

**ENVIRONMENTAL AND SOCIAL MANAGEMENT
PLAN OF THE
BAIXO LIMPOPO IRRIGATION AND CLIMATE
RESILIENCE PROJECT (BLICRP)**



FEBRUARY 2012

ESMP
BAIXO LIMPOPO IRRIGATION AND CLIMATE RESILIENCE PROJECT
(BLICRP)

1. General Information

- Project Number Baixo Limpopo Irrigation and Climate Resilience Project
- Starting date of implementation: December 2012
- Project completion date: 2018
- Date of operation: 2012-2017

2. Objectives of the ESMP

2.1 The purpose of this Environmental and Social Management Plan (ESMP) for the Baixo Limpopo Irrigation and Climate Resilience Project (BLICRP) is to provide a summary of environmental considerations that need to be implemented during the design, implementation and operations stages of the project. The ESMP also aims to assure the compliance of the project with the applicable environmental and social legal requirements and procedures of Mozambique (2006 Environmental Act) as well as the African Development Bank's environmental and social safeguard policies, guidelines and procedures. The mitigation measures proposed by the ESMP seek to contain or manage the project activities that could result in some environmental impacts and to achieve the project goals with a minimal environmental cost.

2.2 As environmental impacts are project specific and dynamic in nature. To account for this, the ESMP proposes a monitoring and surveillance system to support the project in coping with potential changes in earlier findings. This will help in avoiding delays in the project's implementation and in minimizing related costs. Whereas some environmental impacts are expected during the operation phase, no major impacts are anticipated during construction due to the nature of the BLICRP, which is mostly related to the rehabilitation of the already existing roads, water irrigation systems and agrarian houses.

2.3 The ESMP considers environmental and social risks as a combination of different factors, including:

- Location, and environmental and social features of the area
- Type and scale of the project
- Nature and magnitude of potential impacts
- Social perception of the project

2.4 Using the above factors to assess the BLICRP, the project may be classified as a low environmental and social risk project. Nevertheless some issues should be considered and included in the environmental and social management plan.

3. Context



Fig. 1 - Geographical location of the Xai Xai District. Source: <http://www.limporak.org> accessed on the 8th February 2012

The Xai-Xai District

3.1 The District of Xai-Xai is located in the Province of Gaza, comprising an area of 1,745 Km², which corresponds to 2.73% of the total area of the Gaza Province. The Xai-Xai District is the northern tip of the Incomati-Limpopo region, located in the one of the most important transport corridors, the National Road Number One, which links the southern and the northern parts of the country.

Demography

3.2 In 2005 the population of the Xai-Xai District was 206.000 inhabitants, with a density of approximately 111hab/Km². For 2010 this figure was expected to increase to 240.000 inhabitants. 44% of the population has less than 15 year olds and 57% are

women. 40.6% of the families living in Xai-Xai have in average between 3 to 5 members and the illiteracy rate accounts for 60.8% in women.

Table 1 - Xai Xai Population. Source: Perfil do Distrito de Xai-Xai (2005)

	Total	Age classes				
		0 - 4	5 - 14	15 - 44	45 - 64	> 65
Xai Xai	206.270	32.670	57.852	80.676	24.206	10.866
Men	88.676	16.036	29.054	31.106	8.981	3.499
Women	17.594	16.634	28.797	49.571	15.225	7.367

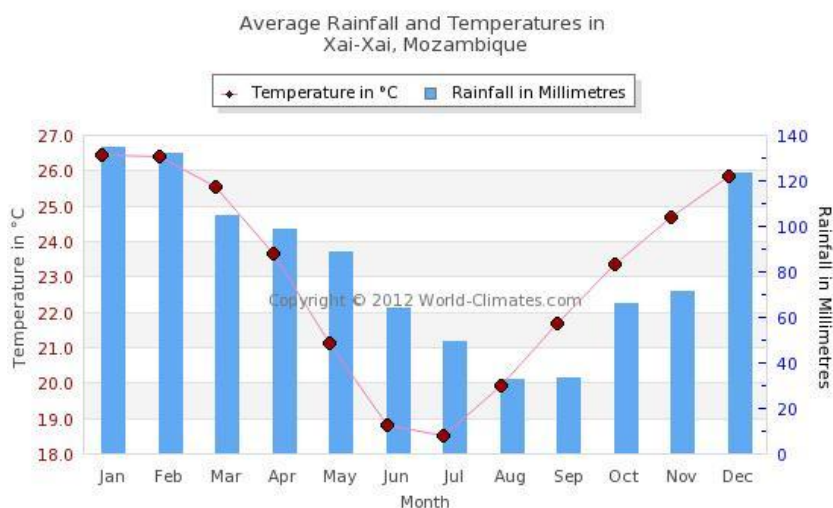
Socio-economy

3.3 Small-scale agriculture is the main socioeconomic activity in the Xai-Xai region. The principal crops are rice, bananas, maize, beans pumpkins and sugar cane. Livestock is still a growing activity in Xai-Xai.

Main biophysical conditions

a. Climate and climate change

3.4 The climate in Xai-Xai is mainly characterized as sub-humid tropical with an annual rainfall of 953 mm, strongly influence by the district's proximity to the ocean. Rainfall is somewhat irregular but with relatively dependable rains between December and April.



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Fig.2 – Average rainfall and temperatures in Xai-Xai. Source: World Climates.cm

3.5 The daily temperature in Xai-Xai ranges from nearly 27°C in January and February to 20°C in August and September. Evapotranspiration can reach an annual total of 1575 mm.

3.6 An analysis of 32 years of available data on maximum annual river levels in Gaza Province (Chokwe) between 1953 and 1994 showed that in half of all years, mild or moderate floods were recorded. Mild floods (with water level between 4-6 meters above reference level) hit seven times, moderate floods (with river level 6-8 meters) occurred nine times in 32 years. Severe floods (levels over 8 meters above reference level) happened four times in 32 years: 1977, 1975, 1972, and 1955. In 2000, river may have reached over 10.5 meters (Intstituto Nacional de Gestão de Calamidades Mocambique, 2003).

3.7 According to the USAID report (2002) Gaza is among the provinces the most affected in 2000 flooding. The total population affected in five provinces is roughly five million people and many people died. Houses, agricultural infrastructure, public buildings, schools, hospitals, water and energy supply systems, road networks, railways and telecommunications were severely damaged.

3.8 The flooding devastated about 12 percent of the cultivated land and 90 percent of irrigated land in five provinces. The largest impact was in Gaza Province and 43 percent of the cultivated land was flooded. Livestock losses were estimated at 20000 cattle, 4000 goats, sheep and pigs, and 180000 chickens.

b. Geomorphology

3.9 From the biophysical point of view, the Xai-Xai District's coastal area belongs to the southern Mozambican region, stretching from Ponta do Ouro at the border with South Africa to Bazaruto Island up north. The coastline of this physical region is 850 kilometers long, and represents almost one third of the entire Mozambican coast. The main physical feature characterizing the District's coastal area is a belt of parabolic dunes extending up to ten kilometers inland and along the entire coastline, except for a couple of kilometers short break at the Limpopo river mouth. The belt of coastal dunes comprises three main physical entities: a) sandy beaches, open or protected by the beach rock; b) the dune hills, rarely flanked with smaller fore dunes; and c) barrier lakes at the backset of the dune hills.

3.10 The inland areas in Xai-Xai can be classified in two broad morphological systems; the sandy upper lands (Serra) and the vast valley, the later corresponding to the lower lands. The Serra has an irregular shape with a variable altitude. The valley has a flat shape with the areas flanking the Limpopo River being relatively high. The transition zones between the Serra and the valley are low and wet (machongo). The Limpopo River is perennial with water quality varying depending on the amount of precipitation. During the low rainfall season the water salinity increases due to the upward movement of seawater. Salt intrusion is critical consideration for the irrigation scheme in Xai-Xai, as the pumping stations are located in sites that are affected by salt intrusion during the dry season. Simplified models that simulate salt water intrusion for different flows of the Limpopo River were formulated and tested on previous studies (Savenije, 1992). Based on these simulations, it seems that the flow from Lumane River is essential for diminishing salt intrusion, which means that this flow would have to be compensated if it is decreased by irrigation use.

c. Vegetation and soils

3.11 Most of the natural vegetation in the area was cleared to open up crop fields. In the Serra areas the dominant fruit trees are cashew (*Anacardium occidentale*), mafurreira (*Trichilia emetica*) and masala (*Strychnos spinosa*). In the South-West, the dominant indigenous trees are the mulhu (*Syzygium cordatum*) and vangani (*Dialium schlechteri*) while messassa (*Brachystegia spiciformis*) is the dominant species in the North-East. In the valley, trees and natural vegetation are mostly found near natural and constructed embankments. The low vegetation is dominated by *Panicum maximum* and *Rhynchelytrum repens* in the Serra and *Setaria flebelleta* (cununu) and *Eragrostis* spp and *Cynadon dactylon* in the valley.

3.12 The soils in the Serra area are predominantly very deep coarse sands ranging in color from orange to brown, with some red. These soils in the Serra have a low inherent fertility and a lower water retention capacity. The high sand dunes are very prone to erosion. Between the Serra and the valley the soils are in general wet and in some cases have a peat layer (machongo) as thick as 20 to 100 cm overlying sand or clay soils. They are poorly drained with high water holding and cation exchange capacities. The pH varies from moderately to strongly acid. The changing moisture conditions in time offer possibilities to cultivate a large variety of crops during the

year. The lower parts of the valley are poorly drained and moderately to strongly saline. Most of these soils are heavy textured and require tractor power to prepare. The majority is poorly drained, thus requiring artificial drainage. They have a high water retention capacity and are fertile.

4. Project description

4.1 The BLCRP project emphasizes the use of climate resilient infrastructure and climate smart agricultural activities as enunciated in the recently approved Strategic Program for Climate Resilience submitted under the Pilot Program for Climate Resilience (PPCR), which is part of the Climate Investment Funds.

4.2 The project's main objective is poverty reduction through increased value addition and provision of climate resilient infrastructure for increased agricultural productivity. It is designed in a compact, market-oriented and all inclusive manner to improve the farmers' circumstances in the District. For the project to be successful, markets need to be available for the produced commodities. To this end, the project will work closely with private sector driven agro-industries.

4.3 Climate variability is a prominent issue in Mozambique. Between 1956 and 2010, 52 extreme weather events were recorded - 23 of which occurred between 2001 and 2010. UNFCCC and the Mozambique authorities have developed the National Adaptation Program of Action (NAPA) outlining urgent and immediate actions required to face climate change impacts and adaptation measures. The NAPA identifies as priority actions : a) strengthening of the capacities of family farmers to deal with the adverse effects of climate change; b) the promotion of public education activities and information dissemination on climate change; c) the promotion of actions to limit erosion and d) the promotion of the integration of climate change into decentralized district planning.

4.4 Also the Mozambique's Action Plan for Reducing Poverty (PARP, 2011-2014) aims to reduce the poverty headcount from 54.7% in 2009 to 42% in 2014, and to promote human well-being and economic development through rapid, inclusive and broad-based growth, based on three objectives: (i) increase of agricultural and fisheries production and productivity, (ii) employment promotion, and (iii) social and human development.

4.5 The project follows both the NAPA and the PARP orientations and addresses the goal of building climate resilience in different ways such as implementing an irrigation scheme that will be adapted to the extreme climatic events (cyclones and floods) that are common in the project area. By ensuring a significant increase of agricultural production and livelihood diversification for the farmers and their communities, the project aims to build social resilience to cope with the effects of climate change. Complimentary to the specific measures oriented to adapt to climate change, the project will follow the implementation of environmental best practices, covering the management of water and other natural resources and soil protection as well as social concerns related to gender, equity, employment, health and education, under an integrated social and environmental responsibility vision. In this respect, the project will provide funding to rehabilitate a school and a clinic within the scheme that were damaged during recent floods.

The project will comprise of three components as follows:

Component A: Infrastructures for Food Security (UA 23.17 million)

4.6 Sub-component 1: Marketing Infrastructure and Agro Processing (UA 5.38 million): The purpose of this sub-component is to develop agro-processing and marketing facilities, and input distribution points. Seven existing agrarian centers will thus be upgraded, comprising of a storage room for agricultural produce, a store for input and equipment, a drying slab, an office, water and sanitation facilities and the necessary equipment (such as cleaning, drying and packaging equipment to be provided by the project). The upgraded agrarian centers will serve as marketing outlets but will also provide farmers with storage facilities, access to farming machinery, and an input supply point (seeds, fertilizers, pesticides and farming tools). The project will assist the agrarian centers in establishing first phase agro-processing facilities for post-harvest value addition. In addition, one of the agrarian centers, Nhocoene, will be equipped with a medium size cold storage room where farmers would store their produce before sale or transportation, thus encouraging vegetable production by increasing produce shelf life. This cold room will be available for use by all the other agrarian centers. Finally, a main agro-processing center will be constructed in the town of Xai-Xai to serve the farmers from the region, thus extending marketing opportunities beyond the irrigation scheme and introducing value

addition to farmers in the entire Gaza Province. The agro-processing center will be equipped with cold storage and processing facilities for fruits and vegetables.

4.7 Sub-component 2: Improved Irrigation Infrastructure (UA 9.60 million): Under this sub-component, irrigation schemes covering a total area of 1050 ha will be developed in the Magula East Block of the Baixo Limpopo Irrigation Scheme (BLIS). The irrigation water will be drawn from the Limpopo River through a pumping station that will be built near Magula. A primary conveyance system, Canal C2, with a total length of 7,372 m will be built starting from the Magula 2 pumping station. A secondary conveyance system of buried PVC pipelines will be constructed to convey water from Canal C2 to the fields.

4.8 Flood control infrastructure will be developed comprising of: (i) a system of secondary drainage ditches to drain excess water from the fields; (ii) rehabilitated two main drains in the scheme namely Umbape and Ponela and improve their management by installing sluice gates at their tail end; (iii) installed a standby generator at Umbape Pump Station to ensure continuous operations of the drainage pumps during electricity blackouts like those experienced from the floods of 2000 and the recent cyclone of January 2012 that affected power supply leading to inundation of large areas of the scheme. This will provide resilience to the scheme against floods and cyclones, and will prevent crop damage. In addition, to ensure that the scheme can withstand flooding due to climate variability and/or salt water intrusion from the sea tides, the main canals, particularly Canal C2 will be lined with geo-membrane (flexible plastic sheets) covered by plain concrete. This will stabilize the canal enabling it to withstand flooding and seepage.

4.9 The project will also improve the irrigation and drainage infrastructure in an area of 2000 ha, which was developed during the first phase of the irrigation scheme in order to improve its performance. In this area, the project will introduce fourteen (14) more secondary drains to improve excess water disposal from agricultural fields. In addition, eighteen (18) water gates and seven (7) gate valves will be installed to improve distribution of irrigation water. Finally, a gated culvert will be installed under the main road to control water flow from/to the Limpopo River.

4.10 The project will also provide resources for the initial land preparation for the areas under irrigation, and will outsource maintenance of the irrigation and drainage network and feeder roads. The cost for these services will be fully covered by the project for the first year after their development, and will subsequently be taken up by RBLEP until farmers' incomes are adequate to pick up the cost.

4.11 Sub-component 3: Rural Roads (UA 8.19 million): Under this component, all the major roads within the irrigation scheme will be rehabilitated and upgraded to All-Weather-Conditions with adequate drainage structures. Rehabilitation will include drainage works and flood protection measures, especially on the western road separating and protecting the irrigation scheme from the Limpopo River. Other feeder roads within the irrigation scheme will be rehabilitated and levelled with measures to ensure their accessibility during the rainy season and reduce soil erosion due to rain water flow. These modifications of installing proper road drainage and solid slopes will render climate resiliency to the roads during flooding.

Component B: Promotion of Farm Diversification (UA 2.85 million)

4.12 Under this component, the project will promote production of cash crops, mainly rice and vegetables, to improve farmers' incomes. For rice, it is envisaged that farmers will enter into direct contracts with the two private rice processors currently operating in the area. The two processors have been providing seeds, technical and marketing support to farmers and recovering the cost from sales. This support will be extended to cover provision of fertilizer and other inputs. The project will provide the necessary agricultural inputs as starter packs to cover the first two cultivation seasons. RBLEP will then roll out a revolving input supply system using vouchers to ensure farmers have access to inputs each season, monitor and coordinate the whole process. In this regard, RBLEP will distribute vouchers to the beneficiary farmers entitled to starter pack of inputs and they will use the vouchers to redeem inputs from the rice millers who will have contracts with rice farmers, or other input suppliers operating in the area. Upon sale of the harvest, the contracted rice processors will deduct from the revenues the cost of the following season's inputs and the service fees to be paid to RBLEP. RBLEP ensure the use of the resources received from payments of inputs to procure inputs for the subsequent season, and hence the term revolving input supply system

4.13 As regards marketing of the horticultural crops, it is also envisaged that RBLEP will assist farmers to enter into appropriate contractual arrangements with service providers (SPs) that will be contracted by the project to play a role similar to the rice processors. The project will engage two SPs under performance based contracts. Two major criteria will be used to assess their performance. The first performance criterion is the number of farmers who chose to continue the contract with that SP for inputs supply as well as technical and marketing services, or those who will choose to change SPs by leaving or joining (new contractors or those leaving the SP). On average, each SP will need to contract 2,000 farmers to receive the average payment relevant to this criterion. The second criterion is the ability to the best price for produce against the going market prices.

4.14 To maintain advantage of this arrangement is that, farmers will have the opportunity to make informed decision to choose the service provider to contract, and SPs will be encouraged to provide attractive packages for these contractual relationships. The contracts with SPs will be signed prior to commencement of production. Farmers will have to sign a service contract with one of the SPs to benefit from the inputs start up package and the project extension services. The contracts will cover the following services: (i) agricultural input supply (ii) technical advice on horticulture crops and best agronomic practices; (iii) training on value addition and post-harvest handling; and (iv) marketing aspects including cleaning, sorting, drying, cutting, packing. Success of SPs to acquire and maintain more service contracts (over 2000), and reach higher commodity price deals, will be rewarded with bonuses stipulated in their contracts with the project. Details of the SPs engagement will be part of the agro-processing and marketing study that will be undertaken by the project during the first year of project implementation.

4.15 Also under this component, the project will provide training on irrigated agriculture for a total of 210 farm families that will be selected competitively to receive plots in Magula Block East. Training will include all on-farm procedures including crop production and handling, management, operation and maintenance of on-farm irrigation and drainage infrastructure, with special attention given to best practices on the use of fertilizers and pesticides. Staff of RBLEP will be trained on different agronomic services and will be equipped with the necessary machinery to

undertake these activities and the date-to-day maintenance of the irrigation scheme in an economic manner.

4.16 In order to improve crop diversification to climate resilient crops, a research institution will be contracted to undertake the testing and proofing of climate resilient seeds in four pilot farms to recommend climate resilient seed varieties that are suitable for regions of Gaza Province mostly affected by drought and flooding. The research will also produce an easy-to-implement guide for farmers on adaptation to climatic changes in Lower Limpopo Region.

Component C: Project Management (UA 2.24 million)

4.17 This component will mainly be funded through the Government's counterpart funds that have already been set aside and reflected in the Public Expenditure. Majority of the funds will be used for the salaries of the RBLEP staff which will initially be supported by the Government until it can collect enough service fees from the farmers. Financial projections by independent consultants show that collected service fees will enable RBLEP to achieve financial autonomy to operate, rehabilitate and manage its schemes by 2016.

4.18 This component will support the project's day to day implementation and management. The project implementation will be strengthened with an M&E specialist who will be recruited under the Enhancing Climate Resilience through Sustainable Land & Water Resources Management Project (ECR-SLWMP). The project will also support RBLEP in terms of training on financial management, procurement and disbursement, and provision of software and hardware on monitoring and evaluation. The project will provide funds for annual project audit exercises and reporting.

5. Beneficial and Adverse Impacts

5.1 The tables below identify the negative and positive impacts during the construction and operation phases for each of the 3 main categories of intervention. The environmental factors that are expected to influence the project are also described below.

5.2 The major potential negative impacts identified are those related with the construction activities. Most of these impacts have a minor significance with low

magnitude and reduced to the specific location of occurrence. During the operation phase no major negative impacts are expected. Positive impacts are expected especially during operation phase as the project will promote and increase of household income, job opportunities and diversification of local economy.

5.3 In general the production infrastructures will have a significant increase in their capacity to cope with extreme events, particularly floods. This will happen also with the agriculture land, resulting in an increase of production.

5.4 Most of the potential negative impacts can be addressed by the implementation of best practices, which will be covered by the training, awareness and capacity building activities that will be promoted by the project.

Table 2 - Expected impacts during Construction

Negative	Positive
IRRIGATION INFRASTRUCTURES	
<ul style="list-style-type: none"> • Soil Destabilization • Potential water pollution • Oil Spillage and Contamination • Air pollution • Disruption of farm activities • Elevated Noise Levels 	<ul style="list-style-type: none"> • Employment growth
RURAL ROADS	
<ul style="list-style-type: none"> • Creation of Borrow Pits • Loss of Crops • Oil Spillage and Contamination • Air pollution • Destruction of Habitats • Soil Erosion • Indiscriminate Waste Disposal • Noise pollution • Motor and Work related Accidents • Traffic Hazard to Farm Workers and other road users • Hindrance of Movement 	<ul style="list-style-type: none"> • Employment creation • Boost to local economy
AGRARIAN HOUSES	
<ul style="list-style-type: none"> • Creation of borrow pits • Increase of waste 	<ul style="list-style-type: none"> • Employment growth

Table 3 - Expected impacts during operation

Negative	Positive
IRRIGATION INFRASTRUCTURES	
<ul style="list-style-type: none"> • Potential pollution of water and soil • Creation of a more favourable 	<ul style="list-style-type: none"> • Employment creation • Boost the local economy

Negative	Positive
environment for pests <ul style="list-style-type: none"> • Potential health problems related with water born diseases • Potential health problems/hazards to wildlife 	<ul style="list-style-type: none"> • Increase of Agriculture land • Increase in Agricultural production • Decline in crop loss • Establishment of agro-based industries • Short term control of pests • Reduced flooding on farms • Reduced incidence of pooling of water • Potential Water retention in Drainage Systems • Reduced soil erosion • Diversification of crops cultivated
ROADS	
<ul style="list-style-type: none"> • Increased Wildlife Mortality • Soil Erosion • Littering • Proliferation of squatters at the fringes of the farms • Overloading of trucks 	<ul style="list-style-type: none"> • Employment creation • Boost to the local economy • Reduced Dust levels • <i>Reduced</i> Ruts and Corrugations • Stabilization of Soils along Roads • Improved all year round Accessibility • Reduced Travelling Time • Open Up Market and Industrial Opportunities Increase in number of areas cultivated
AGRARIAN CENTRES	
<ul style="list-style-type: none"> • Potential increase of waste production 	<ul style="list-style-type: none"> • Increase of the life time of agriculture products • Boost to local economy • Establishment of agro-based industries and service providers • Diversification of employment

Table 4 - Expected positive and negative impacts of environmental parameters on the proposed project

Environmental Parameter	Aspect	Causative link to the project	Potential effects on the project
Rainfall and floods	Temporal variability	Difficulty in timing of plant periods	Crop failure Less than optimum yields
	Regular occurrence and high intensity	Excess water in the soil	Crop loss Disruption of farming and related commercial activities
	Limited rain days per year	Limited growing days	Crop failure Less than optimum yield
Drought	Below average rainfall even during the rainy season	Insufficient soil moisture	Crop failure Less than optimum yield

Environmental Parameter	Aspect	Causative link to the project	Potential effects on the project
Climate Change	Increase of flooding events	Longer periods with pond water in farms	Crop loss
			Less than optimum yields
		Increased availability of soil moisture	Improved yields
			Potential opportunity to introduce new crops conducive to high soil moisture levels
	Rising temperatures	Decrease in available soil moisture	Crop failure
			Less than optimum yields
	Warmer winters	Increase in number of growing days	Potential introduction of double-cropping system
	Increase of extreme events (Cyclones)	Increase of inoperative days	Loss of crops
Destruction and damage in infrastructures			
Possible loss of human life			
Groundwater	Vulnerability to contamination	Threat of pollution from the use of fertilizers and pesticides	Controlled use of pesticides and fertilizers
Biodiversity	Animals trapped in farms and/or canals	Increasing number of kills	Contributing to a poor environmental profile of the project
			Crop damage
	Proliferation of weeds and exotic species	Potential introduction of pests	Diseases and reduction in crop production
	Creation of “new” habitats	Protection and habitat availability to some species	Possible creation of a biodiversity conservation action within the project

6. Enhancement and Mitigation Program

6.1 The mitigation and enhancement measures outlined below should be undertaken as part of the project implementation process to mitigate potential negative impacts while enhancing the positive impacts during the construction and operation activities of the project.

6.2 The project will not induce any resettlements as well as the expected negative impacts during the construction phase are restricted to the areas of existing infrastructures (rural roads and buildings). Thus, the project doesn't require compensation measures for these two items.

6.3 The majority of mitigation and enhancement measures can be classified as best practice routines that should be implemented and will be promoted through the capacity building, awareness and education campaigns included in the project. Apart the specific education/awareness activities, the implementing agency should assure a daily verification of these best practices as well as include them in all subcontracting. The Environmental Coordinator has the direct responsibility to monitor and ensure the implementation of the mitigation and enhancement measures.

6.4 The Tables below gives a summary of the impacts and their related mitigation or enhancement measures that should be undertaken.

Table 5 - Summary of mitigation and enhancement measures for the negative and positive impacts in relation with the Rural Roads during construction

Impact	Recommendations for enhancement or mitigation
Rural Roads	
Construction Phase	
Negative Impacts	
Creation of borrow pits	Borrow pits should be adequately selected. No new pits should be excavated until the existing ones have been exhausted
	According to the location and size of the borrow pits it should be checked with the environmental authorities the need of carrying out in depth EIA for all intended borrow pits for the project
	Excavated borrow pits should be properly decommissioned and rehabilitated after use, following specific plans that need to be approved before the beginning of each borrow pill
Loss of crops	Limit clearing to site of construction
	Timing of construction should be carried out during fallow season on farm
	Provide information to the farmers in not plant crops along the road reserves at the road demarcated area
Noise pollution	Noisy activities should be carried out on

Impact	Recommendations for enhancement or mitigation
	<p>daylight time only during normal working days</p> <p>Providing construction workers with noise suppressors</p>
Oil spillage and contamination	<p>Adequate containment measures should be taken</p> <p>Machinery and equipment operators should be cautioned about the need for proper and safe handling of potential contaminants on site</p> <p>Specific sites to be gazetted for on site maintenance of machinery</p>
Air pollution	Suppress dust by wetting road surfaces
	<p>Timing of construction preferably during fallow season</p> <p>Provide construction workers with protective clothing</p> <p>Inform farm owners and workers of impending dust generation activities</p>
Habitat destruction	<p>Locate camp sites at areas which have already been disturbed within the project area</p> <p>Migratory patterns of wildlife to be observed ensuring that construction takes place when there are no animals</p>
Soil erosion	<p>Choose the best work period (dry season) in order to limit risks of erosion</p> <p>Clearing and excavation activities should be limited to the proposed sites only</p> <p>Any erosion features observed during construction should be restored adequately to establish and ensure stability of the surrounding area</p>
Waste generation and disposal	<p>Provide rubbish bins and sanitary facilities on site</p> <p>Sanitary personnel to be appointed to oversee sanitary issues</p> <p>Sensitize workers on the need to maintain hygiene practices on site</p>
Motor and work related accidents	<p>Training on safety measures</p> <p>Provide first aid equipment on site</p> <p>Workers to be provided with protective equipment</p> <p>Ensure good working conditions of workers by inspecting activities at the project site</p> <p>Run shifts to avoid fatigue of workers</p>

Impact	Recommendations for enhancement or mitigation
Traffic hazard to farm workers and other road users	Deploy personnel to caution vehicle operators
	Where appropriate traffic diversions and entry points to the farms should be provided to minimize disturbance to farm activities
Hindrance of movement	Construction activities should be carried out in such a way that it does not limit access to the farms.
Loss of portion of agricultural land	Compensation should be paid to affected farmers
	Equal land should be taken from farms where roads and drainage lines run parallel
	Farmers not to plant along areas to be affected
Positive Impacts	
Employment creation	Xai-Xai workers should be targeted for the recruitment of casual labour
Boost to local economy	Presence of credit and loans system to help community to start up their own business

Table 6 - Summary of mitigation and enhancement measures for the negative and positive impacts in relation with the Rural Roads during operation

Impact	Recommendations for enhancement or mitigation
Rural Roads	
Operation phase	
Reduce dust levels	Scheduled and periodic maintenance of the roads should be carried out
Reduced ruts and corrugations	Same as above
Stabilization of soil along roads	Same as above
Soil erosion	A monitoring plan of construction activities should be developed in order to ensure that the roads are properly constructed
Littering	“No Littering” signs should be put at entry points and along the roads
Improved all year round accessibility	A permanent maintenance plan of the roads should be implemented
Reduced travelling time	Road design speed should be adhered to
Increase in number of areas cultivated	None required
Proliferation of squatters at the fringes of the farms	Decommission camp site after project completion
	Monitoring should be done to mitigate against proliferation of make shift

Impact	Recommendations for enhancement or mitigation
	accommodation after project ends
Overloading of trucks	Enforcement of weight limits
	Monitoring and maintenance of the road during operation
Increased wildlife mortality	Sensitize population to protect biodiversity

Table 7 - Summary of mitigation and enhancement measures for the negative and positive impacts in relation with the Irrigation infrastructures during construction

Impact	Recommendation for enhancement or Mitigation Measures
Irrigation infrastructures	
Construction Phase	
Destabilization of the soil	Ensure that dug trenches are well compacted
Oil spillage and contamination	Same as for rural roads impact above
Air Pollution	Same as for rural roads impact above
Disruption of farm activities	Construction work should take place when farming activities are less intensive
	Irrigation infrastructures construction activities should be carried out in sections in order to ensure that farming activities are not entirely brought to a halt
Noise pollution	Same as for the rural roads impact above
Employment growth	Same as for the rural roads impact above

Table 8 - Summary of mitigation and enhancement measures for the negative and positive impacts in relation with the Irrigation infrastructures during operation

Impact	Recommendations for Enhancement or Mitigation
Irrigation infrastructures	
Operation Phase	
Potential pollution of water and soil	Ensure adequate training to farmers on best practices and the use of pesticides and fertilizers
	Incorporation of integrated soil fertility management
	A monitoring plan for soil and water quality should be implemented
Potential health problems related with water born diseases	Sensitizing farmers for taking adequate measures to prevent diseases like Malaria
Potential health problems/hazards to wildlife	Implement best practices on the use of pesticides
Employment creation	Same as for rural roads
Boost the local economy	Same as for rural roads
Increase in agricultural production	Use of eco-friendly and best practices

Impact	Recommendations for Enhancement or Mitigation
	farming techniques
Decline in crop loss	None required
Establishment of agro-based industries	ESIA to be undertaken on these to ensure that the adverse impacts they might incur are addressed
Short term control of pests	None required
Reduced flooding on farms	Drainage systems should be maintained on a regular basis
Reduce incidence of pooling of water	Same as above
Potential retention of water in drainage system	Collector drains should be maintained regularly
Reduced soil erosion	Drainage system should be maintained on a regular basis
Diversification of crops cultivated	Extension and research services to assist farmers with information on crop varieties and appropriate technologies for improved productivity
Decline in crop loss	None required

Table 9 - Summary of mitigation and enhancement measures for the negative and positive impacts in relation with the Agrarian Houses during construction

Impact	Recommendations for Enhancement or Mitigation
Agrarian Houses	
Construction Phase	
Creation of borrow pits	Same as for rural roads
Increase of waste production	Same as for rural roads
Employment growth	Same as for rural roads

Table 10 - Summary of mitigation and enhancement measures for the negative and positive impacts in relation with the Agrarian Houses during operation

Impact	Recommendations for Enhancement or Mitigation
Agrarian Houses	
Operation Phase	
Increase of waste production	Provide adequate facilities for waste collection and disposal
	Reutilize the organic component of waste in farming activities
Increase the life time of agriculture products	None required
Employment growth	Same as for rural roads
Establishment of agro-based industries	Same as for Irrigation Infrastructures

7. Monitoring Program

7.1 As one of the main objectives of the project, it is expected a significant increase of agricultural activities following the completion of the infrastructures (agrarian centres, rural roads) and the rehabilitation of the irrigation scheme as well as other initiatives that will be implemented to improve agricultural productivity. Among the interventions proposed, the most environmental concerns that need adequate management are; soil fertility improvement, water quality, habitats and biodiversity conservation and the climate change adaptation aspects. The soil improvement activities could mean an increase in the use of agrochemicals which could likely lead to agrochemical residues in the terrestrial and aquatic habitats. The same applies to the use of pesticides.

7.2 During the construction phases some social aspects should specifically be considered including health and waste management.

7.3 The implications of the above concerns should be included in an integrated management plan to forestall any adverse environmental and social impacts.

7.4 For each specific monitoring action the Project Manager and the Environmental Coordinator should assure its approval by the responsible authorities, which will also be requested to validate the monitoring reports and thus, if necessary, request adequate adjustments to the monitoring plans.

7.5 The Environmental coordinator should prepare a set of indicators that will be used for monitoring the expected increase of social and productive resilience to climate change. This should be done in close relation with the overall objectives of the project as it is not a specific environmental concern but, instead, the main aim of the project. Before or at the early stages of the project it should be established a base line reference including the most relevant environmental, social and productive indicators, which should be used for the monitoring.

7.6 Aspects of the project that have long-term impacts and apply throughout the operation phase of the project are discussed below.

Health Education

7.7 During the construction phase particular attention should be given to the incidence of Sexually Transmitted Infections (STIs), including HIV/AIDS. There is a potential increase in STIs (and also HIV/AIDS) following the concentration of workers into the project areas and surroundings.

7.8 The construction workers as well as the farmers should be protected against malaria.

7.9 Having these issues in consideration, we recommend the following management actions:

- Implementation of a health education programme to be undertaken in the project area prior to starting construction and throughout the operation of the project.
- Condoms as well as Anti Retroviral Therapy should be provided.
- The workers should be given malaria preventive medication prior to starting construction activities and throughout the operation of the project.
- Eventual camps and living quarters should also be sprayed occasionally against vectors such as mosquitoes and other insects.

7.10 The District Health Department should bear the financial responsibility for these interventions. Health education and promotion materials should also be produced and used in public meetings, school visits and specific training actions. The estimated cost for these activities is USD 20,000.

Education on the use of pesticides and fertilizers

7.11 It is important for farmers to be trained on the use of pesticides and fertilizers to ensure a minimal use of pesticides and chemical fertilizers on the farms. The use of pesticides and fertilizers are long term farming practices that will take time to teach the farmers and for them to adopt best practices for these activities. Workshops and seminars, supported by educational materials, should be organized to ensure that

farmers and extension staff in the area work together to apply best practices on the use of pesticides and fertilizers.

7.12 The responsibility for developing educational materials and conducting workshops and seminars to disseminate and share information about best practices in the use of pesticides and fertilizers should be assigned to the District's Agrarian Extension Services. The estimated cost for these activities is USD 10,000.

Monitoring of water and soil quality

7.13 Water and soil quality are two very critical issues and should be monitored and appropriately managed during the operation of the irrigation scheme. This is to determine whether the water quality meets the permitted standards and to prevent the pollution of water bodies, poisoning of wildlife and impairing the health of the entire ecosystem in the project environs.

7.14 The irrigation water quality and soil quality need frequent monitoring to predict and avoid salinization and water logging. The following management steps should be taken in cases when monitored agrochemical residues exceed recommended limits. If elevated levels in water runoffs persist for an extended period, the BLC Company as well as the Ministry of Agriculture should work together to intensify efforts in establishing best practices in the farms.

7.15 Routine inspections by the Agriculture authorities should be implemented through visits to the farms including inspections of the storage areas and the types and quantities of chemicals used on the farms. If monitoring confirms pollutants in the farm runoff, constructed wetlands could also be constructed in conjunction with the above measures to allow the drainage water to pass through in order to clean the effluent of the pesticides. The Ministry of Agriculture should be responsible for these interventions and bear the financial responsibility. The estimated cost for these activities is USD 55,000.

Road and Irrigation Scheme Maintenance

7.16 The roads and irrigation facilities should be maintained regularly to ensure their accessibility. It is recommended that conscious effort be made to impart some

minor repair and maintenance skills to the project beneficiaries or farmers. This will enable them to carry out simple day-to-day maintenance.

7.17 A general maintenance program should be implemented, including routine maintenance as well as emergency interventions, which may be needed during and after extreme events (cyclones and floods). The Regadio do Baixo Limpopo E.P. Company should be responsible for these interventions and bear the financial responsibility. The estimated cost for these activities is USD 921,000.

8. Consultations and Dissemination

8.1 Stakeholders should be actively involved during implementation of the ESMP particularly on the awareness building in health and best practices in the use of pesticides and fertilizers. Annual consultations should be made specifically oriented to assess the effectiveness of the health awareness activities.

8.2 Consultation between the research institute and the beneficiaries should be held to raise awareness on salt intrusion and introduction of new crops. The ESMP reports will be also be available for public consultation.

8.3 At the beginning of the project the implementation the PIU must hold a meeting with each of the communities, to explain the general organization and objectives of the project, the location of intervention sites, types of economic rehabilitation and opportunities, awareness and training activities, with the participation of community and traditional leaders.

8.4 At this meeting, communication focal points will be identified in order to use them as communication channels with the communities in general.

8.5 Following this initial meeting, regular meetings will be held to evaluate/monitor the general development of the Project and the improvements induced by the Project within the communities. These regular meetings will ensure direct consultation with the communities and will provide feedback for the project monitoring. Particular attention should be given to the monitoring of how the communities are adapting their income generation strategies and level of access to infrastructures and services provided by the project.

8.6 The communities and particularly the farmers must receive information about the major interventions promoted by the Project. As there is a high level of illiteracy among the population, as well as low levels of access to media and channels of information such as newspaper and radio, two strategies should be followed to disseminate information about the development of the project:

- a. Schedule and hold regular meetings for direct consultation with the communities. The meetings, should be organized and promoted by the PIU but also involving the specific public departments related with the particular subjects (health, best practices, use of pesticides and fertilizers).
- b. Use church-based groups and/or community leaders to disseminate information about the different stages and actions of the project.

9. Complementary Initiatives

9.1 No complementary initiatives are required.

10. Responsibilities and Institutional Arrangements

10.1 The proposed project aims to improve productivity of the commercial and small-scale agriculture in Xai-Xai to sustainably develop local communities. Sustainable development relies on a collaborative process between all those involved in the agricultural infrastructure's development and in improving produce quality. This requires a reliable system of good governance of the project by local authorities and stakeholders.

10.2 It is recommended that an Environmental Coordinator (EC) should be appointed from the company's staff during the construction stages of the project. The EC as one of the management team member will have as main responsibilities:

- Ensure that environmental responsibilities are undertaken and the project carried out in an environmentally friendly manner.
- Maintain close liaison with the other sectoral coordinators (engineering, marketing, infrastructures, etc.) and the PIU's coordinator in order to ensure that all delegated environmental responsibilities have been adequately discharged.
- Handle any public queries about environmental matters on behalf of the project.

- Establish all necessary connections with relevant stakeholders ensuring their participation and involvement
- Report on the developments of the ESMP as well as, if necessary, review and propose modifications of the ESMP

10.3 At the start of the project the Environmental Coordinator should prepare an overall monitoring programme including the above proposals and a calendar for all actions as well as the reporting. This proposal should be submitted to the official departments (MICOA, MINAG, MDP) for validation prior to starting the monitoring programme.

11. Estimated Cost

Table – 11 Estimated costs for the environmental and social management actions

Management Action	Estimated Cost
Health Education	USD 20,000
Education on the use of pesticides and fertilizers	USD 10,000
Monitoring of water and soil quality	USD 55,000
Road and Irrigation Scheme Maintenance	USD 836,000

12. Implementation Schedule and Reporting

12.1 Implementation of the ESMP will be carried out in parallel with the schedule of the project implementation. The Environmental Coordinator, in close cooperation with the PIU (as part of the management team of the project), through his/her annual work plan will assure that the environmental and social action plan will be implemented as required. The Environmental Coordinator is also responsible for reporting through the project's normal implementation reporting. ESMP implementation will have a dedicated chapter reporting on implementation progress, issues emerging, achievements and failures of its targets, which should be reported within the project progress reports.