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**High Commission for Niger Valley
Development**



AFRICAN DEVELOPMENT BANK

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**"KANDADJI" ECOSYSTEMS REGENERATION AND NIGER VALLEY
DEVELOPMENT PROGRAMME**

(KERNVDP)

DETAILED ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

EXECUTIVE SUMMARY

January 2008

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LIST OF ACRONYMS

ABN	Niger Basin Authority
ADB	African Development Bank
BEEEI	Environmental Assessment and Impact Studies Office
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
HCAVN	High Commission for the Development of the Niger Valley
KERNVDP	Kandadji Ecosystems Regeneration and Niger Valley Development Programme
LDP	Local Development Plan
PRS	Poverty Reduction Strategy
RP	Resettlement Plan
SBCA	Sizable Bird Conservation Area
UNDP	United Nations Development Programme
WCD	World Commission on Dams

Project Name : **“Kandadji” Ecosystems Regeneration and Niger Valley Development Programme**
Country : **Niger**
Project Number : **P-NE-AA0-017**

Summary of the Detailed Environmental and Social Impact Assessment of the “Kandadji” Programme

1. Introduction

1.1 The Kandadji Ecosystems Regeneration and Niger Valley Development Programme (KERNVDP), originally known as the “Kandadji Dam Project”, has always been considered as a major programme for Niger. In the 1990s, when Niger’s authorities became aware of the serious environmental degradation, they reviewed the previous over-ambitious options for the Kandadji site, and made the site play only the role of regulating the Niger River.

1.2 More recent appraisals show that the proposed objectives can be achieved by a small structure with less negative environmental impact on the area upstream. Consequently, the feasibility of the structure had to be determined in light of the socio-economic context and achievement of the proposed development goals. Taking into account these priorities, the Government of Niger requested and obtained financing from the African Development Bank Group (ADB) in 1998 to conduct a feasibility study on the Kandadji Dam.

1.3 Under the study, an environmental and social diagnosis, as well as an initial environmental and social assessment, were also conducted. The findings were presented in October 2002 at a donors’ roundtable, which approved them. Consequently, a detailed environmental and social impact assessment (EISA) was also conducted with ADF funding to deepen the results of previous studies. The final designs of the dam were prepared with financing from the Islamic Development Bank.

1.4 This document is the executive summary of the study and includes, in addition to the Introduction, the following chapters: (2) Description and Rationale of the Programme, (3) Policy, Legal and Administrative Framework, (4) Description of the Project Environment, (5) Alternative Solutions of the Project, (6) Potential Impacts and Mitigating and Optimization Measures, (7) Cumulative Impacts, (8) Cross-border Impacts, (9) Impacts on the General Environment, (10) Management of the Environmental Risk, (11) Monitoring Programme, (12) Public Consultations and Information Dissemination, (13) Supplementary Initiatives, and (14) Conclusion, References and Contacts.

2. Description and Rationale of the KERNVDP

2.1 Located between the Sahel and the Sahara Desert, Niger is ranked as the 22nd largest country in the world with an area of **1,267,000 km²** on which an estimated **12 million inhabitants** live. It is bounded to the north by Algeria and Libya, to the east by Chad, to the south by Nigeria and Benin, and to the west by Burkina Faso and Mali. The Niger River (3rd longest in Africa), at the extreme west of the country, is the only permanent waterway in the country. Only **550 km** of its total length of **4,200 km** pass through the country, and it flows

from the Malian border to the confluence of the border with Nigeria and Benin. With very low annual rainfall and in view of its geographical location, Niger has been experiencing severe droughts since 1970. Over the same period, the average annual yield of the river has diminished by over 30% as a result of climatic changes. The populations are vulnerable to such climatic changes. Farm lands have decreased steadily and their fertility has diminished due to the combined effects of the drought and population pressure. To remedy the situation, the “*Kandadji Ecosystems Regeneration and Niger Valley Development Programme (KERNVDP)*” was chosen as the priority sector programme of the Government by Decree No. 2002-217(a) of 22 August 2002.

2.2 The general area of the study comprises all the districts adjacent to the Niger River from the Malian border in the north to the Nigeria border in the south. However, for the purposes of project impact assessment, a detailed study area was defined in terms of territories that run the risk of being the most affected by the project. With this definition, the detailed study area with the major impacts covers a region of approximately 4,500 km² comprising: the area for the future reservoir to be created by the dam, an adjacent area of variable width bounded to the north by the Malian border, a strip of land downstream the dam about 10 km on either side of the Niger River and with an approximate length of 80 km, as well as a second strip further downstream 2 km on either side of the River up to Tillabéri. A map of the areas studied is given in the Annex.

2.3 The Kandadji site is recognized as a suitable location for the dam because the river bed is quite narrow at that point as a result of the presence of a rocky hill on the right bank at Ourouba that towers over the neighbouring landscape by over 100 m. The site is also appropriate for the location of the dam in view of the rocky nature of the river bed that can support sizeable concrete structures, and the presence of an island that will facilitate the diversion of the river during the construction phase. This site is close to the village of the same name: 61 km downstream the Malian border and upstream the Niger portion of the Niger River, 187 km north-west of Niamey. A few kilometres upstream the site, the Gorouol river flows into the Niger widening the valley considerably, and thereby increasing the capacity of the proposed dam. The relevance of the choice of the site was confirmed by the geotechnical studies conducted as part of the final design of the dam.

2.4 The Kandadji Programme is mainly intended to improve the living conditions of the communities by ensuring food security through the integrated development of natural resources, the control of desertification and environmental degradation, regeneration of the natural environment, and satisfaction of energy needs. The objectives of the Programme are to: (i) increase the water level and reduce environmental degradation, (ii) ensure the sustainability of irrigation and water supply, and (iii) produce electric energy by creating a reservoir of sufficient capacity. The programme will help to meet the following needs: (a) supply of drinking water to urban communities; (b) supply of water to rural communities; (c) supply of water to livestock; (d) supply of water to industries; (e) irrigation; (f) contribution to the country’s electricity supply; and (g) increase in the resilience of ecosystems to climate change.

2.5 The main activities of the programme are as follows: (a) construction of an 8.4 km dam made of an earth dyke equipped with related structures and with a capacity of 1.6 billion m³ of water and a regulated discharge of 120 m³/s in Niamey to provide water for drinking purposes and various socioeconomic uses (potable water, irrigation and energy); (b) construction of a 130 MW hydroelectric plant and a 132 KV high voltage line between Kandadji and Niamey over a distance of 188 km; (c) development of the first phase of 6,000 ha irrigation scheme

mainly for the benefit of communities affected by the Programme, with a medium-term target in 2034 of 45,000 ha out of an irrigable potential of 122,000 ha; and (d) implementation of the Environmental and Social Management Plan (ESMP) and the Resettlement Plan (RP) for the people to be displaced (5,290 households).

2.6 Preparatory works to be undertaken prior to the construction of the dam will consist in the construction of the following: (i) access roads to individual housing areas and borrow pits; (ii) a bridge over the Niger to provide access to the right bank; (iii) the living quarters of the contractor and project owner; and (iv) cofferdams for the first phase of the river regulation. An emergency phase of the ESMP and the RS, which will start at the commencement of the preparatory works and spread over a six-year period, up to the end of construction of the dam, will entail the following activities: (a) the construction of reception facilities for the displaced populations (such works must begin from the second year and be completed before the priming of the reservoir); (b) the displacement and resettlement of populations residing within or around the dam area, borrow pits, access roads and dwelling places to be constructed; (c) the development of irrigation schemes on an estimated area of 2,000 ha for communities to be affected by the initial displacement and those whose farmlands will be rendered unusable; (d) other community amenities for the affected populations; (e) activities of the environmental component to be undertaken under the construction management sub-programme, the impact mitigation sub-programme and the consultation sub-programme.

2.7 Other activities to be undertaken are as follows: procurement of the lands earmarked for expropriation, implementation of the compensation package, construction of reception facilities for the affected populations, deviation of the RN-1, and removal of vegetation in the works zone.

3. Policy, Legal and Institutional Framework

This chapter outlines the policy, legal and institutional framework within which the detailed ESIA of the KERNVDP is set. It presents the relevant environmental and social policies of the ADB and Niger, as well as the national legal requirements. International environmental and social conventions to which Niger has adhered are also presented.

3.1. Policy Framework

The policy framework within which the KERNVDP is set comprises:

- the policy on agricultural and rural sector development (April 2000), energy and crosscutting policies of the ADB Group mentioned in 3.1.1;
- poverty reduction and accelerated growth strategy of Niger, environmental policy and rural development strategy;
- social policies (promotion of women, child protection, education and health) and related sector programmes (agriculture, water, energy; etc.); as well as
- relevant international conventions to which Niger has adhered (Cf. 3.1.2).

3.1.1. Relevant ADB Crosscutting Policies

- the ADB Group poverty reduction policy (February 2004);
- Environmental Policy (February 2004);
- Gender Policy (June 2001);

- Population Policy and implementation strategies (January 2002);
- Policy on involuntary displacement of populations (November 2003);
- Cooperation with civil society organizations - policies and guidelines (October 1999);
- ADB Policy on information disclosure;
- Bank Group strategy on malaria control;
- Integrated water resources management policy (April 2000).

3.1.2. International Conventions, Protocols, Treaties and Agreements

The international agreements, conventions and treaties relating to environmental protection and the social sector ratified by Niger and relevant to the KERNVDP are as follows:

- UN framework convention on climate change (July 1997);
- United Nations convention on biological diversity (July 1997);
- International convention on desertification control in countries affected by drought and/or by desertification, particularly in Africa (January 1996);
- International convention on plant protection (June 1985);
- International convention on wetlands (Ramsar Convention), August 1987);
- Protocol amending the convention on wetlands of international importance especially as waterfowl habitat (April 1987) ;
- Convention concerning the protection of the world cultural and natural heritage;
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES Convention), (September 1975);
- Convention on the conservation of migratory species of wild animals (Bonn Convention), (July 1980);
- Vienna convention for the protection of the ozone layer (April 1992);
- Montreal Protocol on substances that deplete the ozone layer (April 1992);
- London amendment of the Montreal Protocol on substances that deplete the ozone layer (March 1995);
- African convention on the conservation of nature and natural resources (Algiers Convention), (February 1970);
- Phytosanitary Convention for Africa south of the Sahara, (October 1961);
- Phytosanitary Convention for Africa (April 1968)
- Convention establishing a permanent inter-State drought control committee for the Sahel (September 1973);
- Convention establishing the Niger Basin Authority and protocol on the Niger Basin Development Fund (December 1980);
- Act on navigation and economic cooperation between the Niger Basin States;
- Agreement on Niger River Commission and navigation and transport on the Niger River (April 1966);
- Convention on the African Migratory Locust Organization (April 1963)
- Kyoto Protocol to the UN Framework Convention on Climate Change (September 2004);
- Convention on the use of the lower Niger;
- Paris Declaration on shared vision for the sustainable development of the Niger River Basin, 2004)

3.1.3. Legal Environmental Framework

As regards environmental protection and management, in addition to international conventions, treaties and agreements of which it is a stakeholder, Niger has a number of key laws and regulations, comprising general instruments, such as the Constitution, the Ordinance defining the guiding principles of the Rural Code and laws pertaining to environmental management, as well as sectoral instruments in forestry, wildlife and hunting, fisheries, water resources, mining, land use planning, town planning, and housing.

3.1.4. Legal Social Framework

The legal social framework comprises laws and regulations relating to children, women, labour, employment and remuneration, social security, education, health, economic development, agricultural and pastoral sectors, energy, cultural heritage, as well as expropriation for public convenience. In this area, Niger ratified the UN Convention on the Rights of the Child and the African Charter on the Rights and Well-being of the Child in 1990.

3.2. Institutional and Administrative Framework

Several institutions are concerned with the KERNVDP. Apart from the HC/AVN, these are mainly Ministries in charge of the environment, women and child protection, health and control of major diseases, economy and finance, agriculture, animal husbandry, water resources and energy, and at the regional level, the Niger Basin Authority and the Integrated Development Authority of the Liptako-Gourma region. The HC/AVN will be strengthened by a consulting firm, technical assistants and national and international NGOs (UICN and WWF) which will assist in the implementation of the ESMP and the RP.

4. Description of the Programme Environment

Biophysical Environment

4.1 The biophysical environment consists of physical and biological environments. The northern part of the detailed area of study is made up of hills, continental rises and flat terrains where the southern portion is characterized by large seif dunes. On the whole, the area has a low relief (with the notable exception of the Ourouba hill).

4.2 The site of the Kandadji dam is located in the Middle Niger (an area of very low seismicity) namely, the portion between the inland delta debouchure (at the centre of Mali) and the Niger-Nigerian border. The ecology of the Niger River Basin is conditioned by climatic factors, notably rainfall and temperature. The dry season generally occurs between October and May. It is characterized by dust and sand storms, as well as frequent winds that often have negative effects on health and on the environment. The climate of the detailed study area is of the Sahelian type characterized by an annual rainfall of about 300 to 350 ml. Virtually all the surface water resources of the country derive from the Niger River and its right bank tributaries. Annual water resources from the Niger River to Niamey currently average 22 billion cubic metres. Since rainfall in Niger varies significantly over time, the problem of water supply occurs mainly during the dry season. The duration of minimum flow in any given year depends on the flood of the previous year. In a dry year, minimum flows are long and severe (April to July), and can be reduced to a few cubic meters per second. In view of the climate change, this situation has worsened over the last three decades. In July 1974, the discharge rate of the Niger River fell to 0.4 m³/s, and in June 1985, it totally ceased flowing for a few days.

4.3 The soils of Niger are conditioned by the climate, and their distribution depends mainly on the rainfall pattern (Feasibility Study by Lahmeyer et al. 2000). In the detailed study area, seven major soil types can be distinguished, namely raw wash soil of recent ergs, slightly raw wash soil of old ergs, sandy-gravelly to clayey sandy soils in the valleys (alluvial soils), soils of colluvial origin from clayey schist formations, weathered granite soils, stony and shallow hardpan soils, and rock outcroppings.

4.4 In the detailed study area, an inventory of land inventory and the interpretation of satellite images have helped to identify 14 types of plant formation over seven areas. The areas are made up of farms and forests, savannah and grass steppes, bare ground, water bodies and urban areas. In some zones, the animal stocking rates outstrip the carrying capacities of the rangelands. Shrub and tree floras are restricted to some 25 broad spectrum species. The stock of constituent elements of biological diversity indicates substantially rich flora and fauna. None of the plant species is listed as endangered or vulnerable. Endangered or vulnerable fauna species in the detailed study area include the black crowned crane, the white cheek Cape otter, the West African manatee, the common hippopotamus, the dorcas gazelle, the addra gazelle, the African hunting dog, and the striped hyena.

Human Environment

4.5 The high human concentration around the river exerts considerable demographic pressure on the already fragile agro-pastoral environment. Although the regions through which the Niger River flows (Tillabéri, Niamey and Dosso) are not the most densely populated in the country, their population density is among the highest. These three regions have 4 million inhabitants, which represents 37% of the total population of the country, although they cover only 10.4% of the national territory. Several ethnic groups live together in the area, in a historically established perfect harmony: Zarma, Songhay, Fulani, Tuareg, Gourmantché, etc.

4.6 The social organization is largely influenced by the culture and traditions of each ethnic group. Gender-related inequalities exist. For women, the inequalities result in work overload and lower incomes in comparison to men. There are still some socio-cultural constraints, particularly as regards access by women to land resources. In the study area, the population is mainly sedentary, although there are concentrations of nomad communities in the Anzourou, Ayorou and Gorouol districts. The living conditions are characterized by difficulties in meeting essential needs. The main economic activities are farming, stockbreeding, logging, fishing, etc. The primary sector employs nearly 90% of the working population in the Tillabéri region (330,500 out of 372,000). The informal sector is dominant and accounts for over 70% of the value of the national output.

4.7 The common major diseases in the area are malaria, pulmonary diseases (cough/cold, pneumonia), diarrhoeal diseases, and infectious diseases, such as measles. Malaria remains a major public health problem for the people. AIDS accounts for a low percentage of the diseases. According to the data of the Disease Surveillance and Control Department (Former SNIS) of the Ministry of Public Health and Disease Control, this is probably due to the under-notification of cases (520 cases in the Tillabéri region from 2000 to 2004).

4.8 The faith heritage is essentially made up of mosques and cemeteries. A few places of ceremony also exist, but these have not been adequately developed. In the proposed area of the dam reservoir, 163 mosques and 123 cemeteries have been identified. The archaeological, historical and cultural heritage of the detailed study area is also very rich.

5. Alternative Solutions of the Project

5.1 The aim of any dam project should be to improve the well-being of the populations, resulting in human development that is economically viable, socially equitable and environmentally sustainable (World Commission on Dams/WCD, 2000). Consequently, the selection of the project should be based on an assessment of the options at the political, institutional and technical levels.

5.2 The orientations of the Kandadji Programme and the proposed options were subject to broad-based consultations and consensus confirmed by all the stakeholders in several validation workshops following analysis of the feasibility study reports on the Kandadji Dam and ESIA organized by the HCAVN. Consequently, in assessing the alternative solutions, the following options were considered: (a) institutional changes and policy reforms; (b) improved efficiency of existing systems in energy production as well as surface and underground water supply; (c) alternative energy sources; (d) options of dams on the Niger River; and (e) the non-dam option.

5.3 Institutional changes and policy reforms in water management can influence consumption patterns, reduce water demand and affect the viability of the four other options. Over the past thirty years, the Government of Niger has formulated instruments for the planning and use of water resources, including the Niger Water Resources Use Development Plan, the Water Resources and Management Development Master Plan and, more recently, the Water and Sanitation Policy and Strategies for Sustainable Development (Ministry of Water Resources, 2001). Alongside these reforms and institutional changes, the river ecosystem has continued to worsen due to deficits in the river level, increased desertification in the Niger Basin, as well as water and wind erosion. For this reason, it is believed that the option relating to institutional changes and policy reforms alone cannot meet the objectives of the KERNVDP.

5.4 According to the WCD, the improved efficiency of the existing systems is both an option and one of the principles to be observed in evaluating the options. The existing systems considered for the evaluation are fossil fuel resources, development of dams on the Niger tributaries and ground water resources. After considering each of the options in relation to its capacity to meet all the objectives fixed it was concluded that the **KERNVDP** meet all the objectives set. Existing alternative energy sources, including solar energy and wind energy, cannot meet the large-scale energy needs. Moreover, such systems are not multi-purpose and therefore cannot meet the KERNVDP objectives.

5.5 Water resources for energy development are concentrated only in the river and its tributaries. On the Niger River, the two potential sites are Gambou and Kandadji. The Gambou project essentially aims at producing electric energy, and does not address all the KERNVDP objectives. After several studies, it became obvious that the KERNVDP is the option that would meet all the objectives set: (a) increase minimum water levels and reduce environmental degradation, (b) ensure the sustainability of irrigation and drinking water supply in the Niamey and Tillabéri, and (c) produce electric energy. Furthermore, by virtue of its objectives, the Kandadji Programme is consistent with national or regional policies, strategies and master

plans. It is also in line with the priority action plan for the sustainable development of the Niger Basin as a structuring programme of the Shared Vision of the Niger Basin Authority (ABN) which comprises the nine member States of the active basin of the river.

5.6 No water control structure has yet been constructed on the Niger River in the Republic of Niger, and the river ecosystem continues to worsen following very low water levels, increased desertification in the middle basin, and water and wind erosion. The sharp decrease in quantities of water flowing into River Niger since the 1970s, whose future is uncertain, has been having increasingly degrading effects on the river ecosystem, the sustainability of irrigation, public health and water supply for the population, cattle and industry. For these reasons, the non-programme option is not acceptable. The status quo will only worsen the situation of the river, the environment, the ecosystem, and the standard of living of the riparian communities.

6. Potential Impacts, and Mitigating and Improvement Measures

Preparation Phase

6.1 Most of the impacts on the biophysical environment are of minor significance. The fairly significant impact mainly concerns the destruction of fauna habitats and other species as a result of the construction of reception facilities, as well as the displacement and resettlement of populations. To mitigate this impact, the sites or borrow pits could be improved to mitigate, as much as possible, the impact on the fauna and its habitat. No positive impact on the biophysical environment is expected during the preparation phase.

6.2 As regards the human environment, expropriation for public utility will be start and, consequently, a compensation process will be put in place, and the initial compensations granted to eligible persons. The major negative impacts are related to the expropriation of lands, as well as displacement and resettlement of populations. These activities will lead to the involuntary, but concerted, displacement of about 35,000 persons (based on the November 2005 census). However, despite their disruptive nature, the involuntary displacement and resettlement will also generate benefits. The compensation process will help to secure the lands allocated in compensation, and thereby officialize property rights. Compensation will also be given to affected persons by providing them with alternatives to regain and even improve their standard of living.

6.3 The mitigation measures proposed to reduce the negative impacts of expropriation, displacement and resettlement are outlined in the Resettlement Plan (RP). At the social level, the negative impacts of the activities during the preparation phase of the Programme will not be completely eradicated, but the full implementation of the RP should minimize them and contribute to improving the positive impacts.

Construction Phase (Pre-construction and Construction)

6.4 The major negative impacts on the biophysical environment are related to deforestation and priming of the reservoir. The loss of vegetation will destroy the source of firewood, fruit trees, non-wood forest products, and additional feed for livestock during the lean season. It is estimated that over 6,000 ha (1.3% of the detailed study area) of various plant formations will be lost and/or flooded during the priming of the reservoir. About 1,400 ha of wetlands, made up of ponds, flood-prone savannah land, rock vegetation and lowlands will be affected during

this phase. The priming of the reservoir will also involve in the loss of habitat for fauna and a sizeable bird conservation area (SBCA) which covers an area of 10,000 ha. The SBCA of the Ayorou sector is one of the fifteen SBCAs of Niger, and represents 0.1% of the total area of such zones in the country. The construction and reservoir priming works will affect the physical and chemical characteristics of the water, primary production, and fishes. To mitigate the impact of the loss of vegetation in the reservoir, it is suggested that the entire forest biomass in the reservoir be recovered prior to the priming. The implementation of a replanting and water and soil conservation programme will provide firewood and timber sources, while helping to protect the soils against wind and water erosion. To compensate for the loss of the SBCA in the Ayorou sector, it is recommended that islands be developed for the avian fauna.

6.5 The expected major positive impacts will be the reduction of water hyacinth downstream the reservoir, as well as less significant decrease in the dissolved oxygen concentration, following prior deforestation of the proposed reservoir. This will reduce the impact of the priming of the reservoir on biodiversity.

6.6 The negative major impacts on human environment will concern the various construction activities and priming of the reservoir. These activities will result in the loss of about 8% of productive farmlands in the flooded area and destruction of fodder sources, particularly “*bourgou*”. To mitigate this impact, it is recommended that the production potential of pastures be improved by planting suitable fodder species and by developing lakeside pastures between Firgoune and Koutougou.

6.7 Furthermore, major heritage sites will be lost as a result of the priming of the reservoir. Even though an excavation programme was carried out on the identified sites during the detailed study, this impact can only be partially mitigated. To that end, it is proposed that archaeological surveillance be conducted during the works. Other fairly significant residual impacts will include an increase in the incidence of STIs and tuberculosis. A vast information, sensitization and education programme has therefore been proposed. It will also be more difficult for people and livestock to cross the river, and the land use in the area to be flooded will be modified. To mitigate this impact, and apart from the dam which be eventually used as a bridge for crossing the river, appropriate canoes will be proposed to the riparian populations.

6.8 Some positive impacts are expected during this phase, namely the creation of business opportunities for the farmers, stockbreeders and fishermen who will supply labour, job creation for the construction of the structures and tree clearing, development of new skills, reduction of seasonal rural exodus and idleness of youths, the discovery of heritage sites and cultural artefacts on the construction sites, positive migratory trends in the area, as well as beneficial effects associated with tree clearing that will sustain fish yields and provide wood resources to the displaced persons.

Operational Phase

6.9 The significant negative impacts on the biophysical environment are the change in the river from fast to slow upstream the dam and the loss of quality habitat for birds. The expected major positive impacts include the improvement of the water level and the reduction of natural floods, improvement of the water quality downstream during low water level, increase in areas conducive to the hippopotamus and manatee habitat downstream the dam, conservation of the diversity of fish species, and improvement of habitat conditions downstream. There are also many positive impacts of average to minor significance, including the reduction of the

greenhouse effect resulting from the production of energy from the Kandadji hydroelectric plant instead of thermal power generation, beneficial effects of the deposit of sediments on the soil structure upstream the reservoir, the constant replenishment of the alluvial water table downstream the dam, and the increase in the replenishment rate of the underground water in the reservoir environment.

6.10 Most of the impacts are linked to the presence of the reservoir and fluctuations in water level, the presence of the dam, the power plant and the spillway, as well as the presence of the dam crest road. The water supply for irrigation, energy production, the presence of reception sites and the economic development under in the programme are also significant impact sources. The major negative impact concerns the presence of the reservoir that will increase the incidence of malaria, which is already prevalent in the study zone. Moreover, a fresh outbreak of water-borne diseases is likely, especially schistosomiasis, with the presence of the reservoir and irrigation schemes. The proposed measures for the prevention, education and monitoring of high risk diseases will mitigate the harmful impacts of the programme on the health of the people, but the risks of contraction of various water-borne diseases will not be completely eliminated. Social cohesion could also erode in the detailed study area. Such changes can cause conflicts between social groups and even within the same group. Several measures have been proposed to avoid the outbreak of such conflicts or to adequately manage them should they occur.

6.11 However, many positive impacts are expected at the social and economic levels; these include regular access to water upstream and downstream the dam, improvement of the standard of living and quality of life of the displaced persons, improved standard of living of the populations both upstream and downstream of the dam; improved nutritional status of persons affected by the programme, improved health status of the resettled populations as a result of adequate water infrastructure, opening-up of the Gorouol district, development of new skills, reduction of the seasonal rural exodus and idleness of young people; decreased workload of women and increased civil society participation.

6.12 At the economic level, the expected benefits include increased agricultural and pastoral productivity, better supply of inputs and improved access of farm, livestock and fish produce to markets, economic development as a result of the new opportunities created by the programme, development of secondary and tertiary sectors, diversification of economic activities, economic development as a result of the electricity production and reduction of the country's energy dependence, as well as the creation of new infrastructures and services.

7. Cumulative Impacts

7.1 As recommended by the World Commission on Dams, the analysis focuses on the social and environmental components implemented in the Niger River Basin. These components were identified using joint analyses of regional development priorities and the concerns of the local communities expressed during public consultations. The components are *surface water resources, biodiversity, navigation, agriculture, livestock, fisheries and electric power*. Cumulative impacts on these various components remain positive on the whole, and can be summarized as follows:

7.2 During the low water level, the cumulative impact of future dam projects will be positive in view of the regulation of water flow that will help to mitigate the negative impacts of drought that has hit the country since 1970. In addition, it will replenish the water table and

promote the regeneration of ecosystems downstream the structures. The availability of sufficient quantities of good quality water is a major factor for the development of Niger and other countries in the basin.

7.3 The priming of the reservoirs of the proposed Kandadji and Taoussa structures will lead to the loss of wetlands, but it will improve the water table through infiltration and regeneration of plant formations.

7.4 As regards navigation, although the two dams will impede the longitudinal movement of boats, the maintenance of low water flow rates downstream the two structures will sustain permanent local ties between the villages.

8. Cross-border Impacts

8.1 The probable negative and positive impacts of the management of the Kandadji dam on the discharge of the Niger River downstream, particularly for the Kainji and Jebba dams in Nigeria, can be summarized as follows:

Negative Impacts

8.2 The loss, through evaporation and modification of the Niger River water flows, in Nigeria will be low - 2.8% at Yidere-Bode, 2.3% at Jebba and 0.6% at Lokoja. Gradual reduction of the water level could dewater the upper portions of flood plains and affect the vegetation on the plain, and, in the long-term, modify sediments and the balance of the river profile. Moreover, the increased waterlogging in the lowlands, the flow and level of water just downstream the dam will be irregular.

Positive Impacts

8.3 With the Kandadji dam, the minimum water level in Nigeria will improve. The foreseeable positive impacts are as follows: the low water level conditions will be improved, and maintaining minimum flow rates will help to address the constraints of adequate supply of drinking water, sustaining fish life and dilution of the tributaries on the Niger-Nigerian border; sustaining the minimum water level will permanently submerge the lowlands. The level of alluvial groundwater will increase significantly, and thereby improve the regeneration of vegetation, the control of desertification, and restoration of aquatic habitats. In short, the partial modifications of the quantities of water flowing into the Niger River as a result of the Kandadji dam will be minimal in Nigeria.

9. Impacts on Overall Environment

With an annual output of 565 GWh, the KERNVDP will help avoid the adverse effects that a thermal plant of a similar capacity will have particularly by releasing into the atmosphere 381.375 tons of equivalent CO₂ annually mainly made up of carbon dioxide and methane. An extrapolation of the operating life of the structures (namely, one hundred years), indicates that KERNVDP will release 3 times less greenhouse gases than its thermal equivalent. Overall, impacts in terms of greenhouse gas emissions will be positive.

10. Management of Environmental Risk

10.1 The main environmental risk concerns failure of the dam. In case of failure of the Kandadji dam as a result of water level changes, the affected zone will mainly be the lower reaches of the dam. The scale of the consequences is based on several rupture scenarios, including the rupture that will have the most significant impacts. The hydrological and hydraulic impacts of the most critical case will be created by the instantaneous release of sizeable discharges through breaches that could result in major fluctuations in water level, discharge and flow speed. It was necessary to use forecast model for the analysis of the propagation of submersion waves.

10.2 The adoption of emergency measures is based on a series of complementary and coherent activities aimed at alerting the employees and the population and mobilizing the stakeholders, preventing damage, establishing communication lines in order to specify the various stages of the emergency process, communicating the telephone hotlines of various intervention services, mitigating the impacts of the accident and ensuring the return to normalcy.

11. Monitoring Programme

11.1 The Environmental and Social Management Plan (ESMP) was prepared in accordance with the relevance regulations of Niger and based on the environmental and social assessment procedures of the African Development Bank (ADB). Responsibility for the implementation of the ESMP lies with the High Commission for the Development of the Niger Valley under the supervision of the Environmental Assessment and Impact Studies Agency (BEEEI) and relevant institutions. The environmental and social monitoring comprises two components: monitoring of works that would ensure that the mitigation and improvement measures recommended are applied, as well as the monitoring of impacts on the most worrying environmental and social components.

11.2 The budget for implementing the ESMP amounts to CFAF 13.4 billion or US\$ 25.9 million over twelve years at 2005 constant prices. The RP implementation budget, including the LDP, amounts to CFAF 71.8 billion or US\$ 138.8 million. About 75% of the RP budget is devoted to compensations in kind and in cash to persons affected by the project.

12. Public Consultations and Information Dissemination

12.1 Public consultation was one of the methods used for conducting the environmental and social assessment of the Kandadji Programme. Indeed, since the preparation of the ToRs of the detailed ESIA, the HCAVN has embarked on a restricted consultation programme with the civil society represented notably by the WWF and UICN, two international NGOs involved in nature conservation, to supervise and validate the draft ToRs. An ESIA launching workshop for the KERNVDP was held on 21 March 2005 in Tillabéri during which the methodology proposed for the implementation of the study was presented. Over fifty participants from major Ministries, the Niger Basin Authority (ABN) and NGOs including the UICN, women's organizations, youths and producers (fisheries, agriculture, forestry and livestock) were present. Information and public consultation sessions were held from 4 to 16 May 2005. They began with a meeting with the administrative and local authorities to sensitize them on the KERNVDP and the activities implemented within the framework of the detailed ESIA. Meetings with the village chiefs of Dessa, Ayorou and Gorouol districts, which are directly

concerned with the surveys on capital goods and household census, were organized to inform them about the meetings and gather their views and concerns. Public consultations were held in three villages selected by the district chiefs in the study area. Nine consultation meetings were conducted in Ayorou, Séno and Alkondji villages, located in Ayorou, Dessa and Gorouol districts respectively. The groups, who were met separately, represented a broad spectrum of stakeholders present in the study area, namely women's groups, fishermen, stockbreeders, farmers and young people. The national validation workshop of the KERNVDP ESIA report took place in Niamey on 8 and 9 March 2006. During the workshop, the various stakeholders consulted with each other on the contents of the report.

12.2 Consultations specifically on the RP and the LDP were held in the study area on 25, 26, 27 and 28 June, as well as on 3, 4 and 5 July 2006. The reports of these validation workshops, signed by the participants, were appended to the final ESIA report. On 20 and 21 July 2006 in Tillabéri, a validation workshop was organized specifically on the RP and the LDP. The workshop brought together all the stakeholders, including the relevant Ministries, NGOs operating in the area, administrative and traditional authorities, as well as the major donors.

13. Supplementary Initiatives

13.1 The Resettlement Plan (RP) is a component of the detailed environmental and social impact assessment, which outlines measures proposed to mitigate the negative impacts of the displacement of affected populations and expropriation of land and property required to ensure implementation of KERNVDP. The RP includes a resettlement strategy to facilitate the transition and ensure maintenance, as well as improvement, of the living conditions. It also proposes compensation methods, taking into account the types of losses incurred. The RP also includes a Local Development Plan (LDP) to enable the affected populations to adapt their economic activities to new realities so that they may become the key beneficiaries of the opportunities created by the programme.

13.2 On the whole, it is estimated that 5,290 households will be displaced, representing 34,710 persons out of the 38,000 affected persons. The displacement will be carried out in two phases. The first phase will affect 508 households and the second 4,782 households. In the majority of cases, the persons affected by project - eight categories in all – will incur different types of losses (houses, farms, pastures, natural resources, etc.). They also include considered vulnerable, who will be given special attention. Such persons could have needs relating to land or access to services or resources that are different from most of the affected persons, or needs that are not related to the quantity of lands made available to them.

13.3 Eligibility criteria for compensations have been defined taking into account all the land owners, be they holders of land certificates or customary property rights. Users of lands that will be expropriated also have rights as farmers. Compensation of the persons affected by the project will be in cash, in kind and/or in the form of assistance. Even though the type of compensation will be the individual choices of the persons affected, efforts will be made to sensitize them on the importance and advantages of compensation in kind.

13.4 Cash compensations for lands will be based on Ordinance No. 99-50 of 22 November, 1999 determining the alienation and occupancy prices of State lands of the Republic of Niger. This law stipulates that the alienation price of land in the rural areas of rural councils is CFAF 50/m² or CFAF 500,000/ha. To calculate the compensations, expropriated lands were divided into three categories. As for lands in urban areas, they will preferably be compensated in kind.

Where the urban plot is built, it will necessarily be replaced with an equivalent plot on the reception site. If it is not used, cash compensation will be provided on the basis of CFAF 200 /m² in residential areas and CFAF 500 CFAF/m² in commercial areas as stipulated in Ordinance No. 99-50. However, it is not expected that owners of unused lands would opt for cash compensation since the plots on the reception sites will gain in value after the implementation of the KERNVDP.

13.5 In addition to informing the PAPs, the RP proposes to consult and involve them in all the major decisions of the RP, concerning selection of the reception sites, calculation of the compensations, or planning of the displacement and resettlement. In this regard, missions to present the ESIA findings and provide information on the major stages of the implementation of the Kandadji Programme were organized in September, October and November 2007, for the affected populations, elected representatives, as well as the relevant administrative and traditional leaders.

13.6 In a nutshell, it can be said that the main supplementary initiative in the detailed environmental and social impact assessment is the Local Development Plan (LDP), which aims to improve the Kandadji Programme and transform its negative impacts, initially highly disruptive, into development opportunities. The LDP was designed in addition to the RP to facilitate the economic transition of displaced persons in order to restore their standard of living or even enhance it. It is a key instrument that should provide concrete answers to the problems raised. Its implementation should be monitored closely. The LDP takes into account the actual concerns of the local communities in line with the ongoing decentralization process in Niger.

14. Conclusion

14.1 The KERNVDP is the only option that meets all the set objectives, namely: sustain minimum water level and mitigate environmental degradation, ensure the sustainability of irrigation and water supply, and produce electric energy. One of the key objectives of the KERNVDP is to guarantee, on a permanent basis, the satisfaction of all demand for water downstream the Kandadji dam. The programme will help to meet the water needs of the population, livestock, industries and irrigation schemes.

14.2 The KERNVDP will generate significant positive spin-offs in the study area and for the entire country. However, the many positive impacts are counterbalanced by unavoidable negative impacts, though these could be mitigated. The implementation of the ESMP, the RP and the LDP will help to reduce and mitigate the negative impacts of the programme, and improve the positive impacts.

14.3 Furthermore, the option of constructing a multi-purpose regulation structure under the KERNVDP was adopted as one of the priority areas of the country's rural development strategy that would help to operationalize several objectives of the poverty reduction and accelerated growth strategy. The KERNVDP is included in the development priorities of the Niger Basin as a structuring programme of the Shared Vision of the Niger Basin Authority.

14.4 The construction of the Kandadji dam does not face any special technical or geological problem. The choice of an earth dam as the major dike will allow for the exclusive use of local materials that would result in intensive use of local labour. An evaluation of the seismic impact on the Kandadji infrastructures based on seismic data indicates that the structures will be stable in the event of earthquakes.

14.5 The proposed mitigation measures to minimize the negative impacts of land acquisition, as well as the displacement and resettlement of persons are detailed in the Resettlement Plan. The mitigation of some impacts may prove to be difficult. For example, the loss of areas of cultural and worship significance or kinship ties on the land will be irreplaceable for some people. Consequently, at the social level, the negative impacts of the activities during the preparation of the Kandadji Programme will not be completely mitigated, but the implementation of the Resettlement Plan and the Local Development Plan should minimize them and contribute to enhancing the positive impacts.

14.6 However, considering the significant changes in the lifestyle of the communities affected by the implementation of the programme, the implementation of the LDP will be as important as that of the ESMP and the RP.

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Contact persons:

High Commission: Almoustapha GARBA, General Engineer, High Commissioner.

Immeuble SONARA 2,

Tel. : direct line: + 227 20 73 98 39

SWB/offices : + 227 20 73 23 13

Fax: + 227 20 73 21 85

Mobile: + 227 96 59 07 07

BP: 206, Niamey, Niger

Email:

Office: kandadji@intnet.ne

Staff: galmou@yahoo.com

Environmental Assessment and Impact Studies Office (BEEED), Ministry of the Environment and Desertification Control

Dr. KIMBA Hassane, Forestry Engineer, Director

Office**Home**

Tel.: (227) 20 72.41.69

BP: 578 Niamey – Niger

Tel.: (227) 20 72 43 99

Mob :(227) 96969355

B.P. 11033, Niamey, Niger

E-mail:

hkimba@intnet.ne

Lead Consultant: TecSult International Limitée

85, Sainte-Catherine West

Montreal (Quebec) Canada H2X 3P4

Tel.: + 514 287- 8500

Fax: + 514 287 - 8643

Web: www.tecsult.com

Manon CIRCE, Senior Socio-economist

E-mail: manon.circe@tecsult.com

African Development Bank (ADB)

Mamadou Abdoul Kane, Programme Officer (OSAN.3)

Agriculture and Agro-Industry Department

Tel: (216) 71 10 23 90; Fax: (216) 71 10 37 21; E-mail: m.kane@afdb.org

Louis-Philippe Mousseau, Senior Environmental Expert (OSAN.0)

Agriculture and Agro-Industry Department

Tel: (216) 71 10 35 40; Fax: (216) 71 33 43 35; E-mail: l.mousseau@afdb.org

"KANDADJI" ECOSYSTEMS REGENERATION AND NIGER VALLEY DEVELOPMENT PROGRAMME (P_KRESMIN)

LOCATION OF STUDY AREA

