7.1 IINTRODUCTION

This chapter presents the aspects of the project (in construction and operation phase) that can generate significant potential impacts on the natural or human environment, on natural resources, and on ecosystem services. It also includes an assessment of these impacts. Finally, it presents mitigation measures proposed to avoid, reduce, compensate, and manage these impacts.

The impact assessment is based on

- project description in Chapter 3;
- framing of the study in Chapter 4;
- the methodology described in Chapter 5; and
- the identification of the initial state of the site of the project in Chapter 6.

In Chapter 8, the plan for managing and monitoring potential impacts defines the implementation of mitigation and environmental and social monitoring measures.

Major uncertainties regarding impact assessment

The impact assessment presented in this document is based on the knowledge available at the time of this report (February 2018). Given the temporality of studies to date, some data are not yet available to propose a definitive assessment of certain impacts. This concerns in particular:

- Biodiversity: uncertainties related to the presence of sensitive species in the project area, including the chimpanzee in western western chimpanzee and some amphibians.
  → *To overcome these uncertainties, the Project currently provides avoidance of Potentially Sensitive Areas in order to limit any effect of control or direct degradation of sensitive natural environments by Project facilities and construction activities. The Project also provides for further studies to deepen the knowledge of the natural environment of the area, and support the establishment of an action plan for biodiversity compatible with the requirements of the Ivorian regulation and IFC Performance Standard 6.*

- Groundwater: Uncertainties regarding the aquifer's capacity to supply the groundwater to the Project without the drawdown effect (lowering of the aquifer piezometric level) leading to a reduction in the availability of groundwater. water in boreholes and wells that can be used by local residents near the borehole. Uncertainty also about the saline intrusion effect that can be induced by the drawdown.
  → *The Project provides for well testing to determine characteristics of the aquifer at the site, and, by a semi-quantitative hydrogeological study, evaluate the risks of folding and saline intrusion, and their impacts on groundwater uses. In case of impact, definition of a mitigation strategy including study of alternatives for the water supply.*

- Surface water: uncertainties regarding the use of the lagoon for fishing at the point right for the rejection of cooling water, and the potential impact on the income of the fishery. However, modeling studies of the thermal plume in the lagoon show that the impact of the discharge on the water temperature will be low, and within acceptable limits given the Ivorian regulations and the guidelines of the World Bank Group.
  → As part of the Resettlement Action Plan and the Livelihood Restoration Plan, currently being carried out by the BNEDT, take into account the uses of the lagoon and assess the risk of loss of income related to the presence from the point of rejection. Establishment of compensation and livelihood restoration measures for affected fishermen and persons dependent on income from fishing.

7.1.2 Mitigation measures

ATINKOU is responsible for the implementation of the mitigation measures related to the works and the design studies of the project and require the adaptation of the project design, specifications or selection criteria accompanying the invitation to tender. EPC, with the exception of the post and line section for which the State of Côte d'Ivoire is solely responsible.

The engineering, procurement and construction (EPC) firm selected for the project will be responsible for the management of the construction activities. It will be responsible for the proper implementation of the impact management measures under the ultimate responsibility of ATINKOU.

In the operating phase, the new operating and maintenance subsidiary of ERANOVE, ATINKOU, will be responsible for the implementation of the defined mitigation measures. ATINKOU will ensure a planned transition of environmental and social responsibilities related to the plant. The ATINKOU HSE Supervisor will provide the necessary training and support for the provision of information and skills to ensure the proper environmental and social implementation of the project. Regarding the operation of the substation and the HV line, the State of Côte d'Ivoire is responsible for the actions cited by ATINKOU for the plant.

In this context, the description of the mitigation measures specific to each impact identified, is divided into several articles that must be carried out during the construction or operation phase, under the responsibility of ATINKOU or the EPC.

7.1.3 Note on the decommissioning phase

As explained in Chapter 3, Project Description, the plant is designed for a minimum service life of 30 years. Beyond this, the plant can be maintained in operation following maintenance and replacement of equipment as required. The new plant will be the subject of a concession agreement, the term of which should be between 2040 and 2045. It may operate beyond this date, either as part of a concession renewal or under of a retrocession to the state.

The project site is located in an area dedicated to industrial development (see Section 3.1.5), during the years in which the project is in operation until dismantling, the initial condition at the project site is subject to change. important. It is therefore not possible at this stage to determine the nature and extent of the impacts of the dismantling phase. These impacts and the associated mitigation measures will therefore be assessed by the company in charge of operations as far downstream as possible in order to formulate a decommissioning plan that complies with Ivorian regulations and IFC international standards.

When, at the end of its life, the power station will have to be dismantled, dismantling activities will include securing the site, cleaning the equipment, dismantling the equipment and structures, as well as clearing the surface of the site, in accordance with applicable regulatory requirements, international standards and the concession agreement with the state.

While this chapter does not assess decommissioning activities, it is noted that these activities are by nature related to the construction phase, so a number of the mitigation measures described as part of the construction phase will also contribute to the construction phase. minimize the impacts of the dismantling phase.

7.2 *ENVIRONMENTAL AND SOCIAL IMPACTS*

7.2.1 Structure of the Evaluation

This section presents the assessment of the environmental and social impacts of the CIPREL V project. A preliminary analysis of the potential impacts of the project on environmental and social receptors is provided in Chapter 4 Project boundaries and areas. This analysis identified significant impacts for further evaluation. Table 7.1 summarizes the initial sensitivities of the environment and the sources of impact of the project.

The impact assessment is presented in this chapter in the form of two tables describing respectively environmental impacts (Table 7.2) and social impacts (Table 7.2). They indicate in particular

- the environmental or social aspect considered;
- the project component in the construction or operation phase;
- the description of the impact;
- the intensity of the impact (I) and the sensitivity of the receiver (S);
- the severity of the impact;
- proposed mitigation measures for each impact; and
- the severity of the residual impact, after mitigation.

The impacts requiring a more complex quantitative assessment are detailed at the end of the tables.

It should be noted that the actual impacts of the project may be less significant than those identified in the following sections, due to the implementation of mitigation measures incorporated into the project design. Nevertheless, as a precaution, the impact analysis process presented in this chapter is deliberately conservatively maintained at this stage in order to consider as many eventualities as possible..

7.2.2 Environmental impacts

Table 7.1 Evaluation of environmental impacts

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
Air Quality and Climate (AQ)						
CONSTRUCTION						
AQ1 - Construction activities (earthworks, piling, concrete slab, buildings, facilities).	Dust emissions from work and vehicle traffic on unpaved surfaces.	**Low** - Temporary duration.	**Average** - Two houses near the project site, including an inhabited house and a temporary (agricultural) dwelling. The other residents are at the village of Taboth 800 m northwest of the site. Human Receptors near the Autonomous Port of Abidjan along the route between the unloading and loading docks.	**minor**	Implement a grievance management mechanism. Tracking the number of air quality complaints, identifying problem areas and resolving by reducing dust generated by construction work where needed. Implementing good construction practices, including: • prioritize the use of asphalt roads wherever possible; • reduction of dust by water spraying on the dry season access road near residential areas; • speed limits for construction vehicles (maximum 30 km / h for heavy vehicles in populated areas); • prohibition of the movement of construction vehicles outside designated areas; • cover vehicles carrying friable equipment; • maintenance of vehicles and all construction equipment in a clean condition; • minimizing the storage of friable material and remote location of populated areas; no burning of cleared vegetation or waste (unless specifically authorized); • installation of wind barriers around key construction areas.	**Negligible**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
AQ2 - Presence of vehicles / transport and construction equipment	Emissions of PM10, PM2.5, NOx, SO2 and NO2 by vehicles and generators running on diesel.	**Low -** Temporary duration.	**Average -** Two houses near the project site, including an inhabited house and a temporary (agricultural) dwelling. The other residents are at the village of Taboth 800 m northwest of the site. Human Receptors near the Autonomous Port of Abidjan along the route between the unloading and loading docks.	**minor**	Sensitize subcontractors to use construction equipment that meets international standards in terms of exhaust gas and their regular maintenance to ensure optimal combustion and limit emissions of pollutants (soot, unburned, NOx). Check the use of construction equipment that followed the regulatory technical visits by the service providers. Implementing good construction practices, including: • speed limits for construction vehicles (max 30 km / h); • prohibition of the movement of construction vehicles outside designated areas; • maintaining vehicles and all construction equipment in good working order; and • travel management to reduce the movement of vehicles.	**Negligible**
OPERATIONS						
AQ3 - Atmospheric emissions from the cooling system.	The forced draft cooling system causes the emission of salt water droplets. The emission of fine droplets is limited to 0.0005% of the water flow through the use of droplet eliminators, ie 0.1 m^3 / h (see Chapter 3). Saline fallout can affect vegetation, soil quality and infrastructure, but in a limited radius around the plant.	**Average -** Emissions limited by eliminators but droplets occur continuously	**Low -** Environment adapted to the presence of salty sea air No sensitive vegetation, infrastructure and agricultural land in the immediate vicinity of the plant.	**minor**	Installation of efficient drift eliminators capable of reducing emissions to 0.0005% of the water flow.	**minor**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
AQ4 - atmospheric emissions of the plant.	The combustion of the gas will mainly lead to the emission of atmospheric pollutants of the PM10, CO, and NOx type. Impacts on ambient air quality are modeled using the CALMET-CALPUFF software. The main results are presented in Section 7.2.4 and the modeling methodology is detailed in Appendix A. Greenhouse gas emissions (31% reduction in CO2e emissions per unit of energy produced by the combined cycle).	**Low**	**Average -** acceptable air quality in the project area of influence, few populations in the immediate vicinity of the project or in the emission dispersion area, as predicted by modeling study (see section 7.2.4 below).	**Negligible**	• Implement an air quality monitoring program for the first 3 years of the operation phase to measure ongoing real NO2 and PM10 concentrations at the community level. Define an alert procedure in case of exceeding the air quality standards (public information, protection of sensitive persons). • Continuous centralized monitoring of emissions from the GCC stack to ensure emission levels in accordance with facility specifications. • Perform periodic maintenance of the installations to ensure their maintenance in good working order. • Quantify the annual GHG emissions of the plant in accordance with international methodologies and best practices.	**Negligible**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
Noise and vibration (BR)						
CONSTRUCTION						
BR1 - Construction activities (clearing, earthworks, dock and access path development, piles, concrete slab, buildings, installations).	Sound emissions generated by construction activities.	**Low** - Temporary duration, limited scope.	Minor to Average - Two houses near the project site, including an inhabited house and a temporary (agricultural) dwelling. The other residents are at the village of Taboth 800m north-west of the site	**minor**	Implementation of good construction practices. • plan and promote the construction activities that are noisy and close to the Receptors during the day; • Avoid, as far as possible, noisy construction activities on the project site at night; • install noisy project elements as far as possible from Receptors (eg generators, storage and loading areas, etc.); and • Implementation of a plan for monitoring noise emissions and ambient noise levels at the Receptors near the plant site. • Establishment of a grievance management system and follow-up of noise complaints to take additional action if necessary.	**Negligible**
BR2 - Presence of vehicles / transport and construction equipment	Sound emissions generated by traffic and the presence of vehicles and transport and construction equipment	**Low** - Temporary duration, limited scope.	**Average** - As above. Relatively low population density along the project access roads	**minor**	construction machinery will be regularly maintained to minimize noise. Implementation of good construction practices, including: • limit the use of construction and transport equipment at night in the vicinity of the Receptors (eg at the quay of the CHEC and the northern half of the access road); • turn off machine horns during night time activities;	**Negligible**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
					• speed limits for construction vehicles (max 30 km / h for heavy vehicles in residential premises.) • prohibition of construction vehicles; • training drivers on good driving practices (ie avoid using the horn, smooth acceleration, etc ...); • taking into account the manufacturer's data for noise emissions for the selection of vehicles under lease procedures and / or outsourcing; • implementation of mitigation devices for noise emissions on trucks, where necessary and possible (eg exhaust silencer); • establishing a plan for monitoring ambient noise levels at the Receptors near the access road; and • vehicle maintenance in good condition. • Establishment of a complaints management system to take additional measures if necessary.	
BR3 - River Transport.	Noise emissions from the transport boats of materials, gear and equipment (if transport on lagoon chosen for the construction phase).	**Low** - Temporary duration, limited scope. Additional river traffic-related to the marginal project.	**Low** low population density along lagoon, and limited sensitivity in view of the low barge traffic expected	**Negligible**	Avoid operations at loading and unloading dock and river transport on Ebrié lagoon at night.	**Negligible**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
OPERATIONS						
BR4 - Noise emissions.	Impact from the operation of the plant (chimneys, boilers, turbines, cooling systems). The impacts on ambient noise levels are modeled using software SoundPLAN v7.3 and are described in more detail in Section 7.2.4.	During the day: Negligible in the village of Taboth (N1, N2) and the farm to the west (N5) Minor at house level within 400m of the power plant (N3, N4) Overnight: Minor in Taboth village (N1, N2) and farm in the west (N5) Moderate at house level within 400m of the power plant (N3, N4)	**Average -** Two dwellings near the project site, including an inhabited house and a temporary (agricultural) dwelling. The other residents are at the village of Taboth 800 north west of the site. (see Chapter 6.3).	**Negligible** (N1,N2, N3, N5) to **minor** (N4) during the day **minor (**N1, N2, N3, N5) to **moderate** (N4) Overnight	Perform a sound environment measurement campaign in the first year of operation of the open-cycle power station and the first year of operation in combined cycle, day and night at the relevant Receptors to verify the actual exceeding of applicable standards . Plan a consultation with the beneficiaries of the two houses near the plant to consider: • An improvement of homes to make them less prone to station noise; A repurchase of ownership and relocation to a site less close to the plant (RAP issue).	**minor**
BR6 - Vibrations.	Vibrations generated by the project during operation. The expected vibrations are those of the turbines. The foundations of the turbines will be independent of the rest of the structure. The vibrations will be transmitted to the ground but given their frequency and energy, they will be very quickly absorbed by the soil. So there will be no transmission outside the boundary of the building.	**Low**	**Low**	**Negligible**	No measures of identified additional mitigation.	**Negligible**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
Living Environment and Landscape (CP)						
CONSTRUCTION						
CP1 - Construction activities (clearing, earthworks, dock and access path development, piles, concrete slab, buildings, installations).	Presence of vehicles and construction machinery, and aesthetic impact on the landscape between the dock and the project site.	**Low** – changes to landscape limited and temporary	**Low** – low to medium population density. Rural agricultural landscape (plantations) in and peri-urban (Sassako)	**minor**	Implementation of good construction practices. Limit lighting as much as possible. The sites will have to be repaired at the end of the works. In particular, all waste and unused materials will have to be removed. The relief in the initial state of the soil around the site must be rehabilitated (eg evacuation or replacement of the excavated material). Leveling of construction areas to avoid the effects of relief and erosion of soil or turbid runoff.	**minor**
CP2 – Land use by the plant and associated infrastructure (road, pipeline, powerline)	Presence of project facilities and infrastructure and aesthetic impact on the landscape. Forced draft cooling tower to avoid the installation of a natural draft tower 100m high.	**Average** – Result in changed landscape compared to initial state	**Low** – area not valued for its aesthetic value.	**minor**	Implementation of good construction practices.	**Negligible**
CP3 - Development of the site and related infrastructure for the construction of the line, the gas pipe and the water discharge pipe	Impacts on the landscape by clearing.	**Average -** Changes limited to construction areas, temporary duration	**Low -** low population density.	**minor**	The construction zones will be rehabilitated at the end of the works. In particular, all waste and unused materials will be evacuated. Leveling of construction areas to avoid the effects of relief and erosion of soil or turbid runoff. .	**minor**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
OPERATIONS						
CP4 – Atmospheric emissions from the plant	Plume of steam ("white smoke")	**Low –** Plume visible only at certain times depending on weather conditions (dew point and wind)	**Low** - area not valued for its aesthetic value.	**Negligible**	No measures of identified additional mitigation.	**Negligible**
CP5 - Production of waste on the plant site	Presence and accumulation of waste (cuttings, domestic, etc.) and impact on the landscape.	**Low**	**Low** - area not valued for its aesthetic value.	**Negligible**	Establishment of Waste Management Plan according to the hierarchy principle of waste management: reduce, reuse, recycle, recover, final disposal (see Chapter 8, ESMP). Conduct an inventory of waste and implement a performance monitoring system.	**Negligible**
CP6 - Presence of the line (pylons line) and the water discharge pipe	Changing the landscape	**Low** (water discharge pipe) - underground pipe **Average** (line) **-**area semi-natural, little existing infrastructure.	**Average –** low to medium population density	**moderate**	Optimize track of the line to avoid the most populated areas (see Chapter 3). .	

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
Soils (SO)						
CONSTRUCTION						
SO1 - Clearing, backfilling, and land use of the plant, associated infrastructure (road, dock).	Soil deterioration in the areas occupied by the facilities and infrastructure of the project.	**Low** - limited extent.	**Low** - low quality soils, loose and sandy surface (see Section 6.4).	**minor**	Implementation of good construction practices: • ensure that imported backfill are inert and non-polluted; • storage of cleared land for future use as fill or / and rehabilitation of temporary construction areas; • rehabilitation of temporarily disturbed areas as soon as possible once the work is completed; and • if necessary, disposal of surplus land in a designated collection site.	**Negligible**
SO2 - Waste production and waste water on the plant site.	Soil contamination generated by waste generated and wastewater (regular and household waste, construction waste, chemical and hydrocarbon waste, wastewater). A sorting and storage area for construction waste will be developed. A complete sanitary sewage collection system will be installed on site for the use of staff during the construction phase. Wastewater will be collected in a tank and treated before discharge. Hard surfaces will be drained and water treated by an oil separator before being discharged.	**Low** - unlikely contamination, limited amount of waste.	**Low** Medium to - low quality soils, loose and sandy surface (see Section 6.4).	**minor**	Implementation of the Waste Management Plan in the construction phase according to the hierarchy principle of waste management: reduce, reuse, recycle, recover, final disposal. Monitoring the quality of the waste water to ensure compliance with applicable standards.	**Negligible**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
SO3 - exceptional accidental event.	Soil contamination following a spill of oil or other hazardous substances.	**Low** - unlikely.	**Low** low to medium quality soils in most of the area of influence, loose and sandy surface (see Chapter 6.4).	**minor**	Implementation of the measures outlined in the Hazardous Substance Management Plan and Response to Spill, including: • the design of all retention areas with sufficient capacity; • establishment of a program for the inspection and maintenance of storage areas (storage of oil and fuel, etc.) and fuel lines (eg inspection of the refueling station for food cars) ; • provision of spill kits at locations where hazardous materials are handled (eg oil spill kits: granules, carpets, etc.); • procedures for the maintenance of machinery and mobile equipment for these activities to be carried out on impervious surfaces or under conditions allowing the recovery of oils; • procedures for the storage and processing of oils; and • Full fuel for mobile equipment will be provided at the refueling station, which has a concrete surface and anti-spill gun	**Negligible**
SO4 – vehicles and transport and construction equipment	Impact on the soil through compaction phenomenon	**Low –** Limited extent to construction and circulation areas	**Average -** soils sensitive to compaction, natural regeneration possible	**minor**	Prepare a traffic plan indicating the traffic and site areas. Apply the limitations of load and speed on track.	**Negligible**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
SO5 - Clearing corridors for the gas pipeline, water discharge pipe, access roads and track layouts	Impacts on wetland habitats and species of dependent flora and fauna. Risk of erosion.	**Average -** long-term duration (natural restoration of habitat difficult), Presence of swamp forests along the route of the line and the management of water discharges.	**Strong –** Habitat critical (swamp forest) and sensitive (shoal).	**major**	Avoid clearing and development in swamp forests (critical habitats). Minimize the crossing (creation of access track, clearing of the corridor) of the shoal areas (if possible, bypass them). No pylons or access roads located in shoal areas, limiting the influence of the line to the overhanging effect. No permanent maintenance road under the line. If lowland traversal was made necessary by field constraints: first carry out a detailed inventory of flora and fauna to confirm the absence of endangered species on the IUCN route list; if such species are present, propose a compensation plan. Reduce as much as possible the clearing and disturbance of riparian vegetation.	**minor**
SO6 – Management of hazardous waste and products along the route of the line and the gas and water pipes Risk of accidental spillage	Soil contamination following a spill of oil or other hazardous substances.	**Strong -** Large amount of waste generated by the works, of various types, inert and dangerous.	**Strong -** Soil and groundwater sensitive to pollution of hazardous liquid waste	**major**	Waste will be evacuated to the appropriate and approved disposal routes. Storage areas for hazardous products and wastes will be designed to prevent waste from being washed away and liquids from flowing to the ground (closed sealed containers, soil sealing, retention, etc.) . Storage of dangerous products, oils and fuels on retention (eg cans and drums on retention). Train staff in accident response procedures for hazardous materials. Provision of emergency response equipment on construction sites and equipment for spills of dangerous goods. Staff will be made aware of the need for good waste management at regular EHS points.	**Negligible**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
OPERATIONS						
SO7 - Air Emissions.	Emissions of salty droplets at the end of the cooling tower and fallout in the immediate vicinity. This results in the accumulation of a salt deposit on soils in a narrow radius around the plant.	**Average** - limited extent, long term.	**Low** - Low quality soils, loose and sand. Soils already slightly saline by exposure to sea air (see Chapter 6.4).).	**moderate**	Installation of efficient drift eliminators capable of reducing emissions to 0.0005% of the water flow.	**minor**
SO8 - Waste generation and waste water on the plant site	Soil contamination generated by waste produced (ordinary and household waste, chemical and hydrocarbon waste). Wherever possible, all wastewater produced by the plant will be recycled. Non-recycled water will be treated on site and discharged into the Ebrié lagoon via a collection basin. The cleaning water of the TAG will be collected in a dedicated pit and treated externally. The water collected at the bottom of the chimney during the shutdown of the plant will be collected in a dedicated pit and sent to the treatment plant. Rainwater loaded with oil will be stored in a buffer tank and sent to the deoiling unit. After 15 minutes of rain, the runoff water from the surfaces developed on the ground will be sent directly to the storm basin. The fire water will be sent to the de-oiling unit before being directed to the storm pond. Domestic wastewater will be collected separately and sent to	**Low** - unlikely contamination , waste limited .	**Low** low to medium quality soils, loose and sandy surface (see Chapter 6.4).	**minor**	Implementation of the Solid and Liquid Waste Management Plan according to the hierarchy principle of waste management: reduce, reuse, recycle, recover, final disposal. Establishment of a Wastewater Management Plan to ensure the proper implementation of the measures described in Chapter 3, Description of the project, to recover all wastewater (service, cooling and rainfall on contaminated surfaces), to treat them, to reuse them as much as possible and to check their quality with regard to the norms applicable before their discharge in the lagoon.disposal.	**Negligible**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
	the septic tank. Industrial water will be treated in a neutralization unit before being sent to the storm basin. The quality and flow of water from each discharge source will be monitored continuously and must comply with applicable local and international standards.					
SO9 - Exceptional accidental event.	Soil contamination following a spill of oil or other hazardous substances.	**Low** - unlikely.	**Low** Medium to - low quality soils, loose and sandy surface (see Section 6.4).	**minor**	Implementation of the measures outlined in the Hazardous Substance Management Plan and Response to Spill, including: • design of all retention areas with sufficient capacity; • the establishment of a program for the inspection and maintenance of storage areas (aerial chemical tanks, storage of oil and fuel, etc.) and fuel lines; • provision of spill kits at locations where hazardous materials are handled (eg oil spill kits: granules, carpets, etc.); • procedures for the maintenance of machinery and fixed and mobile equipment for these activities to take place inside the workshops or under conditions allowing the recovery of contaminated oils and water; • procedures for the storage and treatment of used oil; and • Full fuel for mobile equipment will be provided at the refueling station, which has a concrete surface and anti-spill gun.	**Negligible**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
SO10 - Management of hazardous products and waste during maintenance of the line and the gas and water pipes	Impact on soil quality.	**Low -** limited maintenance activities (low frequency), few waste products (low intensity)	**Strong –** soils sensitive to pollution from liquid waste	**moderate**	Hazardous products and waste should be managed to prevent the risk of soil or water pollution from runoff. The waste will be evacuated to the appropriate and approved disposal routes. Storage of dangerous products, oils and fuels on retention (eg cans and drums on retention). Train staff in spill response procedures. Staff awareness at EHS points..	**Negligible**
Groundwater and Surface waters (ES)						
CONSTRUCTION						
ES1 – Clearing of the site and work areas Modification of soil permeability due to construction activities, progressive construction of the plant and associated infrastructure (road, wharf).	Modification of the soil surface and surface water flow due to clearing, earthworks and the presence of infrastructure earth and the presence of infrastructure; affects the quantitative aspect of groundwater recharge (direct infiltration of rainwater). A layer of gravel will serve as a temporary top layer to access and circulation tracks within the site to allow water infiltration. The roads will then be asphalted or concreted at the end of the construction phase.	**Negligible** - marginal surface area relative to the recharge surface of the water table, permanent duration.	**Average –** permeable soil with sufficient groundwater recharge	**Negligible**	No measures of identified additional mitigation.	**Negligible**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
ES2 - Runoff of rainwater and discharge of domestic wastewater from the workers' living site	Modification of the soil surface and surface water flow due to the presence of infrastructure; influences the qualitative aspect of the runoff water by soil erosion and the formation of potential hydrocarbons. Hard surfaces will be drained and water treated by an oil separator before being discharged. A layer of gravel will serve as a temporary top layer for access and circulation tracks within the site to allow water infiltration and thus limit surface runoff. A waste water collection system will be installed on site for the use of personnel during the construction phase. The wastewater will be collected in a tank and processed before their rejection.	**Low** - small area of installations, measures planned in the design to limit uncontrolled releases.	**Low** – strong dilution capacity of the lagoon, water already at room temperature (see Chapter 6.3).	**minor**	Implementation of good construction practices. Establishment of a Wastewater Management Plan to ensure the proper implementation of the measures described in Chapter 3, Description of the project (hard surface drainage, oil separator, complete sanitary system and water treatment waste). Monitoring the quality of the waste water to ensure compliance with applicable standards.	**Negligible**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
ES3 - Transport on the lagoon (if necessary, to be confirmed in the context of detailed engineering), risk of oil and fuel leakage.	Impact on water quality of the canal and the lagoon.	**Low** – limited duration, low probability.	**Low** - Strong dilution capacity of the lagoon, already high ambient temperature water (see Chapter 6.3).	**minor**	Sensitize the barge transport subcontractor to inspect the barge prior to its use in the project to ensure there are no oil and fuel leaks. Sensitize the subcontractor in charge of the barge transport so that it ensures the maintenance in good operating condition of the barge, carry out the necessary inspections, repairs and interviews (possibly to supervise with the selected carrier and to be included in the contract clauses and the E & S monitoring program).	**Negligible**
ES4 – Risk of oil spill	Accidental spill of hydrocarbons on site or following a transport barge accident (if transport on lagoon chosen by the project) resulting in groundwater pollution and / or surface water.	**Low-** low probability	**Low** - Strong dilution capacity of the lagoon, already high ambient temperature water (see Chapter 6.3).	**minor**	Implement the measures described in the Hazardous Substances Management and Response Plan, including: • measures described in SO9 against soil pollution; • the measures described in ES3 for maintaining the barge in good working order, including navigation and communication systems; • measures to prevent accidents related to river traffic; and • emergency response measures in the event of a river accident to limit the worsening of the situation, reduce the barge to the port if possible and limit water pollution.	**Negligible**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
OPERATIONS						
ES5 - Consumption of Water from the lagoon	Impact of water intake on the amount of surface water: Lagoon water consumed at a rate of 960m³ / h as makeup water for the plant cooling system (see Chapter 3, Project Description).	**Low** - low amount of water consumed in relation to the available stock.	**Low** - water available in sufficient quantity.	**Negligible**	No measures recommended mitigation.	**Negligible**
ES6 - Discharge of cooling water in the lagoon	Impact on quality of surface water: Continuous release of water at theoretical maximum temperature of 33.55 ° C (see Chapter 3, Project Description). Water parameters will be checked prior to discharge (pH; PO4 <2.5 ppm, free chlorine <0.2 - 0.5 ppm).	**Low** - According thermal plume modeling performed by the Project increase in temperature between 0.21 ° C and 1.68 ° C up to a distance of 100 m from the cooling water discharge point.	**Low** - Strong dilution capacity of the lagoon, already high ambient temperature water (see Chapter 6.3).	**minor**	Establishing a Wastewater Management Plan to ensure the proper implementation of the measures described in Chapter 3, Project Description, to control the release of water parameters in accordance with the applicable standards .	**minor**
ES7 - Consumption of groundwater for the plant (for water service Central: 20 m³ / h in steady mode - see Chapter 3, Project Description).	Impact on the amount of groundwater by a drawdown of water table.	**Average** - Long-term, continuous consumption, moderate amount in relation to water availability.	**Low** - high soil permeability and significant recharge rate of the watertable, a food source for local populations (see Section 6.4).	**minor**	As part of the design study of the drilling of the site for its water supply, ERANOVE plans to carry out a more detailed assessment of the impact of pumping on the water table, and in particular the cone of drawdown and its effect on the surrounding boreholes (if present). An analysis of the piezometric level of groundwater and the quality of groundwater will be conducted once a quarter to detect any alarming decline in the level and any potential contamination caused by the project.	**Negligible**
	Impact on water quality due to saline intrustion when creating a cone of depression and/or lowering the water level of the	**low to Average** -	**Average –** underground water	**moderate**		**minor**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
	lagoon causing the intrusion water from the lagoon in the water table.		consumed by the inhabitants of Taboth in the absence of clean fresh water source nearby.		In the event of an impact on the quantity (lowering of the water table) or quality (eg saline intrusion), the project will evaluate the possibilities of reducing water consumption and / or alternative sources (p. eg desalinated seawater). If groundwater pollution is identified, authorities and communities should be informed and measures taken to eliminate the source of the impact and manage impacted sites.	
ES8 - Discharge of service wastewater into lagoon	Impact on quality of surface water.	**Average** - long duration, quantity of rejected water important but water rejected treated and complies with the applicable standards.	**Low** - Strong dilution capacity of the lagoon, brackish water not used for human consumption, no particularly sensitive natural environment in the lagoon.	**moderate**	Establishing a Wastewater Management Plan to ensure the proper implementation of the measures described in Chapter 3, Project Description, to treat all discharged service water and contaminated stormwater to be controlled the parameters of the discharge water in accordance with the applicable standards. The results of the monitoring of the quality of the discharged water will be communicated periodically to the relevant environmental authorities (CIAPOL) and will be made available during the follow-up audits. In case of non-compliance of certain parameters additional measures will be taken.	**minor**
ES9- Waste generation.	Contamination of surface water generated by the waste produced (ordinary and household waste, chemical and hydrocarbon waste). *The cleaning water from the TAG and the chimney will be collected in a dedicated pit and treated externally and equipped with means to load the trucks with the contaminated cleaning water.*	**Low** - unlikely contamination, limited amount of waste.	**Average** - water quality of the lagoon degraded in initial state (see Section 6.4).	**minor**	Establishment of the Waste Management Plan according to the hierarchy principle of waste management: reduce, reuse, recycle, recover, final disposal. Establishment of a Wastewater Management Plan to ensure the proper implementation of the measures described in Chapter 3, Project Description, to recover all wastewater (cleaning, service, cooling and rains on contaminated surfaces), to treat them, to reuse them as far as possible, to check their quality against the standards applicable before their rejection in the canal and to treat them externally if necessary.	**Negligible**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
ES10 - Accidental oil spill	Risk of groundwater pollution	**Low -** limited probability	**Strong** - high degree of vulnerability of the watertable due to the high permeability of the ground, water source of food for local populations.	**moderate**	Implementation of the measures described in the Hazardous Materials Management Plan and Response to Spill: see SO9.	**minor**
	Risk of pollution of surface waters.	**Low** - unlikely.	**Strong -** lagoon used for fishing, swimming (see Section 6.4).	**moderate**		**minor**
ES11 Exceptional accidental event (eg transportation accident, oil storage leak, fires, explosions, natural disasters etc.).	Risk of groundwater pollution.	**Low** - unlikely	**Strong** - high degree of vulnerability of the watertable due to the high permeability of the ground, water source of food for local populations.	**moderate**	Implementation of the measures described in the Hazardous Materials Management Plan and Response to Spill: see SO9. Development and implementation of a Emergency Prevention and Response Plan (see Chapter 8, ESMP). Based on an identification of all feasible emergencies, this plan will identify measures for prevention, intervention procedures and reporting procedures to be followed in case of emergency or natural disaster.	**minor**
	Risk of pollution of surface waters.	**Average** - Long-term, continuous use, small amount in relation to water availability.	**Strong -** lagoon used for fishing, swimming (see Section 6.4).	**moderate**		**minor**
ES12 - Consumption of groundwater by the operational town	Impact on the quantity of groundwater by depletion of the water table and risk of saline intrusion if the level of the aquifer falls below sea level and creates a cone of depression at the well.	**Low** - long duration, quantity of water discharged low	**Low** - high soil permeability and high recharge rate of the water table, a source of food for the populations (see Chapter 6.4)	**minor**	See ES7 measures.	**Negligible**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
SS13 - Discharge of previously treated domestic sewage and runoff from the site into the lagoon.	Impact on quality of surface water.	**Low** - Quantity of water discharged low, water treated prior	**Low** - Strong dilution capacity of the lagoon, already high ambient temperature water (see Chapter 6.3).	**minor**	See ES8 measurements. Treat all domestic wastewater in the city with a treatment plant before disposal. Collect rainwater from parking areas and treat in a de-oiler before discharge. After 15 minutes of rain, the runoff water developed surfaces on the ground will be directly sent to a storm basin.	**Negligible**
Ecology of the lagoon						
CONSTRUCTION						
EC1 – Discharge of wastewater and stormwater into the lagoon (see ES1 & ES2).	Discharge of waste water from the living area and construction site and runoff of contaminated rainwater in the Ebrié lagoon.	**Low** - small area of installations, measures planned in the design to limit uncontrolled releases.	**Low** - Low sensitivity of the biodiversity of the lagoon (see Section 6.5) in relation to the discharge.	**minor**	Implementation of good construction practices. Establishment of a Wastewater Management Plan to ensure the proper implementation of the measures described in Chapter 3, Description of the project (hard surface drainage, oil separator, complete sanitary system and water treatment waste). Monitoring the quality of the waste water to ensure compliance with applicable standards.	**Negligible**
EC2 - River transport (see ES3) and lagoon dredging (alternative option)	Disruption of biodiversity and degradation of the aquatic environment of the lagoon (noise under water of river transport, risk of leaks oils and fuel).	**Low** - limited duration.	**Low** - Low sensitivity of the biodiversity of the lagoon (see Section 6.5) with respect these activities.	**minor**	Sensitize the barge transport subcontractor to inspect the barge prior to its use in the project to ensure there are no oil and fuel leaks. To sensitize the subcontractor in charge of the barge transport so that it ensures the maintenance in good operating condition of the barge, carries out the inspections, repairs and necessary interviews (possibly to supervise with the selected carrier and to integrate in the clauses of the contract and the E & S monitoring program).	**minor**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
	In case of dredging: • Increased turbidity of the water due to the suspension of particles. • Physico-chemistry effects of sediments from dredging. • Impacts on the hydrodynamics and geomorphology of the seabed Impact on the benthic environments of the lagoon..				If the alternative of barge transport on the lagoon to a wharf in N'djem is chosen, CIPREL will carry out a complementary study to determine the impacts of dredging and to define appropriate mitigation measures.	
EC3 – Risk of accidental oil spill (See ES4)	Accidental spill of hydrocarbons on site or following a boat accident resulting in pollution of the lagoon.	**Low-** low probability	**Strong -** lagoon used for fishing, swimming (see Chapter 6.4).	**moderate**	Implementation of the measures described in the Management Plan for Hazardous Substances and Spill Response, including: measures described in ES4.	**minor**
OPERATIONS						
EC4 - Release of cooling water into the lagoon (see ES6).	Discharge of treated and heated water, at the exit of the circuit of plant cooling (see project description in Chapter 3).	**Low** - Based on the thermal plume modeling performed by the Project, increasing the temperature from 0.21 ° C to 1.68 ° C at a distance of 100 m from the cooling water discharge point	**Low** - High dilution capacity of the lagoon, brackish water not used for human consumption, no particularly sensitive natural environment in the lagoon.	**minor**	See ES6.	**minor**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
EC5- Discharge of service wastewater into the canal (see ES8).	Discharge of the service wastewater from the power station in the Ebrié lagoon	**Low** - long term, rejected water treated and in compliance with applicable standards.	**Low** - High dilution capacity of the lagoon, brackish water not used for human consumption, no particularly sensitive natural environment in the lagoon.	**minor**	See ES8.	**minor**
EC6 - Air emissions from the cooling tower (see QA3, SO4).	The forced draft cooling system causes the emission of salt water droplets. The emission of fine droplets is estimated at 0.1 m^3 / h. (see Chapter 6.1).	**Low**- long-term, rapid fallout (near plant site) and dilution in water. .	**As above**	**Negligible**	See AQ3 and SO7.	**Negligible**
EC7 – Waste Production (see ES9)	Contamination of surface water generated by waste products (ordinary and household waste, chemical waste and hydrocarbon).	**Low** - unlikely contamination, limited amount of waste.	**As above**	**minor**	See ES9.	**Negligible**
EC8 - exceptional accidental event (see ES10, ES11).	Risk of degradation of the water quality of the lagoon.	**Low** – low probability.	**As above**	**minor**	See ES10 and ES11.	**minor**
Terrestrial Biodiversity (BT)						
CONSTRUCTION						
Important Note - In order to address the uncertainties regarding the sensitivity of natural environments and species in the Project area, particularly with respect to the presence (or not) of the West African chimpanzee and some amphibians, the Project intends to deepen knowledge of the Project area, with a view to refining critical habitat analysis (as per IFC Performance Standard No. 6) in the area, and developing (where appropriate) a plan for action for biodiversity (BAP), consistent with the expected level of impact of the Project, and compatible with conservation issues of the sensitivities of the natural environment and the requirements of Performance Standard 6						
BT1 - Clearing of the site of the plant and the management of water discharges, work areas during construction.	Loss of natural natural habitats useful for terrestrial biodiversity (habitat, food). Risk of destruction and collision of small wildlife.	**Average** – temporary duration.	**Low** - Absence of sensitive species and interest for conservation, presence of modified habitat (coconut plantation). Absence of sensitive	**minor**	Avoid sensitive areas to avoid impact directly (including bypassing the swamp forest located in the route of rejection towards the lagoon) Limit the clearing area to a minimum with only one access to the site. Prohibit any access of Project personnel to natural areas	**minor**

			habitats from the point of view of the possible presence of chimpanzees (avoidance of sensitive areas).		outside the site, especially areas of swamp forest. Prohibition of any purchase of bushmeat and any hunting or disturbance of flora and fauna by Project personnel. Clearing to be done according to a precise plan of clearing favoring the escape of the fauna (from the inside to the outside). Use a reduced level of illumination whenever possible. Limit lighting upwards to near and above the horizon as far as possible (see CP1). Speed limit of construction machinery and trucks at 30km / h. Revegetation in the clearing area of the water discharge pipe. See other measures AQ1, AQ2, BR2 and BR2 to mitigate the impact on air quality and the sound environment.	

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
BT2 - Clearing of the line corridor, access roads and track layouts	As above	**Average -** long-term duration (natural restoration of habitat difficult), wetlands present along the route.	**Strong –** Critical and sensitive habitats near the track (swamp forest / shoal)	**major**	Avoidance policy. Choice of electric line layout to avoid the most sensitive habitats (swamp forest, raffi palm grove). No habitat considered for cross critical under IFC Performance Standard 6. Avoid any clearing and development of access roads in the marsh area (critical habitats). Reduce as much as possible the clearing and disturbance of riparian vegetation and large isolated trees. Prohibit any access of Project personnel to natural areas outside the site, especially areas of swampy forest. Prohibition of any purchase of bushmeat and any hunting or disturbance of flora and fauna by Project personnel.	**moderate**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
BT3 - Construction activities (earthworks, piling, concrete slab, buildings, facilities).	Noise light and air emissions from construction activities, vehicles and associated facilities. Risk of collision with wildlife.	**Low** - Temporary duration and limited impact in the vicinity of the project area.	**Average** - Potential / sporadic presence of chimpanzees in the immediate area of influence of the Project	**minor**	Speed limit on construction machinery and trucks at 30km / h. Use a reduced level of illumination whenever possible. Limit lighting upwards to near and above the horizon as far as possible (see CP1). See other measures AQ1, AQ2, BR2 to mitigate the impact on air quality and the sound environment.	**minor**
BT4 - Presence of labor and housing of workers.	Disturbance of wildlife due to noise emissions, human presence and removal of valuable space for biodiversity.	**Low** - Temporary duration.	**Average** - Potential / sporadic presence of chimpanzees and other sensitive species.	**minor**	Placement of living site at a distance from sensitive habitats (for example south of the plant site, along the Avagou-Taboth road - in all cases, within reasonable distance of any swamp forest or potentially sensitive shoal) . Awareness of the workforce to the preservation of wildlife. Prohibition of purchase of bushmeat, hunting, disturbance of flora and fauna. Develop good environmental practices within the company. Communication of rules on the attitude to adopt towards biodiversity (prohibition to hunt, kill or deliberately harm an animal species present on the site, encourage the escape of the fauna encountered before the start of work, prohibition of dispose of waste in the wild, prohibition of exotic species on the site, prohibition of the use of herbicides or selection of the least environmentally harmful herbicides, take preventive measures against accidental ignition of vegetation , reduce the risk of collision, etc.)	**Negligible**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
OPERATIONS						
BT5 - Air emissions from the plant	Salt deposition around the project site, linked to fine salt droplet emissions, modifies the salinity of soils and therefore of the terrestrial ecosystem in the immediate vicinity of the site.	**Moderate** - Accumulation over time but limited deposit radius around the plant.	**Low** - Dominant winds towards non-agricultural and poor biodiversity areas, soils exposed to salty sea air from the coast (see Chapter 6.4).	**moderate**	See QA3 and SO7.	**minor**
BT6 - Noise emissions and human presence on the plant site	Noise emissions from the plant, its night lighting and the human presence outside the plant are likely to disturb the local wildlife.	**Average -** Night lighting and noise will be limited.	**moderate -** Potential presence of chimpanzees (to be verified in additional studies) that may be sensitive to noise. No site conducive to the permanent presence of chimpanzees in the immediate vicinity of the plant. Limited human presence outside the plant site, excluding periods of construction and maintenance.	**moderate**	See BR4 and BT3 in particular regarding the policy of avoidance of sensitive habitats in the Project.	**Negligible**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
BT7 - Construction and use of an operational town for the power plant.	Footprint of the city leading to the removal of natural environments from terrestrial biodiversity.	**Low**	**Low**	**minor**	Site selection for the town avoiding any sensitive habitat. Development of the necessary additional studies and obtaining planning and construction permits. If the town is developed on a natural area, carry out an assessment of the impact of this project on biodiversity. See measures BT1, BT2, BT3.	**Negligible to Minor**
BT8 - Presence of the infrastructure of the line (pylons and cables)	Risk of collision and electrocution of birds.	**Strong -** Permanent duration, one of the leading causes of unnatural mortality for birds (source: CMS, AEWA / MOP 5.38, 2012). Risk of more moderate electric shock on the HV lines than for MV and LV (larger difference between the conductors).	**Average -** Sensitivity varies by species, risk of average electrocution for large birds and raptors. Absence of particularly sensitive species.	**major**	In accordance with the EHS guidelines of the World Bank for power lines: • maintain a spacing of at least 1.5 m between drivers; • maintain a spacing of at least 1.5 m between conductors earthed elements, and when this is not possible, isolate energized parts and earthed elements. • install signaling devices on guard cables (eg balls, flappers, spirals). Integrate these design measures in the contract with EPC. Maintain these devices periodically.	**moderate**

7.2.3 Social Impacts

Table 7.2 Evaluation of Social Impacts

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
Local governance, demography and social dynamics (DG)						
CONSTRUCTION						
DG1 - Land acquisition for the plant.	Loss of legitimacy for local authorities following the acquisition of land by the project.	**Average** - 42 hectare footprint of the relatively limited site.	**Average** - Traditional local authorities are considered as administrators and protectors of land rights. Low land pressure at the plant. Public consultations have highlighted a limited sensitivity to the loss of land associated with the influence of plant.	**moderate**	Compensation for the loss of customary rights (Decree No. 2014-25) in accordance with the law. Incorporate a representative village committee and the Ministry of Construction into the land acquisition and customary rights compensation process, in accordance with the law. Develop and implement a functional Grievance Mechanism, accessible to all and widely communicated throughout the life of the project.	**minor**
DG2 - Presence of labor and housing of workers.	Changing the traditional family structure due to the flow of job-seeking migrants, especially single men, and potential change in the ethnic composition of the area. Increases in single mother or father households and potentially risky practices (drug use, prostitution). Increased social tensions caused by migration flows and competition for salaried positions, other economic activities and natural resources in the area. Tension and possible social conflicts between the workforce of the project	**Average -** temporary duration, large number of workers (about 2000 in peak of construction) for a small population in the study area, local extension, housing of the employees in base of life and not in the local communities.	**Low -** relatively heterogeneous population, immigrant component small, inadequate infrastructure and basic services.	**major**	Integrate local people into the Stakeholder Engagement Plan by developing a transparent and regular dialogue during the construction and operation phase. Develop and implement a functional Grievance Mechanism, accessible to all and widely communicated throughout the life of the project. Assign the part-time role of Community Liaison Officer to an employee of the company who will act as a bridge between the project and the local communities. Development of a Code of Conduct, a Drug Use Policy, rules for the use of the living area and access to external communities, and awareness of the importance of adopting culturally appropriate behaviors interactions with the local community.	**minor**

	housed in the living area and the local communities of the area. Loss of legitimacy of local authorities as a result of the population's concerns about the presence of labor and population growth.				Avoid hiring at the entrance to the plant. Set up a recruitment and information center at Abidjan and Jacqueville and not at Taboth. Communicate clearly and widely on manpower requirements, required qualifications and recruitment procedures.	

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
OPERATIONS						
DG3 - Presence of workers and their families.	Inequality, tension and possible social conflicts between the workforce of the project housed in the base exploitation life and the local communities of the zone.	**Low** - long term but number of workers limited to 70	**Average -** relatively heterogeneous population, immigrant component small, inadequate infrastructure and basic services.	**minor**	See DG2	**minor**
Mobility and Transport (MT)						
CONSTRUCTION						
MT1 - Redevelopment of the track between the unloading bay and the power plant, and vehicle traffic.	The development of the existing track into an asphalt road for the project could reduce access to this runway and crossing opportunities to reach the canal banks.	**Low** - temporary duration, section impacted reduced.	**Average** - little used and little traveled road, means of reduced mobility, road used to access the canal bank and the south of the island.	**minor**	Provide crossing areas to ensure the safe passage of pedestrians. Ensure the respect of vehicle speed limits (30km / h on track for construction vehicles). Maintain free passage on a pedestrian strip 1m wide all along the track during construction. Develop and implement a functional Grievance Mechanism, accessible to all and widely communicated throughout the life of the project.	**Negligible**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
MT2 - Presence of vehicles / transport and construction equipment on the public road in the industrial zone of Vridi or N'djem at the exit of the Jacqueville bridge if the alternative is chosen	Increase in the density of traffic and degradation of the public road near the Port of Abidjan (especially Blvd de Vridi) if point C is chosen as the loading dock (see Chapter 3). Increase in the density of traffic and degradation of the public road at the Jacqueville bridge on the N'djem side if the alternative wharf is retained.	**Low** - Temporary duration, uncertain probability, length of track limited to 3.7 km.	**Average** - A partially degraded and regularly congested public road, the bridge at point 2 is not designed for the heaviest loads.	**minor**	Favor platform B (see Chapter 3) for unloading. If platform C is selected, ensure that the total load meets the deck capacity at point 2.	**Negligible**
MT3 - River Transport.	Increased river traffic and disruption of the passage of boats for the transport of construction equipment and materials: imported equipment will cross the Vridi Canal and construction materials and equipment will be transported by barge from the port of Abidjan to Vridi, then by road transport to Taboth. Port Authorities, Customs and Offshore Companies were consulted. The possibility of unloading directly from the ship on the barge in the bay, not far from the jetty of the site has been confirmed. The project should not disturb the river traffic of the port and the canal. The alternative is a barge-to-ballast transport of materials to a wharf at the Jacqueville bridge and then a road transport to Taboth.	**Low** - Temporary duration, limited traffic: only one barge will provide round trips between the port and the unloading bay.	**Low** - Users accustomed to heavy river traffic to the initial state.	**Negligible**	Respect the rules of navigation in the lagoon, near the port and in the canal.	**Negligible**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
Welfare, health and safety (BS)						
CONSTRUCTION						
BS1 - Construction activities (clearing, earthworks, piling, concrete slab, buildings, facilities).	Risk of accident related to the possible presence of people external to the construction site. Noise emitted by construction activities and equipment present on site. Emissions of particulate matter and combustion fumes from work and vehicular traffic on unpaved surfaces. Changing the landscape and the living environment.	**Average** - Temporary duration and day, distance between the project site and the village and village mostly outside the area under the prevailing winds. Ambient air clean and well renewed by the sea winds.	**Average** - Calm rural environment unaccustomed to industrial construction activities. Taboth is located 1 km northwest of the project site.	**moderate**	Close construction areas before work begins and control entry to the site. Implement additional measures for repeated complaints about noise and air quality in construction activities. Assign the part-time Community Liaison Officer role to a company employee who will act as a bridge between the project and the local communities and escalate potential traffic and construction related complaints. See measures AQ1, BR1, CP1, CP2.	**minor**
BS2 - Presence of vehicles / transport and construction equipment..	Risk of accident with the users of the track. Emissions of PM10, PM2.5, NOx, NO2 and SO2 and greenhouse gases from diesel powered vehicles and generators. Noise from vehicles and construction machinery on the runway and public roads.	**Average** - Temporary duration and during the day. Uncrowded track and clean air and renewed well in the initial state. Track under prevailing winds over	**Strong** - Calm rural environment unaccustomed to industrial construction activities.	**major**	See measures AQ2, BR2, CP1, CP2, MT1, MT2, MT3. Implement additional measures in case of repeated complaints about noise and air quality of transport activities. Assign the part-time Community Liaison Officer role to a company employee who will act as a bridge between the project and the local communities and escalate potential traffic and construction related complaints.	**moderate**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
BS3 – Presence of workforce	Workers' interaction with the local population: risk of social unrest and risk of transmission of sexually transmitted diseases.	**Average** - Intermittent frequency unlikely event, labor-intensive (approx. 2000), accommodation in basic living site area but with possibility to leave (living site not contained)	**Strong –** Poor population and relatively unaccustomed to interactions with strangers.	**major**	Develop and implement a functional Grievance Mechanism, accessible to all and widely communicated throughout the life of the project. Assign the part-time role of Community Liaison Officer to an employee of the company who will act as a bridge between the project and the local communities. Development of a Code of Conduct, a Narcotic Drugs Use Policy, rules for the use of the life base and access to external communities, and awareness of the importance of adopting culturally appropriate behaviors interactions with the local community. Awareness of workers on STDs, on the prohibition of prostitution of minors. Information on the means of HIV testing.	**minor**
BS4 – Presence of workforce	Risk of non-compliance with certain workers' rights, working conditions that do not comply with applicable standards and accidents at work.	**Low** - unlikely, but some of the low-skilled jobs may be of foreign origin in a context where labor law is not always applied.	**Strong -** high vulnerability of employees in a context of competition for employment, level of qualification and relatively low education.	**moderate**	Development and implementation of a Hygiene, Health and Safety Management Plan (see Chapter 8) which will detail in particular the different risks at work, procedures and measures to reduce these risks. Development and implementation of a Emergency Prevention and Response Plan (see Chapter 8) which will define in particular the measures to be implemented to ensure the safety of employees in the event of a major accident. Ensure the presence of an infirmary and emergency evacuation service at the project site. Ensure working conditions and workers' rights in accordance with local regulations and IFC's PS2 and ILO standards. Indicate these conditions and rights in the EPC's HR policy and employment contracts and communicate this information to employees. Develop living area and procedures within the living area in accordance with the IFC Standards and Procedures for Housing Workers (2009).	**negligible**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
BS5 - exceptional accidental event.	Risk of accident, bodily injury, equipment or environmental pollution in the event of an exceptional accidental event of the construction activities (shipping accident, loss of cargo, explosion, fire, fuel leakage, etc.).	**Low –** low probability.	**Strong** - High vulnerability: poverty, lack of insurance, social and medical security, dependence on the quality of the natural environment as a source of livelihood.	**moderate**	See measures SO3, ES4. Ensure the proper management (depollution, containment etc. depending on the nature of the problem) of soils and groundwater possibly contaminated following an exceptional accidental event at the plant.	**minor**
OPERATIONS						
BS6 - Air Emissions.	Impact on the well-being and health of the plant's air emissions in the gas regime.	**Average** - continuous emission.	**Low -** limited impact of the plant on air quality.	**minor**	See measures AQ1, AQ2, AQ3	**Negligible**
BS7 - Noise emissions.	Impact on the well-being and health of the local population related to noise emissions from the power plant in operation (chimneys, boilers, turbines, cooling systems).	**Average** at night, **Low** the day - A low exceedance of IFC noise limits is observed at night for approximately 50 nearby homes but not during the day.	**Average** - Impact of noise limited during the operation phase; except for two houses near the plant, one of which is temporary.	**moderate**	See BR4 measures. Provide consultation with rights holders of two houses near the plant to consider: • An improvement of homes to make them less prone to station noise; • A repurchase of ownership and relocation to a site less close to the plant (RAP issue). Implement additional measures in the event of repeated complaints about the noise level of the plant. Implement additional measures in the event of repeated complaints about the noise level of the plant.	**minor**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
BS8 - Presence	Potential risk of non-respect of certain workers' rights, non-compliant working conditions and workplace accidents.	**Low** - unlikely, low number of employees and mostly indeterminate, semi-skilled and national jobs.	**Average -**competition context for employment, level of qualification and average education at high.	**minor**	See BS4 measures.	**Negligible**
BS9 - exceptional accidental event.	Risk of accident, personal injury, equipment or environmental pollution in the event of an exceptional accident (explosion, fire, fuel leakage, etc.).	**Low –** low probability .	**Strong** - High vulnerability: poverty, lack of insurance, social security and medical, addiction to the quality of the natural environment as a source of livelihood.	**moderate**	See measures SO6, ES11, ES12. Provide compensation for material and immaterial damage and possible bodily injury caused by an accidental event related to construction and transportation activities. Ensure the good management (depollution, containment etc. depending on the nature of the problem) of soils and groundwater possibly contaminated following an exceptional accidental event related to construction and transport activities.	**minor**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
Electromagnetic Field (EMF)	Potential public health impact from exposure to the electromagnetic field	**Average -** EMF intensity below the line and at 2m height well below the exposure limits (100 µT, 5000V / m according to the recommendations of ICNIRP (1998) and the European Union (1999)	**Average** The research carried out could not formally identify a possible risk to health, nor did it exclude it.	**Low to Moderate**	Choose a phase configuration to limit the magnetic field induced by the line. Avoid the installation of high-voltage lines above or near residences and other buildings that are almost permanently occupied (eg schools, offices, hospitals, etc.) in accordance with IFC EHS standards for the transport of electricity. If necessary, move houses located inside the building corridor. Prohibit the installation of dwellings in the corridor of the line during the operating phase (operator). Raise awareness and inform people about the prohibition to install homes in the corridor of the line and the potential health risks of electromagnetic effects.	**Negligible to Low**
Tenure (OF)						
CONSTRUCTION						
OF1 - Land occupation by the plant.	No physical displacement planned. Loss of customary use rights	**Average -** surface and limited natural resources.	**Average** - Rural area with average and increasing land pressure.	**moderate**	See DG1 measures.	**minor**
OF1 – Land occupation by the electric line	Physical displacement of some homes in the power line corridor. Economic displacement of agricultural activity present in the corridor of the electric line	**Average** - Large impacted area, temporary duration (prohibition to practice perennial agriculture but opportunity to practice annual agriculture in	**Strong -** Poor population whose livelihood depends mainly on the farm and the collection of natural resources (firewood, natural culinary plants, fruits, etc.)	**major**	See DG1 measures	**minor**

		operation phase, the natural resources present on along the corridor are limited (mainly farmland)				

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
OPERATIONS						
OF2 – Land occupation by the operating city	No planned physical displacement.	**Average –** surface and natural resources limited	**Average** - Rural area with average and increasing land pressure.	**moderate**	See DG1 measures	**minor**

Project Component	Description of the impact	Intensity of the impact (I)	Receptor sensitivity (S)	Project Component	Description of the impact	Intensity of the Impact
Access and use of natural resources (AU)						
CONSTRUCTION						
AU1 - Land use of the plant, associated infrastructure (road, dock).	Loss of access to natural resources at the plant site and along the runway (fodder for livestock, small firewood, food and medicinal plants, palm oil).	**Low** - limited impact area, limited natural resources present.	**Average** - population whose subsistence is partially based on the exploitation of this type of resource, grasses mostly present along the runway, site of the plant little exploited for its grasses, minor exploitation of firewood and palms on the site, wide presence of alternative areas and more abundant in natural resources.	**minor**	See DG1 measures.	**Negligible minor**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
AU2 – Land occupation by the electric line	Loss of access to natural resources in the corridor of the power line that will be cleared (fodder for livestock, small firewood, food and medicinal plants, palm oil).	**Average** - moderate impact area, significant natural resources present.	**Average** - poor population whose subsistence is partially based on the exploitation of this type of resource, grasses mainly present along the runway, site of the plant little exploited for its grasses, minor exploitation of firewood and palms present on the site, wide presence of alternative areas and more abundant in natural resources.	**moderate**	See DG1 measures.	**Negligible**
AU3 - Dust emissions from construction activities.	Reduction of plant production due to the dust on the leaves.	**Low** - expected dustfall in limited quantities from areas in close proximity to the runway and project site.	**Average** - presence of agricultural crops near the work areas.	**minor**	See AQ1 measures. Implement additional measures in case of repeated complaints about the dust on agricultural areas nearby.	**Negligible**
AU4 - Presence of vehicles and construction machinery on the access road.	Risk of cattle colliding on pasture or crossing along the access trail	**Average -** temporary duration, pasture area along access road limited	**Average -** pasture areas used by livestock, important livelihood for pastoralists, availability of alternative pastures.	**moderate**	See MT3 measures. Limit disposal areas as far as possible along the runway during development. Prohibit the passage of gear and clearing outside the construction area to ensure the maintenance of the grassy area located on both sides of the track. Rehabilitate temporary construction areas along the runway for grass growth after the work	**Negligible to minor**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
AU5 - Presence of labor and housing of workers	Increased pressure on natural resources for self-consumption and income generation (agriculture, well water, and collection of forest products) generated by the flow of migrants into the area in search of employment. Increased pressure on self-consumed natural resources (berries, fruits, medicinal plants) generated by the project labor force.	**Low -** temporary duration, limited scale of activities.	**Average -** diversity of economic activities and sources of income.	**minor**	Prohibit the collection of forest products (berries, fruits, medicinal plants, etc.) from the project labor force.	**Negligible**
EXPLOITAITON						
AU6 - Emissions	The salt deposit in the immediate vicinity of the project site, linked to fine salted droplet emissions changes the salinity of soils and therefore the agricultural potential of soils.	**Average -** accumulation over time but prevailing winds towards non-agricultural areas. Immediate proximity to the plant.	**Low** - soils and vegetation exposed to salty sea air from the coast (see Chapter 6.4).	**minor**	See AQ3, SO4 and ES9.	**Negligible**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
AU7 - Discharge of wastewater and cooling into the canal	Risk of degradation of the aquatic environment of the lagoon and a decrease of the catch of fishing.	**Average** - long duration, treated and discharged service water in accordance with applicable standards..	**Low to medium**- Alternative fishing areas available. Significant source of income and livelihood for the Taboth population Ecology of the degraded lagoon at baseline (see Chapter 6.4).	**Minor to Moderate**	See ES6, ES8.	**Negligible to Minor**
AU8 - Consumption of groundwater.	Impact on groundwater quantity due to over-consumption of water and drawdown of water table. Impact on water quality due to saline intrusion when creating a cone of depression and / or lowering the water level of the water table below the level of the lagoon or the sea causing the intrusion of water from the lagoon, canal or sea into the water table.	**Average** - long term, continuous consumption, moderate amount in relation to water availability.	**Strong** – groundwater consumed by Taboth residents in the absence of a clean freshwater source nearby. Strong soil permeability and high recharge rate of the aquifer.	**major**	See ES7 measures.	**minor**
AU9 – Land occupation by the operational town	Loss of access to natural resources possibly present on the site of the town (fodder for livestock, small firewood, food and medicinal plants, palm oil, fruit trees, cultivable area, etc.).	**Low** - limited impact area, natural resources not known..	**Average** - poor population whose livelihood is based on the exploitation of natural resources. Availability of alternative natural resources in the project area.	**minor**	Developing the necessary additional studies and obtaining of the urban permits and construction. If necessary (eg if development of the town on a virgin site), take into account the impacts of the town. See measures GD1 and AU1.	**Negligible**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
Jobs and economic activities (EA)						
CONSTRUCTION						
EA1 - Presence of labor, worker housing and migration.	Generating economic opportunities for local communities, especially small businesses and services (workers and households). Job creation at local and national level. Increase in the supply of building materials and consumer goods needed at the living area	**Average** - creation of around 2,000 jobs in the construction phase (temporary employment, maximum figure in peak construction only). Employees in the construction and operation phase living in a home base	**Strong –** Expectations high in the population of a formal job in a context where households live mainly from various livelihood activities and with low and random incomes.	**moderate positive**	• establish a recruitment policy that favors local employment; and • give preference to local procurement of goods and services.	**major positive**
OPERATIONS						
EA2 - Presence of workers and their families.	Same as above	Low - creation of 70 permanent jobs in the operation phase. job creation from households in phase operating.	**Strong** - Expectations high in the population of a formal job in a context where households live mainly from various livelihood activities and with low and random incomes.	**minor positive**	See EA1.	**moderate positive**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
Basic infrastructure and services (IS)						
CONSTRUCTION						
IS1 –Presence of labor and housing of workers.	Migrant flows in the area seeking employment generating additional pressures on basic infrastructure and services, particularly housing, surface water, schools, health posts and sanitation.	**Low** - temporary duration, limited scale of activities, project staff housed in the living area, migrants mostly single households.	**Average** - relatively high population density and population growth, lack of basic services in the area.	**minor**	Measures to limit the flow of migration seeking employment in the Project area: • avoid hiring at the entrance of the plant; • install a recruitment and information center in Abidjan and Jacqueville rather than at the project area; and • communicate clearly about the need for labor, the required qualifications and recruitment procedures.	**Negligible**
OPERATIONS						
IS2 - Presence of workers and their families.	About 70 employees and their families will be housed in a base near the plant site.	**Low** - number of families limited to 70	**Average** - population density and increasing population growth, lack of basic services in the area	**minor**	Ensure the provision of social infrastructure, education and health in the living area, if required.	**Negligible**

Project Component	Description of the impact	Intensity of the Impact	Receptor Sensitivity	Impact Severity	Reduction measures	Residual Severity
Cultural Heritage (PC)						
CONSTRUCTION						
PC1 - Clearing of the site and work areas during construction.	Physical deterioration of tangible heritage sites, deterioration of access conditions, or changes in the environment and setting of sites and associated moral damages for communities.	**moderate** - Presence of sacred and heritage sites identified in the power line corridor directly or indirectly affected by the presence of the Project.	**Strong** - Strong cultural significance of sacred and heritage sites for local communities.	**major**	As part of the RAP, identify the sacred sites present in the Project's right-of-way and proceed with the compensation or relocation of these sites in consultation with the local communities according to a procedure agreed with them. Develop and implement an incidental findings procedure to ensure that unsung or suspected sites are discovered on time and managed appropriately. Identify and assess the sensitivity of sacred sites in the vicinity of the project site. Integrate respect for cultural heritage and the procedures associated with the induction training of workers and visitors.	**minor**

7.2.4 *Quantitative assessments of impacts*

This section presents the results of impact assessments that require a quantitative approach in the form of calculations or modeling. The environmental impacts concerned are the following:

- air quality ;
- the climate ; and
- sound environment.

Air quality

A simulation of the air quality was conducted using the CALMET-CALPUFF recommended by the US Agency Modeling System for Environmental Protection (EPA), a modeling domain of 20 km x 20 km and a resolution of 250 m. The model quantifies concentrations at ground level for the main air pollutants, arising from normal plant operations in its area of influence.

The modeling methodology, the assumptions made, and the results are detailed in Appendix A. The following pollutants are studied:

- nitrogen dioxide (NO2); and
- nitrogen oxides (NOX) in 2016 only.

Two scenarios are studied for the gas power plant:

- Scenario 1 - combined cycle operation; and
- Scenario 2 – open cycle operation.

In the absence of applicable Ivorian standards for ambient air quality, the atmospheric concentrations modeled in both scenarios are compared with the standards specified in the IFC EHS Directive and the European Directives (see Table 7.3).

Table 7.3 Standards for air emissions and ambient air quality

Pollutant	Parameter	Standards SFI µg/m³	Institution/Régulation
NO2	1 hour	200	IFC directive and US Standards(1)
	Calendar Year	40	IFC and US Standards
CD8	8 heures	10000	US Standards(3)

Notes on the limits of the EU standard:
1. The hourly concentration is limited to 18 mesh overruns per calendar year.
2. The daily concentration is limited to 35 mesh overruns per calendar year
3. The maximum concentration averaged over 8 hours is estimated by examining the average of 8 consecutive hours and calculated on the basis of updated hourly data every hour.

Emissions of particulate matter (PM) have not been quantified since emissions of PM by burning gas are considered non-significant.

Scenario 1: Combined Cycle Gas

Table 7.4 presents the maximum concentrations predicted by the model in comparison with the applicable standards and the significance of the impact over the entire spatial and temporal domain.

Table 7.4 Maximum predicted concentrations for the Combined Gas Cycle Scenario

Pollutant	Parameter	Concentration maximum modeled g / m³	Standards µg/m³		% of standard	importance the impact
NO2	1 hour	30.82	200	IFC Directive and US Standards(1)	15.41%	*minor*
	calendar year	0.71	40	IFC and US Standards	1.77%	*Negligible*
CO	8 hours(2)	4.37	10000	US Standards(2)	0.04%	*Negligible*

Notes on the limits of the US standard:
1. The hourly concentration is limited to 18 mesh overruns per calendar year.
2. The maximum concentration averaged over 8 hours is estimated by examining the average of 8 consecutive hours and calculated on the basis of updated hourly data every hour.

All levels of pollution meet the applicable standards of air quality. The modeled concentrations are at least an order of magnitude lower than the associated standard.

The impact on air quality is considered minor when the contribution of the project is less than 25% of the applicable standard. Thus, the expected impact on air quality of the combined cycle operation of the power plant is estimated to be negligible for the CO pollutant, and negligible for the NO2 pollutant.

The iso-concentration maps in NO2 illustrated below, make it possible to identify the location of the maximum concentrations and the measurement sites.

Figure 7.1 Cycle Combined Gas: average annual NO2 concentration

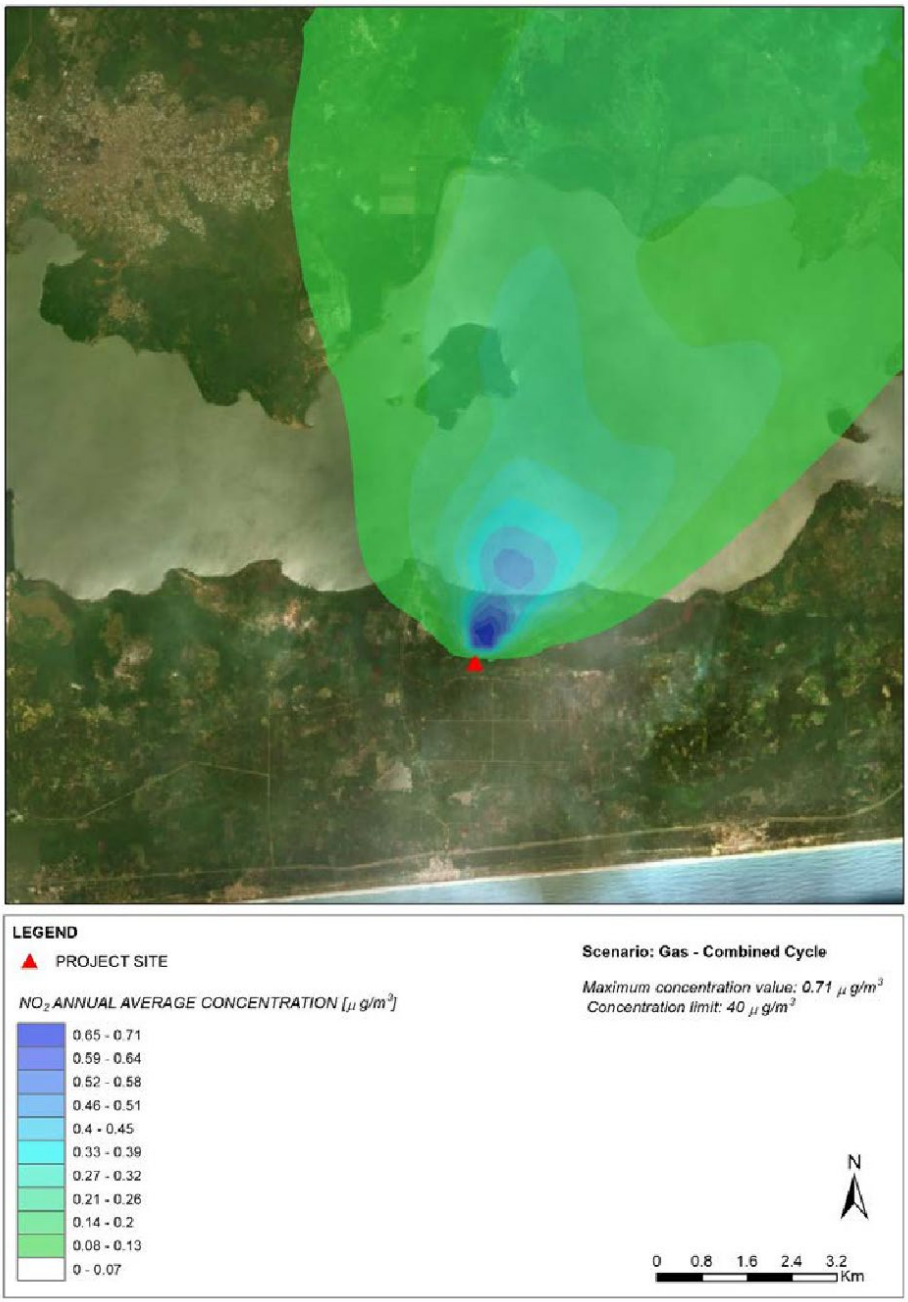
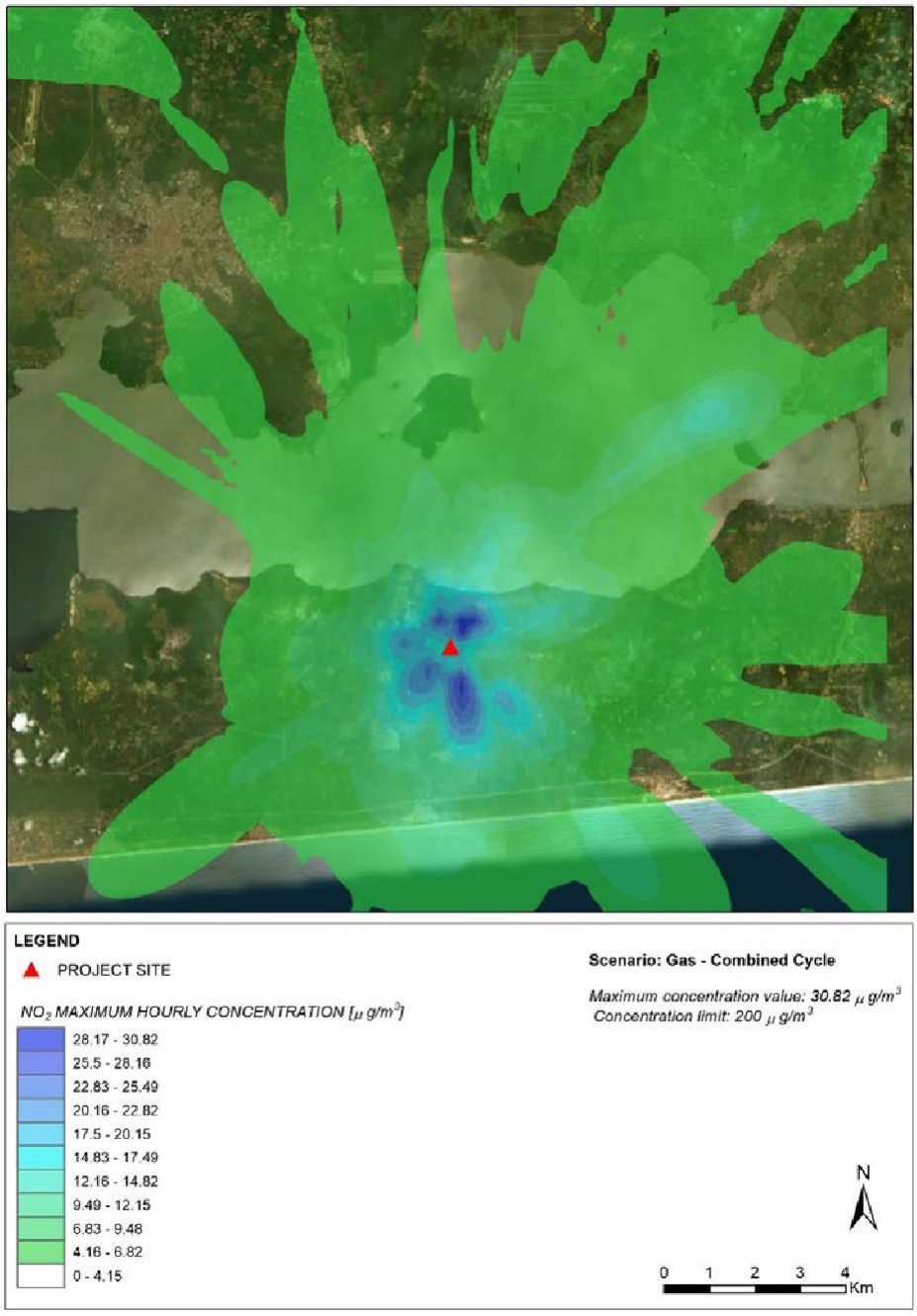


Figure 7.2 Cycle Combined Gas: maximum hourly NO2 concentration



The maximum concentrations are downwind of the project site, northeast of the plant, in the immediate vicinity of the plant. The maximum annual average NO2 concentration is estimated at a distance of 600 m from the project site. These maxima are well below the applicable air quality standards.

The maximum hourly average NO2 concentrations are expected upstream and downstream of the plant but remain confined to a distance of less than 1 km from the plant.

Scenario 2: Open Cycle Gas

Table 7.5 presents the maximum concentrations predicted by the model in comparison with applicable standards and the importance of the impact on the whole field of space and time.

Table 7.5 Maximum predicted concentrations for the Open Gas Cycle Scenario

Polluant	Paramètre	Concentratio maximum n modeled	Standards mcg /	% of standard	Importance the impact
NO2	1 heure	7.79	200 IFC and Directive standard US(1)	3.89	*Negligible*
	Year calendaire	0.04	40 IFC and standard US	*0.09* %	*Negligible*
CD8	hours(2)	0.69	10000 standard US (2)	0.007%	*Negligible*

Notes on the limits of the EU standard:
1. The hourly concentration is limited to 18 mesh overruns per calendar year.
2. The maximum concentration averaged over 8 hours is estimated by examining the average of 8 consecutive hours and calculated on the basis of updated hourly data every hour.

All levels of pollution meet the applicable standards of air quality. The modeled concentrations are at least two orders of magnitude lower than the associated standard.

However, the impact on air quality is considered negligible when the contribution of the project is less than 10% of the applicable standard. Thus, the expected impact on air quality of the combined cycle operation of the power plant is estimated to be negligible, for NO2 and CO pollutants.

The iso-concentration maps in NO2 illustrated below, make it possible to identify the location of the maximum concentrations and the measurement sites.

Figure 7.3 Cycle Open Gas: Annual mean NO2 concentration

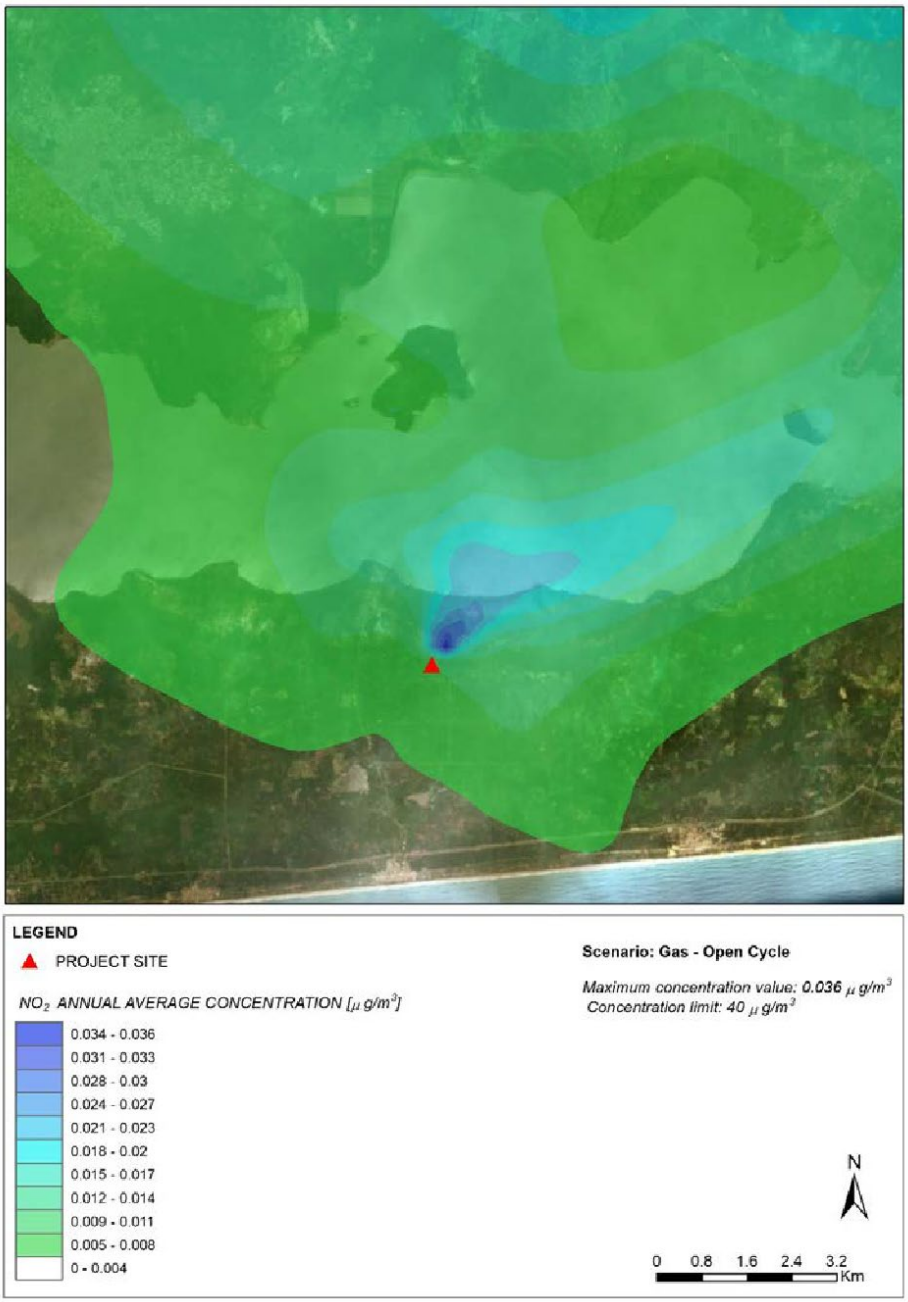
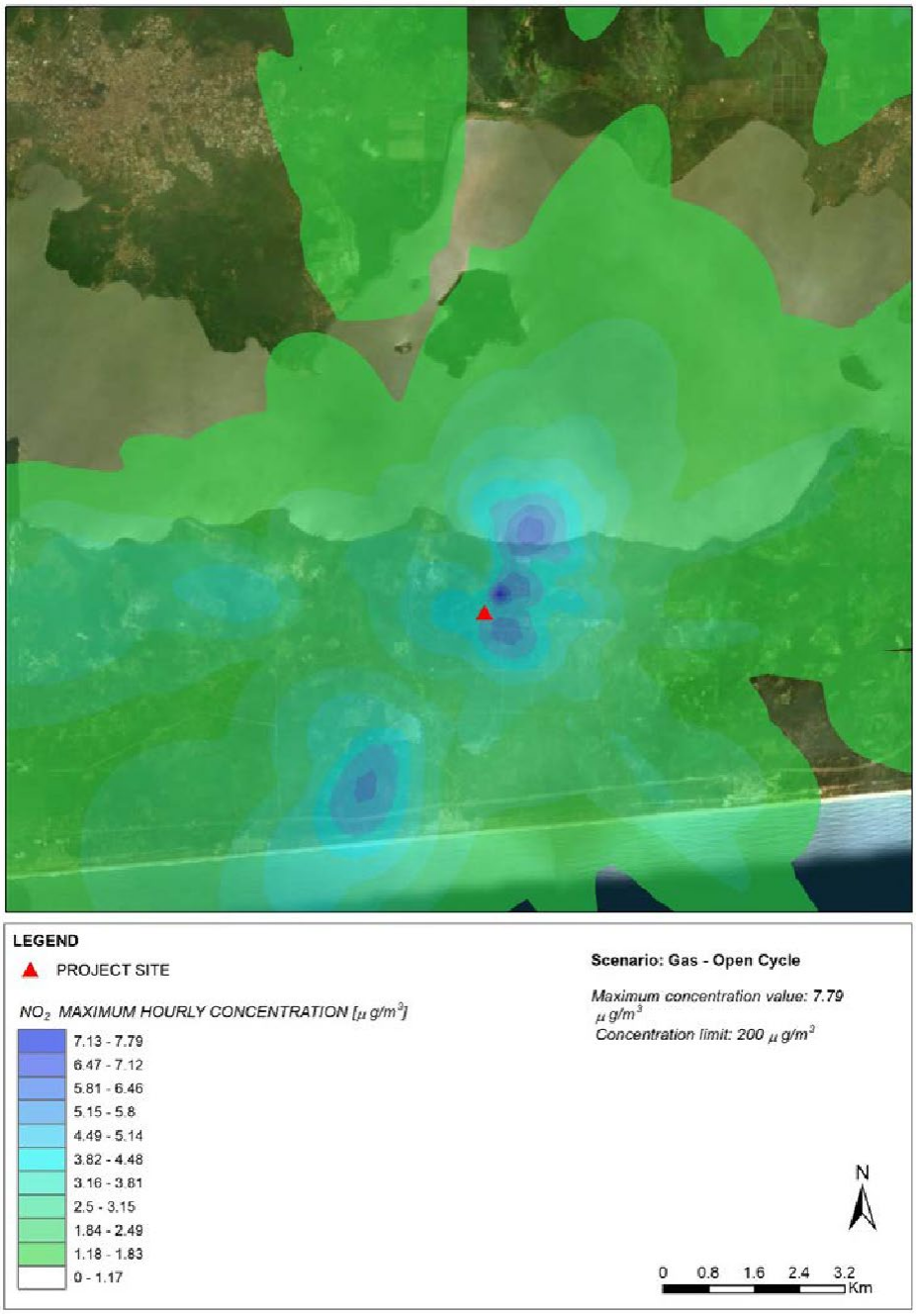


Figure 7.4 Cycle Open Gas: maximum hourly NO2 concentration



The maximum concentrations are downwind of the project site, northeast of the plant and near the plant. Maximum annual and hourly concentrations for NO2 are expected at a distance of approximately 450m northeast of the plant. These maxima are well below the applicable air quality standards.

Climate

Because climate change affects receptors worldwide, the magnitude of the impact and the sensitivity of the receivers can not be determined in the same way as for other domains. The IFC cut-off value of 25,000 tonnes of carbon dioxide equivalent (tCO2e) is used as a trigger for measures to mitigate climate change impacts.

The estimate of the GHG footprint of the project was made on the basis of the company's Accounting and Reporting Standard for the Greenhouse Gas Protocol (1).

The GHGs included in the GHG assessment methodology are the gases covered by the UNFCCC / Kyoto Protocol. Among these, carbon dioxide (CO2), methane (CH4) and nitrous oxide (N2O) are considered the main pollutants for the project depending on the planned activities.

The GHG protocol defines three Scopes for GHG accounting and reporting: Scope 1, 2 and 3. Scope 1 includes direct GHG emissions from the project. Scope 2 includes indirect GHG emissions associated with off-site energy consumption (ie electricity generated from the grid). Scope 3 concerns all other indirect sources of GHG.

A summary of Scope 1, 2 and 3 emissions included in the project is provided in Table 7.6.

Table 7.6 Scope 1, 2, and 3 Emissions for the Project

Scope 1 emissions include sources of combustion. For this first GHG inventory, Scope 1 emissions were included for the gas turbine train, assuming an electrical input of 400 MW. Emissions were estimated using assumed global energy efficiencies of 38% (open cycle) and 55% (combined cycle) and US EPA pollutant emission factors for general gas turbines .
Scope 2 emissions include all emissions associated with electricity imports, heat imports, cold imports and compressed air imports. Since the project aims to provide more power to the grid, the project will be a net exporter of power and, therefore, will not use additional power from the grid. The indirect GHG emissions from Scope 2 are therefore assumed to be zero for the purposes of this preliminary GHG inventory.
Scope 3 emissions include all other indirect emissions, such as (but not limited to) contract and other related activities. For example, this includes emissions associated with any machine or vehicle used by a supplier. For this first GHG inventory, none of the Scope 3 emissions associated with the project were included.

(1) Protocol on greenhouse gases: Corporate Accounting and Reporting Standards (Revised), World Resources Institute.

The annual estimate of GHG emissions, based on the foregoing assumptions is presented in Table 7.7 as follows.

Table 7.7 Estimates of GHG emissions per year

Activity	GHG emissions			
	CO2 [Tonnes / year]	CH4 [Tonnes / year]	N2O [Tonnes / year]	All GHG [Tonnes CO2e / year]
Year 1 – open cycle open	1020874	80	28	1031203
Following years - combined cycle	1085143	85	30	1096208

Assuming :

- *emission factors (AP-42, Fifth Edition, Volume I, Chapter 3.1 (2000)).*
  - *CO2: Fuel consumption 110 lb / MMBTU.*
  - *N2O: Fuel consumption 0.003 lb / MMBtu.*
  - *CH4: Fuel consumption 0.0086 lb / MMBTU.*
- *Global Warming Potentials (2007 IPCC AR4).*
  - *N2O: 298.*
  - *CH4: 25.*
- *Fuel consumption 2335 MMBTU / h (calculated for the open cycle mode to provide 260 MW).*
- *fuel consumption 2482 MMBTU / h (calculated for the combined cycle mode to provide 400 MW).*
- *Approximately 8760 hours of operation per year.*
- *Year 1, 100% open cycle mode; thereafter 100% in combined cycle mode.*

Annual GHG emissions will be greater than 25,000 tCO2e. Based on this preliminary GHG emission inventory, the project GHG emissions during the operation phase are considered significant. It should be noted that combined cycle technology reduces CO2e emissions by 31% per unit of energy produced. In fact, a 400 MW open cycle plant would have emitted 1,586,330 tonnes of CO2eq per year, 31% more than in combined cycle.

In order to comply with the IFC Performance Standards, projects with GHG emissions exceeding 25,000 tCO2e must quantify annual GHG emissions in accordance with international methodologies and best practices (see Section 8.6: Management Plans).

Noise

A simulation of the impacts resulting from the noise emissions emitted by the project activities was carried out using the SoundPLAN v7.4 software. The modeling allows to quantify the sound levels at the receiver levels, resulting from the normal operations of the plant on its zone of influence.

SoundPLAN v.7.4 applies the sound propagation methodology ISO 9613-2 (1), which predicts noise levels in the wind direction. The method takes into account the absorption of air and soil. It is assumed that the soil in the operating area of the power plant is an acoustically hard reflective surface, while the off-site area is assumed to be absorbent. The sound propagation model includes the acoustic screen effect associated with buildings located on the site.

Incoming modeling data are based on the technical description of the project and the meteorological data considered are as follows:

• temperature: 30 ° C;
• humidity: 83%;
• atmospheric pressure: 1013 mbar;
• wind speed: less than 5 m / s; and
• wind direction: northwest. Conservative hypothesis with a wind towards the receivers.

In the absence of confirmation of the mitigation measures put in place on the plant's equipment, a scenario is studied for emissions from the power plant during the operating phase.

Noise scenario - expected performance during plant operation phase

In this scenario, the values of the acoustic pressure levels of the equipment are those specified in the plant specifications.

The power plant shall be designed not to exceed a sound pressure level (NPS) greater than 85 dB (A) at 1 m from equipment at pedestrian traffic areas and at 70 dB (A) at 1m from the outer limit of the Central. The following arrangements are planned to limit the ambient noise level in and around the power plant:

• soundproof container around the TAG;
• buildings around the alternator of TAG and TAV; and
• silencer installed at the TAG air intake, at the boiler outlet and in the bypass chimney.

Acoustic pressure levels (SPL) of the noise scenario at a distance of 1 m from the plant equipment are presented in Table 7.8.

(1) International Organization for Standardization (ISO) (1996); International Standard 9613-2: Attenuation of sound during propagation outdoors - Part: General method of calculation.

Table 7.8 SPL acoustic pressure levels of equipment for the noise scenario

Plant equipment, source of noise	Number of equipment	SPL at 1 m dB (A)
Gas Turbine Exhaust Duct	1	80
Gas Turbine Intake	1	82
Gas Turbine Generator	1	84.0
Gas Turbine Step-up Transformer	1	80.5
Gas Turbine Fin Fan Cooler	1 (12 fans)	70.0
Enclosure (ST body + generator)	1	74.6
Steam Turbine Step-up Transformer	1	80.5
HRSG Body	1	80.0
HRSG Feed Pump	1	81.0
HRSG stack (outlet)	1	97.0
HRSG stack (wall)	1	77.5
Cooling tower	1 (6 fans)	78.0

The modeled noise levels modeled in the scenario are compared with local regulations and the standards specified by the IFC EHS Guidelies.

Table 7.9 Applicable Sound Level Standards

Reference	Ivorian Order No. 01164 for new facilities (2008)		World Bank/IFC Guidelines (An hour LAeq)	
Dining area	*Residential or rural areas with low land, river or air traffic*	*Urban residential areas*	*Industrial*	*Residential*
Day	45 dBA	50 dBA	70 dBA	55 dBA
Period intermediate	40 dBA	45 dBA	-	-
Night	35 dBA	40 dBA	70 dBA	45 dBA
maximum increase compared to the noise level in the initial state	-	-	3 dBA as compared to the noise level in the initial state at the closest sensitive receptors offsite.	

The results of the modeling for both scenarios are presented in Table 7.10. They present the expected sound levels taking into account the participation of the project in the exploitation phase as well as the pre-existing sound floor evaluated during the initial state as described in Section 6.

Table 7.10 Sound levels modeled for both scenarios

Receptor	Distance to the project site	initial Sound levels [1] LAeq [dB (A)] day / night	modeled noise levels [dB (A)]	INCREASE as compared to the noise level in the initial state [dB (A)] Day Night	Applicable sound level standards	
					Ivorian ordinance No. 01164/2008 [dB (A)] Day / Intermediate / Night	IFC [DB (A)] Day Night
Village Taboth (N1)	1100 m	50/47 [2]	43.0	0.5 / 1.5	50/45/40	55/45
Detached house - developing area, extension of the village of Taboth (N2)	1000 m	41.5 / 41.5 [3]	44.0	4.5 / 4.5	50/45/40 [4]	55/45
temporary housing N3)	400m	38.5 / 38.5 [3]	50.0	12/12	45/40/35	55/45
isolated house (N4)	300 m	42.0 / 42.0 [3]	49.5	8/8	45/40/35	55/45
Farm and Home (N5)	1000 m	46.0 / 46.0 [3]	45.5	2.5 / 2.5	45/40/35	55/45

[1] The modeled levels are compared with the lowest initial measurements to allow for a conservative approach in assessing sound increase.
(2) Initial state of night not evaluated. Given the presence of existing noise sources associated with village life (human activities, road traffic, animals, etc.), it has been assumed for the night that the background noise level is 3 dB lower than noise. background day (realistic reduction of noise levels from day to night).
(3) Initial state of night not evaluated. Because the receiver is located in a rural area and lacks sources of noise that can cause significant variations in the acoustic climate between day and night, the background noise level at night has been assumed to be equal to the background noise monitored during the day.
(4) This area is under development and should be an extension of the village of Taboth; it was therefore classified as a future residential area and the same noise limits applicable to the village of Taboth (N1) were considered.

Based on the noise emission scenario for the operation of the plant described in Table 7.8, the noise modeling study yielded the following results.

During the day:

• The Ivorian limits for residential urban areas (50 dBA and 45 dBA) are respected at the level of the N1 and N2 receivers, while the limits of the IFC (45 dBA) are respected at all the receivers;

• The Ivorian limits for rural areas (45 dBA and 40 dBA) are exceeded at the N3 and N4 receptors, the two houses closest to the limits of the plant. However, it is noted that the N3 receiver is a temporary dwelling so no impact is expected in the long term at this receiver.

• A slight emergence is expected at the N5 receptor, however the increase generated by the project above the ambient N5 receptor noise levels will not be perceptible to local populations (emergence of 2.5 dBA)

Overnight :

• The Ivorian limit of 40 dBA for residential areas is exceeded by about 3 and 4 dB at the N1 and N2 receivers respectively. However, the increase over existing background noise generated by the project is not expected to be

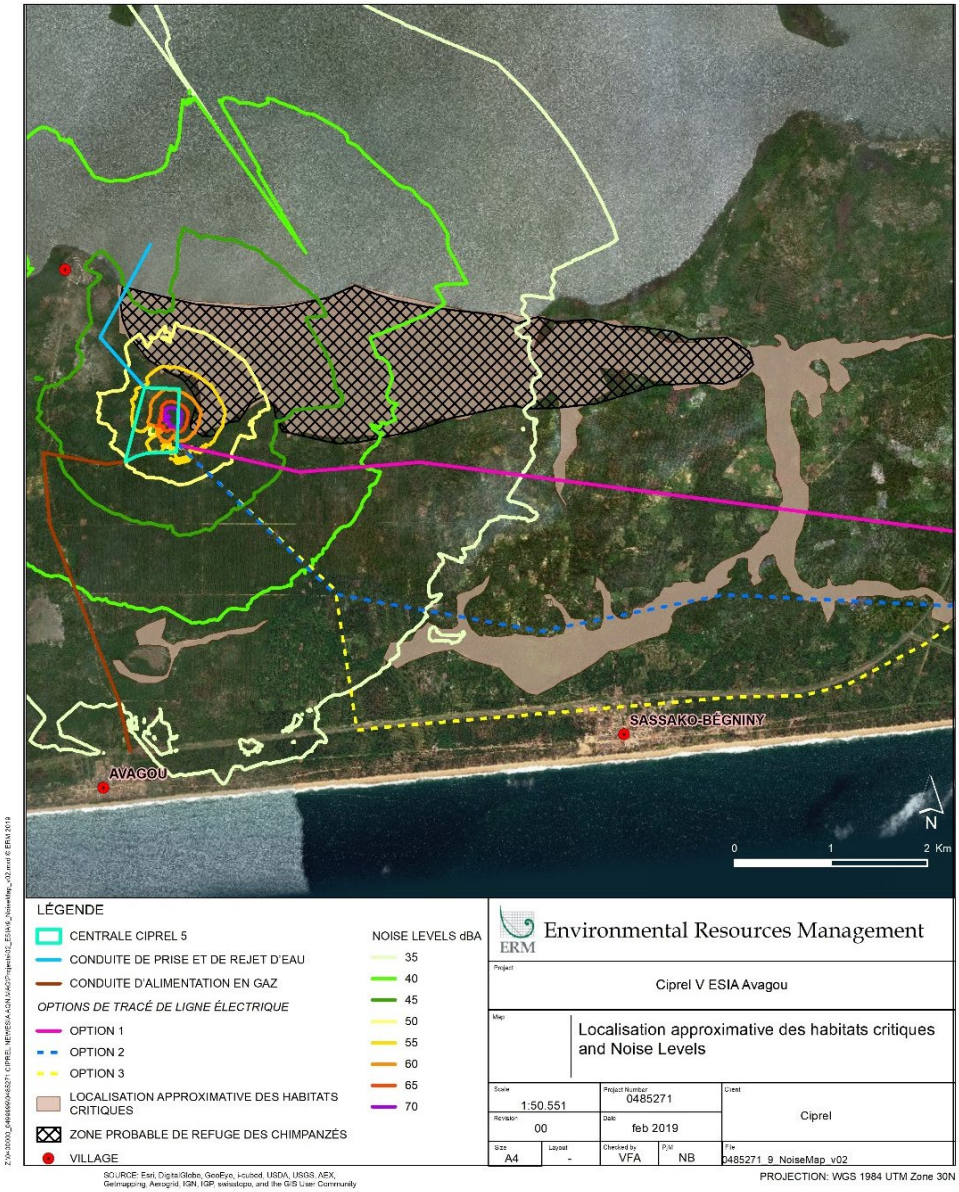
perceptible to the local population at N1 (1.5 dBA increase) and barely noticeable at N2 (about 4.5 dBA increase).);

• The Ivorian limit of 35 dBA for rural areas is exceeded at N3, N4 and N5; this is the result of the very strict limit set by local legislation for rural areas at night.

• The IFC limit (45 dBA) is almost met at N1, N2 and N5 (only minor exceedance of 0.5 dB at N5); while there is a 3 dB overflow at the two nearest receivers (N3 and N4), due to their proximity to the project site (approximately 300-350 m).

Figure 7.5Error! Reference source not found. illustrates the sound environment ensuring compliance with applicable standards.

Figure 7.5 ***Noise scenario – expected sound environment of the power plant***



Groundwater

There are three levels of uneven aquifers in the coastal sedimentary basin:
- Quaternary aquifers;
- Continental Terminal (Moi-Pliocene) aquifers;
- The Maastrichtian aquifer.

These aquifers communicate with each other and each of these aquifers is also composed of different sub-aquifers.
In the Quaternary sediments on the four horizons composing it, 2 aquifers stand out: coarse marine sands (Nouakchottian aquifer) and fine to coarse sands (Oogolian aquifer). These free webs are very vulnerable to pollution; because, their piezometric surface is very close to the surface of the ground (Level P: 0-1 m under the ground).

It appears that Quaternary aquifers are not exploited for drinking water supply because of their exposure to pollution (except by means of shallow domestic wells).

The Maestrichtian aquifer located 200 m deep and topped by the Continental Terminal is operated by SADEM for the production of mineral water, the "AWA" water.
The Continental Terminal contains the tablecloth commonly referred to as "Aquifer of Abidjan" or "Aquifer of the Continental Terminal". This aquifer is the most exploited aquifer in Côte d'Ivoire. It is used by the Water Distribution Company of Côte d'Ivoire (SODECI) for the supply of drinking water (AEP) to the Abidjan populations and is also operated by PALMCI for its water needs.
The thickness of the aquifer varies from 30 to 160 m maximum, with increasing depth from south to north. The continental terminal comprises four horizons (layers), (h4) the discontinuous lateritic armor locally capping sandy clays and clay sands, (h3) coarse fluvial sands, (h2) black clays and clay sands and (h1) gravelly sands. past variegated clays. H3 and h4 form the bulk of the Continental Terminal aquifer. At the roof of the horizon 3, clay beds make the aquifer locally captive. h3 and h4 form a single layer in the absence of these banks.

The waters of the Continental Terminal flow into the lagoon and also feed the Maestrichtian nappe by its base (Loroux, 1978). This aquifer is recharged by direct infiltration of rainwater and surface water.

Rainfall is important in this area, and despite significant evaporation and runoff to watercourses, groundwater recharge is positive, and estimated at 324 mm / year in 2006 (Source: Conceptual Model of the Aquifer Continental Terminal of Abidjan, Auguste K. Kouassi, Francis W. Kouassi, 1 Jules OM Mangoua & Issiaka Savane).

At the level of the annual volume of recharge this could represent at the scale of the aquifer approximately 2,268 Mm3 of water renewed each year (considering the surface of the aquifer).

Moreover, when it is outcropping, this aquifer is locally vulnerable to pollution. In recent years, this water table has been experiencing problems with nitrate pollution in the southern part.

To date, there is no exhaustive inventory of drilling points or formal data on the volumes of water extracted annually from the Abidjan aquifer. On the other hand, the available information underlines that this aquifer presents a risk of overexploitation, and decreases of piezometric level can be observed locally, in particular during the dry season.

The withdrawals envisaged for the ERANOVE project, estimated at 20 m3 / h (ie 480 m3 / d or 175 200 m3 / year) will not contribute significantly to the exploitation of the water table as a whole.

On the other hand, this exploitation could have a localized impact on the resource (local drawdown and saline intrusion).

As part of the design study of the drilling of the site for its water supply, a more detailed evaluation will be carried out by ERANOVE of the impact of pumping on the water table, and in particular the risk of water table drawdown, saline intrusion. , and the impact of drilling operations on surrounding water uses (if present).

Throughout the operation, it is also recommended to monitor the evolution of the piezometric levels.

Surface water and fishing

The impact of the cooling water discharge of the plant on the Ebrié lagoon was evaluated on the basis of a modeling carried out by Tractebel and presented in a report dated December 11, 2018 Assessment of temperature and salinity variation of the power plant discharge in the Ebrié lagoon.

The World Bank's EHS guidelines recommend that the temperature rise due to cooling water discharges should not exceed 3 ° C at the boundary of the mixing zone. As part of the modeling, for the Ebrié lagoon, the radius of the mixing zone was defined at 100 m on the basis of the directives of the Environmental Protection Agency of the United States of America., US EPA (1996). *The Metals Translator: Guidance for Calculating a total recoverable allowed limit from a Dissolved criterion. EPA 823-B-96-007, Washington. DC.*

The modeling of cooling water discharge shows an increase in temperature between 0.21 ° C and 1.68 ° C at a distance of 100 m from the discharge point of cooling water, depending on the season, because:

- variations in the flow rate and discharge temperature (note that the maximum nominal release of approximately 1680 m^3/ H, a relatively limited flow relating to the importance of the mass of water in the lagoon); and
- varying the temperature of the waters of the lagoon, between about 26 ° C during the rainy season and more than 30 ° C in the hot season.)

The impact of the release in terms of the aquatic environment temperature rise appears acceptable under the World Bank EHS Guidelines

As regards the addition of biocides and corrosion types produced, the amount of added products will be adjusted depending on the composition of the incoming water in the cooling system and to meet the

following contents as described in Section 3.2.6 of the Project Description section:

- pH between 6 and 9;
- PO4 phosphate content less than 2.5 ppm; and
- Content of free chlorine of less than 0.2 mg / l.

These parameters will be monitored prior to discharge into the lagoon. If regularly exceeding these values, the concentrations of additives in incoming water will be adjusted to comply with discharge limits.

A water management plan for the project will be developed as shown on page 8.52 of section 8.5.4 of Chapter 8 Environmental and Social Management Plan. The objective of this management plan is to integrate in the ESMP the conservation of soil and water resources that are part of the IFC's EHS regulations and standards, and inherent in the development of the project.

Also, the discharge of cooling water in the lagoon can cause disruption of the lagoon ecological environment at the exit of the discharge pipe, and impact the fishery resource for some fishermen.

Fishermen conduct business in the thermal plume influence area will be identified as part of the Resettlement Action Plan (RAP) developed by BNEDT or through further study if necessary.

Biodiversity

At the time of finalizing this report (February 2019), the state of knowledge concerning the natural environment does not make it possible to definitively decide on the sensitivity of the environments, in particular because the sensitive species identified as potentially in the zone (West African chimpanzee Phrynobatrachus frog).

At this stage of the study, given the potential sensitivity of the habitats in the Project's area of influence (including swamp forests for chimpanzees and amphibian shoals), the Project chose to favor a avoidance in order to reduce any risk of direct impact on sensitive habitats. This took shape, including:

- a choice of site of the plant located outside areas of forests or lowlands (coconut plantation);
- a choice of power line layout favoring the avoidance of forest areas ("Option 1" of the analysis of variants of the power line referenced in Chapter 3, Project Description);
- a commitment not to install access roads or pylons in lowland areas (thus limiting the effect of right-of-way at the height of the overhead line, without disturbing the ground);
- a choice of water intake and lagoon pipelines avoiding forest areas east of Avagou-Taboth.

In order to address uncertainties related to the sensitivity of natural habitats and species in the Project area, particularly with respect to the presence (or

not) of the West African chimpanzee and certain amphibians, the Project intends to deepen knowledge about the Project area, with a view to refining the analysis of critical habitats (within the meaning of IFC Performance Standard No. 6) in the area, and develop (where appropriate) an action plan for the Biodiversity (BAP), consistent with the expected level of impact of the Project, and compatible with the conservation issues of the sensitivities of the natural environment and the requirements of IFC Performance Standard 6.

7.3 *ECOSYSTEM SERVICES*

The services provided by ecosystems benefit the population in general, but also projects for the success of their operations and / or the health and well-being of their workers. This section assesses the impacts of the project on ecosystem services and project dependencies on these services.

Ecosystem services are a representation of the dependence of the human environment on the natural environment. They are generally classified into four categories, as presented in Box 1: Procurement, Regulatory, Cultural and Support Services.

Box 6.1 Definition and types of ecosystem services

The Millennium Ecosystem Assessment[1] has classified ecosystem services into four categories:

Supply services refers to the production by ecosystems of goods or products such as food, wood, medicines, fiber, and fresh water.

Regulatory services refer to natural processes that regulate an ecosystem such as climate, disease control, erosion, water flow and protection from natural hazards.

Cultural services refer to the contribution of ecosystems to non-material benefits, such as recreational recreation, spiritual values, or aesthetic advantage.

Support services refer to natural processes such as soil formation, nutrient cycling, and primary production that support other ecosystem services.

[1] Millennium Ecosystem Assessment, available at: www.millenniumassessment.org.

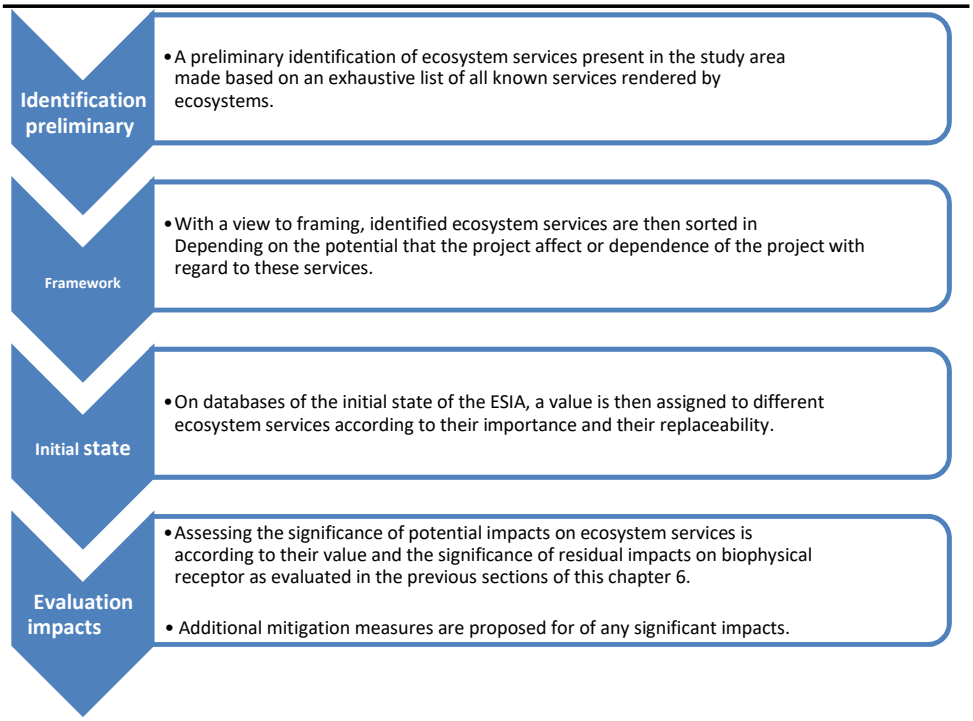
In support of the environmental and social impact assessment of the project (Table 7.1 and Table 7.2, respectively), this section identifies priority services that may be affected, of importance to the population or necessary for the project. Mitigation measures to be implemented by the project are proposed to maintain the value and functionality of these services.

7.3.1 *Methodology*

The approach for valuation of ecosystem services is presented in Figure 7.6, in line with the guidance provided by the IFC Performance Standards. The study area for the valuation of ecosystem services is identical to that defined in Chapter 4 of the ESIA.

The first step is preliminary identification of services that may be present in the study area. The result of this identification then allows to frame these different services, depending on the impact or potential dependence of the project on these services. A value is then assigned to these services based on the initial state (Chapter 6). The impacts of the project on these services are then evaluated and mitigation measures proposed.

Figure 7.6 Approach to evaluation of ecosystem services



7.3.2 *Preliminary identification of ecosystem services*

Preliminary identification of ecosystem services present in the project study area is based on knowledge of the environment and populations derived from the ESIA process and other publicly available information. Preliminary identification is based on an exhaustive list of different ecosystem services1 as presented in Table 7.11. All identified services are considered "potentially present" in the project study area and are therefore considered in the ecosystem scoping phase.

Table 7.11 Ecosystem services present in the project area

Service category	Ecosystem service	Resource / EXAMPLES	Potential presence
Provision	Food: game.	Game hunted for food and sale (eg agoutis and other rodents).	x
Provision	Food: crops.	Agriculture as a source of livelihood or income.	x
Provision	Food: Livestock Cattle.	sedentary or nomadic herding as a source of livelihood or income.	x
Provision	Food: Fish wild.	Fishing in the lagoon.	x
Provision	Food: wild plants, nuts, fruits, honey, mushrooms.	collected wild plants or other food products for household or livestock feed.	x
Provision	Water.	Water for drinking, for domestic use, livestock and irrigation.	x
Provision	Sea water.	Production of salt.	
Provision	Extraction of sand.	Sand for the production of bricks or cement.	x
Provision	wood construction.	Timber for construction.	
Provision	NTFPs.	Straw as roofing and construction materials.	
Provision	Fuel.	Firewood and charcoal.	x
Provision	remedies natural.	Plants and wild mushrooms or minerals used for medicinal purposes.	x
Provision	ornamental resource.	Minerals cut, skins animal or other decorative animal products.	
Cultural	spiritual or religious value.	Natural areas or species associated with cultural or religious significance.	
Cultural	traditional practices	cultural value placed on traditional practices such as hunting, fishing, roaming livestock.	

(1) The preliminary identification list is adapted from Ecosystem Assessment Millennium (2005), as presented in World Resources Institute (WRI). Weaving into 2013. Ecosystem Services Impact Assessment.

Service category	Service ecosystem	Resource / EXAMPLES	Presence potential
Cultural	Recreation and tourism.	Use of spaces and natural resources for recreation or tourism (eg swimming, fishing, wildlife watching).	
Cultural	aesthetic value.	Cultural value for landscapes and large sites.	
Cultural	Value of existence.	fauna and flora of intrinsic value of existence nationally or internationally, regardless of their usefulness to humans (eg endangered species, flagship species).	
Regulation	Regulation of air quality.	The influence of ecosystems on air quality in the cleansing (extraction of pollutants and dust emissions and oxygen).	x
Regulation	Local climate regulation, regional or global.	Regulating the temperature and humidity at the local level by trees or water bodies and global level by CO2 sequestration.	x
Regulation	Regulation of surface water and groundwater.	Roles of reliefs and soils in the recharge of groundwater and surface water.	x
Regulation	Erosion regulation.	The vegetation controls erosion and sediment delivery to streams.	x
Regulation	Coastal protection.	Role of natural habitats (eg estuaries beaches, reefs, vegetation) in coastal protection and its residents, crops and other valuable areas, storms and waves.	
Regulation	Regulation of natural hazards.	Regulatory risk of flooding, drought and fires.	
Regulation	Control of diseases and pests.	Influence of ecosystems and predators on the control of pests (eg locusts, parasites) and diseases (eg stagnant water promotes disease transmitted by mosquitoes).	
Support	Pollination.	Some birds and insects involved in pollination of some species of flora.	
Support	Nutrient cycling.	natural cycles of carbon, nitrogen and phosphorus from the water through different ecosystems.	x

Service category	Service ecosystem	Resource / EXAMPLES	Presence potential
Support	Soil formation.	natural formation of topsoil soil in vegetation zones.	
Support	Offer habitat natural.	natural areas that provide habitat the fauna and flora.	x

Potentially x = present; Blank = Not present.

7.3.3 Framework

A scoping exercise was carried out to define the ecosystems likely to be affected by the project or on which the project depends. The ecosystem services selected by the framing are classified according to the following two categories:

- Type I: ecosystem services over which the client has direct control or significant influence, and for which the impacts on these services could affect communities; and

- Type II: Ecosystem services over which the client has direct control or significant influence and whose project is dependent on its operations.

Customer requirements for Performance Standard 6 for ecosystem services are only applicable when the customer has "direct control over management or significant influence" over such services. As a result, ecosystem services that benefit beneficiaries globally, and sometimes at the regional level, are not covered under Performance Standard 6. These include ecosystem services for regulation, such as carbon sequestration or climate regulation, when the benefits of these services are manifested on a global scale. Impacts related to the ecosystem services project will be assessed by Performance Standard 1 when the client does not have direct control or significant influence over management.

The support services defined by the Millennium Ecosystem Assessment (pollination, nutrient cycles, soil formation and habitat supply) are partly present in the project area. However, since support services are intermediate ecological services that are not directly used by the population but serve as a support for other ecosystem services, these services are not directly evaluated. Instead, they are taken into account indirectly in the evaluation of procurement, cultural and regulatory services. For example, a change in habitat for wildlife will be considered in the assessment of supply (eg game) or cultural (eg, existence value) services.

The ecosystem services framework is detailed in Table 7.12.

Table 7.12 Results of the Ecosystem Services Framework

Service	Potential impact of the project	Framework
Provision		
Food: game	Agoutis, and other species of rodents, gazelles, monkeys and monitor lizards on the site. They are consumed by the local population.	Retained
Food: Cultures	Culture on the project site and its immediate surroundings. Plantation Village on the site of the central and Culture on the route of the line (coconut, cassava and other food crops)	Retained
Food: Livestock Cattle	grazing area for a low number of cattle in search of grass along the main access road and to a lesser extent on the project site.	Retained
Food: Wild fish	Practice fishing in the lagoon shallows.	Retained
Food: wild plants, nuts, fruits, honey, mushrooms	Some plant species on the project site are likely to be consumed by local people for food.	Retained
Water	The tablecloth Continent Terminal is the fresh water source of supply of the local population (see Section 6.3). The project will draw water from the groundwater and the aquifer is vulnerable to soil pollution.	Retained
Extraction of sand	Local people extract sand from quarries nearby. Sand is available at the project site but does not appear to be exploited.	Not retained
Fuel	People extract the small firewood on the project site (presence of bundles of wood found) wells and hydrocarbon extraction craft.	Retained
timber forest products and not woody	The timber is used as building materials in the study area. Raffia is used for roof construction.	Retained
natural remedies	Some plant species on the project site are likely to be consumed by local people for medicinal purposes.	Retained
ornamental resource	Some plant species on the project site are likely to be consumed by local people for ornamental purposes.	Not retained
Cultural		
spiritual or religious value	Absence of sacred sites identified in the nip of the Project. The forest is likely to have a proprietary interest for local communities.	Retained
traditional practices	Practice of artisanal fishing in the lagoon. It is not expected that the project hinders this cultural practice.	Not retained

Service	Potential impact of the project	Framework
Recreation and tourism	non-tourist location. It is not expected that the project has an impact on the service.	Retained
aesthetic value	Absence of aesthetic enhancement. It is not expected that the project has an impact on the service.	Retained
Value of existence	An individual Iroko (Milicia excelsa) near the landing site is vulnerable and must be maintained during the project.	Retained
Regulation		
Regulation of air quality	The vegetation on the site of a nature and sparse shrub has a positive but negligible impact on the quality of ambient air. Atmospheric emissions in the Central are likely to degraded air quality but not the regulatory capacity of the service as such.	Not retained
Local climate regulation, regional or global	GHG emissions from the plant will contribute to global warming. However, the client does not have direct control over the regulation of service, it is not retained in accordance with the requirements of IFC PS6.	Not retained
Regulation of surface water and groundwater	Vegetation has a beneficial effect recognized drainage of rainwater and surface water, promoting good quality of water recharged in the aquifer by infiltration of the soil. Similarly, it contributes to the support service which governs the virtuous cycle of natural nutrients (carbon, nitrogen and phosphorus) and the water cycle. Thus, site clearing, land use and accumulation of salty droplets impact on the surrounding area, will impact these services.	Retained
Erosion regulation	Vegetation allows regulation of erosion. Site clearing therefore involve a loss of service.	Retained
Coastal protection	No cliffs or any other form of coastal protection. It is not expected that the project has an impact on the service.	Not retained
Regulation of natural hazards	There is no regulation of natural hazards by ecosystems in the study area. It is not expected that the project has an impact on the service.	Not retained
regulation diseases and pests	It is not expected that the project has an impact on the service.	Not retained

7.3.4 *Initial state and value of ecosystem services*

The value of an ecosystem service is defined based on the following criteria:

- the importance of a service to its beneficiaries; and
- the replaceability, or how this service can be replaced, or not, by alternatives.

The importance of an ecosystem service, designated low to critical, for its beneficiaries is defined by the following criteria:

- intensity of use - eg daily use, weekly or seasonal supply of a service; number of villages downstream that rely on erosion control service;
- context of use - eg individual use or village level, through subsistence or commercial activities;
- geographical proximity (when applicable); and
- degree of dependence - eg contribution of fisheries in diet or income sources.

The replaceability of an ecosystem is evaluated on the following criteria and is categorized from low to high:

- the existence of alternative - eg other places offering the same service and close enough to be used by affected populations; and
- sustainable alternatives in light of the possibility of a stronger exploitation of these services by the affected population and in consideration of its conservation status and threats.

Based on an analysis of the initial state and input from stakeholders, the importance and replaceability of each service are assessed according to Table 7.13 to assign a value to ecosystem services.

Table 7.13 Matrix for assessing the value of ecosystem services

		Replaceability service		
		High (many alternatives available)	moderate (Some alternatives available)	Low (or no alternatives available)
Service Importance for beneficiaries	Low	Low	Low	Average
	moderate	Low	Average	high
	high	Average	high	Critical
	essential	high	Critical	Critical

7.14 The table shows the value of ecosystem services, held in the scoping phase, depending on their importance and replaceability.

Table 7.14 Value of ecosystem services retained

Service	Description	beneficiaries	Importance (Low- Essential)	Replaceability (Low-High)	Value (Importance x replaceability)
Provision					
Food: game.	Agouti, rodents, gazelles and monkeys present in the project site. These species are hunted and consumed locally.	**Local communities**	***Low*** Consumption of this type of game is not widespread and does not represent a significant part of the diet.	***high*** These are present in large numbers throughout the area of influence	**Low**
Food: Cultures	Culture on the project site and its immediate surroundings. Plantation Village on the site of the central and Culture on the route of the line (coconut, cassava and other food crops)	**Local communities**	***moderate*** The consumption and sale of crops are an important part of the livelihood activities of local community	***High*** replacement land are present in large quantities in the study area.	**Low**
Food: breeding cattle.	Activities breeding sheep and cattle in it without Project area have been found in the hold of the Project	**Local communities**	***Low*** The breeding is a secondary activity in the project area.	***high*** Alternative grazing areas are widely available throughout the Project area.	**Low**
Food: wild fish.	The main subsistence activity is Taboth artisanal fishing. The main fishing areas are the lagoon and the shallows.	**Local communities**	***moderate*** Fishing is the main livelihood activity of the village of Taboth a part of the villagers fish in the area of the discharge pipe water ..	***moderate*** The replaceability of the ecosystem service is considered moderate, indeed fishing can be practiced throughout the lagoon and sea, but travel times are increased.	**Average**
Food: wild plants, nuts,	Plant species that may be consumed by local people for purposes	**Local communities**	***moderate***	***high***	**Low**

Service	Description	beneficiaries	Importance (Low- Essential)	Replaceability (Low-High)	Value (x Importance replaceability)
fruit, honey, mushrooms.	food present on the project site are: • *Pterocarpus santalinoides;* • *Raffia hookeri;* • *Thaumatococcus daniellii;* and • *Uapaca paludosa.*		The collection of plants and fruits for food is a marginal but important for a balanced diet. The project site does not present a high density of these species.	Alternative spaces are widely available throughout the area of influence.	
Water.	The Continent Terminal aquifer is the fresh water source of supply of the local population (see Section 6.3). The project can potentially impact the quantity and quality of water from the water, vulnerable to risks from industrial contamination and saltwater intrusion.	**Local communities** **Project Users**	***essential*** The local population draws its water from various wells fed by the aquifer for drinking water needs and other domestic consumption needs. The project will depend on the availability of groundwater for the success of its operations.	***Low*** The aquifer is a vital source for the drinking water supply of local populations.	**Critical**
Fuel.	The population collects bundles of wood at the plant site and has used artisanal oil wells in the Project area in the past.	**Local communities**	***Moderate*** consumption and marketing of bundles of wood is an important source of livelihood for the local population. The use of artisanal oil wells is currently strictly prohibited. strictly prohibited	***High*** Alternative spaces with firewood resources are widely available throughout the area south of the village of Vridi-Ako.	**Low**

Service	Description	beneficiaries	Importance (Low- Essential)	Replaceability (Low-High)	Value (x Importance replaceability)
Wood and non-wood forest products	The timber is used as building materials in the study area. Raffia is used for the roof construction.	**Local communities**	***moderate*** Lumber and raffia are widely used components in the study area for residential construction.	***High*** Presence of important forest resources in the area, which could provide an equivalent service to communities.	**Low**
Natural Remedies.	Plant species likely to be consumed by local people for medicinal purposes on the project site are as follows: • Alchornea cordifolia; • Costus afer; • Nauclea latifolia; • Nephrolepis biserrata; • Palisota hirsuta; • Paullinia pinnata; and • Raffia hookeri.	**Local communities**	***moderate*** The use of medicinal plants contributes to the health of local populations. This practice is however partially abandoned in favor of so-called modern medicine.	***High*** Alternative spaces with the same plant species are widely available throughout the area of influence.	**Low**
Resources	Plant species likely to be consumed by local populations for ornamental purposes on the project site are as follows: • *Nauclea diderrichii;* and • *Raffia hookeri.*	**Local communities**	***Low*** The use of these species for ornamental purposes is unconfirmed and is probably marginal.	***High*** Alternative spaces with the same plant species are widely available throughout the area of influence.	**Low**
Cultural					
spiritual or religious value	Absence of sacred sites identified in the nip of the Project. The forest is likely to have a proprietary interest for local communities.	**communities local**	***Low to medium*** During consultations with local communities, no sacred sites identified in the zone. It may not be	***moderate*** significant presence of sites with similar characteristics close to the work of the Project.	**Low**

Service	Description	beneficiaries	Importance (Low- Essential)	Replaceability (Low-High)	Value (x Importance replaceability)
			excluded that the sites of heritage value are impacted indirectly by the project.		
Value of existence.	Several species of flora declared "vulnerable" by the IUCN were inventoried during the inventory Mission Biodiversity: • *Milicia regia;* • *Milicia excels;* • *Turraeanthus africanus;* • *Nauclea diderrichii;* and • *Afzelia Africana.* Two species endemic flora in the Ivory Coast were inventoried during the inventory Mission Biodiversity: • *Albizia adianthifolia;* • *Baphia bancoensis;* and • *Leptoderris miegei.* Also, 14 wildlife species reported "Vulnerable" or "at risk are potentially present in the area of influence. Also, according to several testimonies of the population, chimpanzee Pan troglodytes verus, declared "critically endangered" by the IUCN, is present in the area of influence.	**International community**	***high*** The international community attaches a high value of existence to the preservation of vulnerable flora and fauna.	***Low*** The chimpanzee Pan troglodytes verus is a species in critical danger and is not replaceable in this title. Endemic species are also limited in occurrence and therefore difficult to replace.	**Critical**
Regulation					
Regulation of air quality.	The vegetation has a positive impact on the recognized quality of ambient air.	**communities local**	***moderate***	***high***	**Low**

Service	Description	beneficiaries	Importance (Low- Essential)	Replaceability (Low-High)	Value (x Importance replaceability)
	Emissions in the operation of the central gas NOx and CO and those related to the use of marginal distilled diesel (DDO) degrade the quality of the air. Thus, site clearing and project emissions will impact the service.		The air quality affects the health of local populations	The vegetation on the project site plays a significant role on the regulatory capacity of the air quality of the surrounding space (presence of significant vegetation around and the ocean. The prevailing wind from the ocean has the effect of replacing the ambient air almost continuously (depending on weather conditions).	
Regulation of surface water and groundwater.	Vegetation has a beneficial effect recognized drainage of rainwater and surface water, promoting good quality of water recharged in the aquifer by infiltration of the soil. Thus, site clearing and land use are likely to impact these services.	**Local Communities** **Project Users**	***essential*** The local population draws its water from various wells fed by groundwater Continent terminal aquifer for drinking water needs and other domestic consumption needs. The project will depend on the availability of groundwater for the success of its operations.	***Low*** The Continent Terminal aquifer is a major source for drinking water for local populations.	**Critical**
Erosion regulation.	Vegetation allows regulation of erosion. Site clearing therefore involve a loss of service.	**communities local** **Project Users**	***Low*** Vegetation sparse and very active in the protection of erosion in the initial state.	***high*** A drainage system and recovery of rainwater in a storm basin will be installed during the construction and operation coming and replace this ecosystem service.	**Low**

This section also aims to prioritize ecosystem services based on their value and relationship to the project, provided that the project has direct control or ability to influence the impact on the service in question.

The ecosystem services that the project is likely to affect and whose value was assessed as High or Critical for at least one beneficiary group are considered "Type I Priority Service".

Services whose project is dependent on the success of its operations are considered "Type II Priority Service".

Special attention is given to mitigating the impacts on the services deemed to be priorities. Ecosystem services of medium or low value are always considered beneficial to their users. As such, they are included in the impact assessment, but in a less detailed way.

Table 7.15 Priority Ecosystem services

ecosystem service	beneficiaries	Value	Type of priority
procurement			
Food: wild fish	local communities	***Critical***	Type I
Water	local communities	***Critical***	Type I & II
Cultural			
Existence of valued species	International community	***high***	Type I
Regulation			
Regulation of surface and groundwater	local Community Project Users	***Critical***	Type I & II

7.3.5 Assessment of impacts

The Importance of impacts on ecosystem services takes into account the importance of the impacts on the biophysical receptors that form these ecosystems and the value of the services rendered by these ecosystems as assessed above.

The significance of impacts on biophysical receptors is derived from the assessment of residual impacts (eg after mitigation measures have been implemented) as detailed in the previous sections of this chapter: Sections 7.2.2 to 7.2.3 and according to the methodology developed in Chapter 5. The importance of an impact is defined as the result of the severity of the impact (e.g. nature, intensity, duration, range) and the sensitivity of the receiver after implementation of the mitigation measures.

The significance of an impact on an ecosystem service is categorized as non-significant, minor, moderate, major or critical. Table

7.16 gives the matrix for assessing the significance of impacts on ecosystem services, based on the value of services and the significance of residual

impacts on biophysical receptors.

When a combination of direct and indirect impacts affects the biophysical receptors that are at the base of an ecosystem service, the highest importance or weighting of different sizes is used according to expert judgment.

Table 7.16 Assessment Matrix of the Importance of Impacts on Ecosystem Services

		Significance of residual impact on the biophysical receptor (Impact severity x receiver sensitivity)			
		insignificant	minor	moderate	major
Value of Ecosystem service (Importance to beneficiaries x replaceability)	Low	Not significant	Not significant	minor	moderate
	Average	Not significant	minor	moderate	major
	high	Not significant	moderate	major	Critical
	Critical	Not significant	major	Critical	Critical

In accordance with IFC performance requirements and standards, impacts on priority ecosystems are mitigated according to a hierarchy strategy of mitigation measures (eg avoidance, source reduction, impact reduction, compensation) in order to maintain or restore the 'value and functionality' of these services. Compensation or replacement of services is provided on a temporary basis or when complete restoration of ecosystems is not possible (eg for some landscape impacts). For non-priority services that are negatively affected by the project, standard mitigation measures are proposed to avoid, or where this is not possible, to reduce or offset the impact.

For type II priority ecosystem services, which the project depends on, impacts must be minimized and measures put in place to increase the sustainable use of the resources on which it depends.

The assessment of the significance of impacts on ecosystem services is presented in Table 7.17.

Table 7.17 Evaluation impacts on ecosystem services and mitigation measures

Ecosystem service	Source of potential impacts on the biophysical receivers (including direct and indirect impacts and linkages with intermediary ecosystem services)	Key mitigation measures identified in the ESIA	Significance of residual impact (And reference to the corresponding sections of the ESIS)	Ecosystem service value (including priority type I and II)	Importance of the impact on the ecosystem service (importance x value)	Additional mitigation measures	Importance of the residual impact
Provision							
Food: game	Removing space for the habitat of species of rodents hunted locally.	Include the project site in the Recovery Plan Livelihoods (PRMS) to develop. Limit the possible areas of deposition along the track during its development.	***Negligible to minor***	**Low**	***No significant***	Not applicable	**Not significant**
food; Culture	Loss of access to cultural sites at the plant site and in the corridor of the power line.	Include the project site in the Recovery Plan Livelihoods (PRMS) to develop. Limit the possible areas of deposition along the track during its development.	***minor***	**Low**	***No significant***	Not applicable	**Not significant**
Food: breeding cattle	Removing grazing areas at the construction site and along the access road.	Include the project site in the Recovery Plan Livelihoods (PRMS) to develop. Limit the possible areas of deposition along the track during its development. Prohibit the passage of the gears and the clearing out of the area of building to maintain	***Negligible to minor***	**Low**	***No significant***	Not applicable	**Not significant**

Ecosystem service	Source of potential impacts on the biophysical receivers (including direct and indirect impacts and linkages with intermediary ecosystem services)	Key mitigation measures identified in the ESIA	Significance of residual impact (And reference to the corresponding sections of the ESIS)	Ecosystem service value (including priority type I and II)	Importance of the impact on the ecosystem service (importance x value)	Additional mitigation measures	Importance of the residual impact
		the grassy area located on either side of the track. Rehabilitated temporary construction areas located along the track to allow them to growth grass after construction.					
Food: wild fish	fish stock reduction after a disturbance ecology of the lagoon due to wastewater discharge from the plant.	Establishing a Wastewater Management Plan to ensure the proper implementation of the measures described in Chapter 3, Project Description, to treat all water service rejected and the rain and contaminated water control the release of water parameters in accordance with the applicable standards. Making a dilution modeling of the thermal plume and cooling water pollutants. The results of modeling and monitoring of wastewater, provide the connection of the drain water in industrial water treatment system or the installation of an intermediate buffer tank dedicated to lower the temperature of the waste water.	*minor*	**Average**	*minor*	• consultation with fishermen in the operational phase to assess their perception of the impact of the plant on their activities; and • performing measurements of the quality and biophysical characteristics of the water near the discharge point and at a distance of 200m in the channel for comparison.	**not Significant**

Ecosystem service	Source of potential impacts on the biophysical receivers (including direct and indirect impacts and linkages with intermediary ecosystem services)	Key mitigation measures identified in the ESIA	Significance of residual impact (And reference to the corresponding sections of the ESIS)	Ecosystem service value (including priority type I and II)	Importance of the impact on the ecosystem service (importance x value)	Additional mitigation measures	Importance of the residual impact
		The results of monitoring the quality of the waste water will be periodically communicated to the relevant environmental authorities (CIAPOL). In case of non-compliance of certain measures parameters Additional taken.					
Food: wild plants, nuts, fruits, honey, mushrooms	Removing useful space for the collection of wild plants at the plant site.	Include the project site in the Recovery Plan Livelihoods (PRMS) to develop for the power line.	***Negligible to minor***	**Low**	***No significant***	Not applicable	**not Significant**
Resources water	Reducing the quantity and quality of groundwater in case of over-consumption of water by the project and / or saline intrusion into the aquifer.	An analysis of the groundwater level and quality of groundwater will be carried out once a month to detect any alarming drop in the level and potential contamination caused by the project during construction and quarterly during operation. In case of impact on the amount (lower the water table) or quality (eg saltwater intrusion), the project will evaluate the possibilities of water consumption reduction and / or alternative sources (eg Lake bakre).	***minor***	**Critical**	***major***	• if proven reduction in the availability or quality of groundwater for local people, implementation of mitigation measures or additional compensation. .	***minor***

Ecosystem service	Source of potential impacts on the biophysical receivers (including direct and indirect impacts and linkages with intermediary ecosystem services)	Key mitigation measures identified in the ESIA	Significance of residual impact (And reference to the corresponding sections of the ESIS)	Ecosystem service value (including priority type I and II)	Importance of the impact on the ecosystem service (importance x value)	Additional mitigation measures	Importance of the residual impact
		If pollution of the water table is identified, the authorities and communities should be notified.					
Fuel	Loss of access to the site of the plant and timber resources heater.	Availability of wood from clearing activities for the local community. Include the project site in the Recovery Plan Livelihoods (PRMS).	***Negligible to minor***	**Low**	***No significant***	Not applicable	**not Significant**
timber forest products and non-timber	Loss of access to the site of the plant and the power line on which we find these products.	Include the project site in the Recovery Plan Livelihoods (PRMS)	***minor***	**Low**	***No significant***	Not applicable	**Not significant**
natural remedies	Loss of access to the plant site which include medicinal plants.	Include the project site in the Recovery Plan Livelihoods (PRMS)	***Negligible to minor***	**Low**	***No significant***	Not applicable	**not Significant**
ornamental resources s	Loss of access to the central site where we find plants used as ornamental resources.	Include the project site in the Recovery Plan Livelihoods (PRMS)	***Negligible to minor***	**Low**	***No significant***	Not applicable	**not Significant**
Cultural							
spiritual or religious value	Risk of indirect disturbance natural site with a heritage for local communities.	Develop and implement a procedure Incidental findings to ensure that the unsung sights	***Negligible***	**Low**	***No significant***	Not applicable	**Not significant**

Ecosystem service	Source of potential impacts on the biophysical receivers (including direct and indirect impacts and linkages with intermediary ecosystem services)	Key mitigation measures identified in the ESIA	Significance of residual impact (And reference to the corresponding sections of the ESIS)	Ecosystem service value (including priority type I and II)	Importance of the impact on the ecosystem service (importance x value)	Additional mitigation measures	Importance of the residual impact
		or suspected to be discovered in time and managed appropriately. Identify and evaluate the sensitivity of these sacred sites near the project site. Integrate respect for the cultural heritage and the procedures associated with the induction training of workers and visitors.					
Value of existence	Risk of destruction of large trees (p. Ex. Milicia excelsa) during the development work of the driving water discharges and power line. Impacts on habitats for the possible presence of chimpanzees	Adapter construction plans to avoid the destruction of large trees and forest environments for the presence of chimpanzees	***Negligible***	**Critical**	***No significant***	Not applicable	**not Significant**
Regulation							
Regulation of air quality	The vegetation has a positive impact on the recognized quality of the ambient air, thus clearing the site will impact the service. Air emissions from the plant will degrade the air quality.	Implement the air quality monitoring program the first 3 years of the operation phase to measure the actual NO2 concentrations at ground level. Minimizing the operation of the plant in open cycle to ensure	***Negligible***	**Low**	***No significant***	Not applicable	***minor positive***

Ecosystem service	Source of potential impacts on the biophysical receivers (including direct and indirect impacts and linkages with intermediary ecosystem services)	Key mitigation measures identified in the ESIA	Significance of residual impact (And reference to the corresponding sections of the ESIS)	Ecosystem service value (including priority type I and II)	Importance of the impact on the ecosystem service (importance x value)	Additional mitigation measures	Importance of the residual impact
		minimum emissions per kWe by operating in a closed cycle. Continuous monitoring by centralized system of emissions in chimney outlet to ensure emission levels in accordance with the specifications of the facilities. Adapt if necessary the regime of operation of the plant. Perform periodic maintenance of the facilities to maintain them in good condition. Monitoring the quality of ambient air through campaigns of annual measurements using diffusion tubes. When exceeding the air quality standards, adapting the design of the plant (eg adding filters).					
Regulation of surface water and groundwater	Site clearing and land use are likely to impact these services.	No measures of identified additional mitigation.	***Negligible***	**Critical**	***No significant***	Not applicable	**not Significant**

Ecosystem service	Source of potential impacts on the biophysical receivers (including direct and indirect impacts and linkages with intermediary ecosystem services)	Key mitigation measures identified in the ESIA	Significance of residual impact (And reference to the corresponding sections of the ESIS)	Ecosystem service value (including priority type I and II)	Importance of the impact on the ecosystem service (importance x value)	Additional mitigation measures	Importance of the residual impact
Erosion regulation	Vegetation allows regulation of erosion. Site clearing therefore involve a loss of service.	Implementation of measures in the project design and good construction practices to reduce erosion. Establishing a Wastewater Management Plan to ensure the proper implementation of the measures described in Chapter 3, Project Description (drainage of hard surfaces, oil separator, complete sanitation and water treatment waste). Monitoring the quality of wastewater for compliance with applicable standards.	***Negligible***	**Low**	***No significant***	Not applicable	**not Significant**

7.4 *CUMULATIVE IMPACTS*

Cumulative impacts are the results of a combination of impacts generated by a single project or multiple projects over time (past, present or future) and in space. The cumulative impact assessment aims to estimate the potential additive or interactive impacts arising from different projects

7.4.1 Potential cumulative project impacts identified

A development project has been identified in the Project area that is likely to generate cumulative impacts. This is the real estate development of a new city between Abreby and Sassako as part of the development of Greater Abidjan.

Grand Abidjan Project

The project area in is located near the new city creation project planned as part of the Grand Abidjan Urban Master Plan (SDUGA) published in March 2015. The project area is included in unit 10 of the SDUGA 2015: Greater Western Abidjan (Dabou, Jacqueville). This unit includes the cities of Dabou and Jaqueville as well as their rural hinterland.

The SDUGA provides for the creation of a new town between the villages of Sassako and Abreby that can accommodate up to 60,000 inhabitants. Subdivision projects have already been submitted to local authorities and approved. However, the construction of these subdivisions has not started yet.

New ATINKOU Power Plant

Considering the past, current and likely future context of strong growth in the energy sector in Côte d'Ivoire (see Section 3.2.1), the extension of the power station is considered a possible scenario. This extension would take place within the 30 ha of land currently allocated to the project and the construction of an enclosure is planned from the start of construction of the plant.

7.4.2 Evaluation of impacts

The *Table 7.18* shows the main potential interactions of these projects with project impacts the central ATINKOU.

Table 7.18 ***Potential Key Interactions Between the Plant Project and Investment Projects***

Investment Project	Terrestrial physical environment	Terrestrial biological environment	Surface water and lagoon ecology	waste and hazardous substances	Socio-economic and cultural environment
New ATINKOU Plant	X		X		X
Grand Abidjan Project	X	X	X	X	X

ATINKOU plant

The equipment necessary for the possible extension of the plant could be installed within the limits of the power plant that is the subject of this ESIA. The entire site will be cleared and landscaped with a hard surface during the construction phase of the plant. No additional land acquisition or additional land clearing activity would therefore be necessary. The unloading wharf and the access runway would not require additional facilities. The administrative buildings of the plant currently planned would suffice for the purposes of an extension.

As such, the main cumulative impacts of a possible extension would be:

- Impact on air quality following additional air emissions and salt droplets (see Section 7.2.2 - AQ3 to AQ5);
- Impact on noise environment related to noise emissions from new facilities (see Section 7.2.2 - BR4);
- Increase in groundwater consumption Section 7.2.2 - ES7);
- Increased discharge rates for service and cooling wastewater (see Section 7.2.2 - ES6 and ES8); and
- Local and national job creation (see Section 7.2.3 - EA1, EA2).

Grand Abidjan Project

The creation of a new town between the villages of Sassako and Abreby would imply the transformation of a very poorly urbanized rural area with critical habitats into a densely populated urban area. This transformation will have potential environmental and social impacts

on all physical, biological and socio-economic components and receptors in the study area.

The potential cumulative impacts with the project will be numerous. The assessment of these impacts described below is not intended to cite each of these impacts but to highlight the key environmental and social issues.

As such, the main cumulative impacts of a possible transformation of the zone into an area of industrial activity would be as follows:

- impact on the physical environment causing degradation of air quality, sound environment and the living environment and landscape (see Section 7.2.2 - AQ, BR and CP);
- impact on the biological environment causing the disappearance of fauna and existing flora including harvested area of critical habitats potentially harboring a species Critically Endangered (see Section 7.2.2 - BT);
- increasing groundwater consumption (Section 7.2.2 - SS7);
- increase in wastewater discharge flows into the lagoon and degradation of the ecology of the lagoon (see Section 7.2.2 - SS6 and SS8 and EC);
- changes in local governance and social dynamics following the work of labor immigration and the changes brought about the social composition and demographic structure Jaqueville department (see Section 7.2.3 - GD);
- modification of well-being in the study area by living environment and landscape change and improvement in social and health infrastructure (see Section 7.2.3 - BS);
- a total change of land occupation and loss of customary rights over all the surrounding land in the territory of the new city (see Section 7.2.3 - OF);
- reduced access to natural resources by occupying the floor of the new city (see Section 7.2.3 - AT);
- an increase in employment and economic activity (see Section *7.2.3 - EA*); and
- improvement of basic infrastructure and services (see Section 7.2.3 - IS).

The assessment of the cumulative impact of the different development projects on the ERANOVE project is detailed in Table 7.19.

When a combination of impacts affects the same biophysical or socio-economic receptors, the highest importance or weighting of the different importances is used according to expert judgment.

Table 7.19 Evaluation of Cumulative Impacts

Cumulative Impacts Assessment			
Description of the potential impact	**Importance the residual impact of the project ERANOVE**	**Related effect interaction impacts**	**Importance of the cumulative impact**
Extension of the Plant ERANOVE			
Impact on air quality following additional atmospheric emissions (see AQ4, AQ5);	Negligible	Enhancement average	**minor**
Impact on air quality following additional salty droplet emissions (see AQ3);	Negligible	Enhancement low	**Negligible with minor**
Impact on the noise environment related to noise emissions from new installations (See BR4)	minor	Enhancement low	**Minor to moderate**
Increased groundwater consumption may reduce the quantity and quality of water available (see ES7)	Negligible with minor	Enhancement low	**minor**
Increased discharge rates for service and cooling wastewater that could lead to degradation of surface water quality (see ES6, ES8)	minor	Enhancement low	**minor**
Job creation and economic activity (See EA1 and 2)	moderate to major	Enhancement low	**major**
Grand Abidjan Project			
Impact on the physical environment leading to a deterioration in air quality, sound environment and quality of life and landscape (see QA BR and PC);	minor	Enhancement high	**moderate**
Impact on the biological environment causing the disappearance of the existing fauna and flora of the area fished especially in the critical habitat areas (see BT)	moderate	Enhancement way	**major**
Increased groundwater water consumption (see ES7)	Negligible with minor	Enhancement high	**moderate**
Increased wastewater discharge rates in the lagoon and degradation of the ecology of the lagoon (see ES6, SS8, EC6, EC7)	minor	Enhancement average	**moderate**
Changing of local governance and social dynamics following the immigration of labor and the induced changes in the social composition and demographic structure of the Project area (see DG)	minor	Enhancement average	**moderate**
Change in well-being and health through a change in lifestyle and landscape and an improvement of social and health infrastructures (see BS)	minor	Enhancement strong	**major**
Changing the land tenure and use rights (see OF)	minor	Enhancement high	**major**
Reduced access to natural resources by occupying the ground of the industrial area (see AT)	Negligible with minor	Enhancement high	**major**

Increased employment and economic activities (see EA)	major	Enhancement high	**major**
Improvement of infrastructure and basic services (see IS).	minor	Enhancement average	**moderate**

Mitigation measures and residual impacts

The mitigation of cumulative impacts and corresponding residual impacts are shown in Table 7.20 below.

Table 7.20 Mitigation measures and residual cumulative impacts

Description of the impact	cumulative impact before mitigation	Key mitigation measures	Residual cumulative impact
Extension of the Plant ERANOVE			
Impact on air quality following additional air emissions (see AQ4, AQ5).	**minor**	If necessary, development of ESIA and modeling the combined impact of present and future emissions on air quality to ensure compliance with the applicable standards.	**Minor to negligible**
Impact on air quality following the emission of additional salty droplets (see AQ3).	**Negligible to minor**	• if necessary, development of ESIA and evaluating the impact of salty droplets impact on the environment; and • Installation eliminators systems more efficient droplets (drift eliminators) on future installations that can reduce emissions to 0.0005% of the water flow.	**Negligible to minor**
Environmental impact sound related to the new facilities noise emissions (see BR4).	**Minor to moderate**	• if necessary, development of ESIA and modeling the combined impact of present and future noise on the quality of ambient sound environment; • if necessary, implementing measures to reduce noise to ensure compliance of the eventual extension project with the applicable standards; and • consider the possibility of installing at this stage of the power generation facilities project south of the administrative buildings.	**minor**
Increased groundwater consumption may reduce the quantity and quality of water available (see SS7).	**minor**	• where appropriate, in the context of the ESIS of any extension, assess the availability of water (including the risk of reduction in the level of the web and create a cone of depression) and a possible reduction of the availability of water and saline intrusion; and	**minor**

Description of the impact	cumulative impact before mitigation	Key mitigation measures	Residual cumulative impact
		• depending on the result of the assessment, consider the possibility of a service water supply from Lake bakre.	
Increased wastewater discharge rates of service and cooling can cause a deterioration in the quality of surface water (see SS6, SS8).	**minor**	Implementation of measures similar to those proposed in SS8.	**minor**
Job creation and economic activity (see EA1 *and* 2).	**major**	Implementation of measures similar to those proposed in EA1 and 2.	**moderate**
Grand Abidjan Project			
Impact on the physical environment leading to a deterioration in air quality, sound environment and the living environment and landscape (see QA BR and PC).	**moderate**	• provision of social and environmental data collected as part of the ESIA and tracking studies; • share with future developers and the authorities good environmental practices implemented within the project ERANOVE; and • implementation by the authorities of Greater Abidjan a strategic impact assessment of the project, leading to the definition of measures for the protection of public health and the environment as part of the project.	**moderate**
Impact on the biological environment causing the disappearance of the fauna and existing flora of the exploited area (see BT).	**major**		**moderate**
Increased groundwater consumption (see SS7).	**moderate**		**moderate**
Increased rejection rates of sewage into the canal and the lagoon and deteriorating ecology Lagoon (see SS6, SS8, EC6, EC7).	**moderate**		**moderate**
Changing Local Governance and Social result of implementing the labor immigration dynamic and the changes brought about the social composition and demographic structure of the area project (see GD).	**moderate**	• share with future developers and the competent authorities of good practices and mitigation implemented in the project; and • share with future developers of the engagement experience feedback with the project stakeholders and functionality of the complaints management mechanism.	**moderate**
Changing the wellbeing and health in the area projetpar a living environment and landscape change and improvement of social infrastructure and health (see BS).	**major**		**major**

Description of the impact	cumulative impact before mitigation	Key mitigation measures	Residual cumulative impact
Changing the tenure and use rights (see OF).	**major**	• share with future developers the importance of integrating the process of land acquisition and compensation rights customary village committee and a representative recognized by all to ensure transparency and a shared enjoyment of compensation; and • share with future developers the importance of land in the project area for access to natural resources and feedback for developing a Livelihoods Restoration Plan.	**major**
Reduced access to natural resources of the occupation on the ground of the industrial area (see AT).	**major**		**major**
Increased employment and economic activity (see EA).	**major**	Share with developers the future action experience feedback promoting employment and local procurement.	**major**
Improving basic infrastructure and services (see SI).	**moderate**	• share with future developers the importance of integrating the process of land acquisition and compensation rights customary village committee and a representative recognized by all to ensure transparency and a shared enjoyment of compensation, and • communicate the merits of promoting compensation for loss of customary rights (Decree No. 2014-25) in the form of community infrastructure of preference.	**moderate**