan (RAP) for the dam construction component (dam, reservoir, power plant, borrow pit and buildings) of the project.
15	2016	Artelia (2016). Projet Hydroélectrique de Nachtigal Amont. Plan de Gestion Environnementale et Social (Version Final). Ref 8541191. Daté 24/10/2016	Environmental and Social Management Plan (ESMP)
16	2016	Artelia (2016). Projet Hydroélectrique de Nachtigal Amont. Élaboration du Plan de Gestion Environnemental et Social (PGES) Detaille : LOT 2A - Plan D'Action Biodiversité (PAB). Ref 8541191. Daté 03/10/2016	Biodiversity Action Plan (including Ecosystem Services)
17	2016	<i>EDF (2016). Nachtigal amont. Cadrage de la stratégie de compensation des espèces piscicoles situées en habitat critique. Ref. E124/SANAG1/E3HNDEV-ES</i>	Biodiversity Action Plan - Fisheries
18	2016	<i>EDF (2016). NACHTIGAL AMONT. Stratégie des mesures d'accompagnement pour la conservation de Ledermanniella sanagaensis et Ledermanniella thalloidea</i>	Biodiversity Action Plan – Conservation Plan for <i>Ledermanniella sanagaensis</i> et <i>Ledermanniella thalloidea</i>
19	2017	<i>Artelia (2017) Upstream Nachtigal Hydroelectric Project. Summary of Environmental and Social Studies. Ref 8541191. Dated 23 May 2017.</i>	<p>The report presents a summary of the major environmental impacts and proposed mitigation measures as well as a number of additional studies undertaken between 2014 and 2016 to complement the approved 2011 ESIA and to enable the preparation of a more detailed and operational ESMP. The additional studies undertaken included:</p> <ul style="list-style-type: none"> <li>• Baseline studies and data collection on meteorology, air quality, noise level, sediment transport including modelling and flora and faunal studies (Section 4)</li> </ul>

No	Year	Reference	Description
			<ul style="list-style-type: none"> <li>• Additional inventories on flora and fauna (terrestrial, aquatic and ecosystem services) (Section 5)</li> <li>• Health Studies and Action Plans (Section 6) including a Social Influx Management Plan (Section 6.3).</li> </ul>
20	2017	Artelia (undated) Upstream Nachtigal Hydroelectric Project.	<p>A concise summary of the following reports:</p> <ul style="list-style-type: none"> <li>• Environmental and Social Management Plan</li> <li>• Livelihood Restoration Plan for Sand Mining Workers</li> <li>• Resettlement and Compensation Action Plans</li> <li>• Local Economic Development Action Plan</li> </ul>
21	2017	<i>Artelia (2017) Projet Hydroélectrique de Nachtigal Amont. Plan de Restauration des Moyens D'existence lies aux carrières de sable affectées par le Projet. Version Final. Ref 8541191, date 23/03/2017</i>	Compensation Management Plan for artisanal sand miners affected by the project
22	2017	<i>Groupe d'Études des Populations Forestières Équatoriales et ENDA International Sarl (2017). Plan d'Action de Réinstallation et d'indemnisation (PAR) Projet Barrage Nachtigal Amont Partie Ligne Haute Tension Barrage-Yaoundé &amp; Cité de l'exploitant Batchenga. Date 17/01/2017</i>	Resettlement Action Plan (RAP) for the Project Component the transmission lines from Nachtigal to Yaoundé and the permanent base camp near Batchenga.