



**ADAPTATION FUND**

AFB/PPRC.8/6  
1 March 2012

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Adaptation Fund Board  
Project and Programme Review Committee  
Eighth Meeting  
Bonn, 14 March 2012

## **PROPOSAL FOR BENIN**

## I. Background

1. The Operational Policies and Guidelines for Parties to Access Resources from the Adaptation Fund, adopted by the Adaptation Fund Board, state in paragraph 41 that regular adaptation project and programme proposals, i.e. those that request funding exceeding US\$ 1 million, would undergo either a one-step, or a two-step approval process. In case of the one-step process, the proponent would directly submit a fully-developed project proposal. In the two-step process, the proponent would first submit a brief project concept, which would be reviewed by the Project and Programme Review Committee (PPRC) and would have to receive the approval by the Board. In the second step, the fully-developed project/programme document would be reviewed by the PPRC, and would finally require Board's approval.

2. The Templates Approved by the Adaptation Fund Board (Operational Policies and Guidelines for Parties to Access Resources from the Adaptation Fund, Annex 3) do not include a separate template for project and programme concepts but provide that these are to be submitted using the project and programme proposal template. The section on Adaptation Fund Project Review Criteria states:

*For regular projects using the two-step approval process, only the first four criteria will be applied when reviewing the 1st step for regular project concept. In addition, the information provided in the 1st step approval process with respect to the review criteria for the regular project concept could be less detailed than the information in the request for approval template submitted at the 2nd step approval process. Furthermore, a final project document is required for regular projects for the 2nd step approval, in addition to the approval template.*

3. The first four criteria mentioned above are:

1. Country Eligibility,
2. Project Eligibility,
3. Resource Availability, and
4. Eligibility of NIE/MIE.

4. The fifth criterion, applied when reviewing a fully-developed project document, is:

5. Implementation Arrangements.

5. Based on the Adaptation Fund Board Decision B.9/2, the first call for project and programme proposals was issued and an invitation letter to eligible Parties to submit project and programme proposals to the Adaptation Fund was sent out on April 8, 2010.

6. According to the paragraph 41 of the operational policies and guidelines, a project or programme proposal needs to be received by the secretariat not less than nine weeks before a Board meeting, in order to be considered by the Board in that meeting.

7. The following project concept titled "Adaptation of Cotonou Lagoon ecosystems and human communities to sea level rise and extreme weather events impacts" was submitted by the National Environment Fund (FNE), which is a National Implementing Entity of the Adaptation Fund. This is the first submission of the project. It was received by the secretariat in time to be considered in the 17th Adaptation Fund Board meeting. The secretariat carried out a technical review of the project proposal, assigned it the diary number BEN/NIE/Coastal/2012/1, and filled in a review sheet.

8. In accordance with a request to the secretariat made by the Adaptation Fund Board in its 10th meeting, the secretariat shared this review sheet with FNE, and offered it the

opportunity of providing responses before the review sheet was sent to the Project and Programme Committee of the Adaptation Fund.

9. The secretariat is submitting to the Project and Programme Review Committee the summary of the project, prepared by the secretariat, in Annex 1. The secretariat is also submitting to the Committee the technical review sheet and the responses provided by FNE, in an addendum to this document. Finally, FNE has submitted a Project Formulation Grant Request, which is also available as an addendum to this document.

## Annex I. Project Summary

Benin – Adaptation of Cotonou Lagoon ecosystems and human communities to sea level rise and extreme weather events impacts

Implementing Entity: *FNE*

Project/Programme Execution Cost: USD 484,000

Total Project/Programme Cost: USD 8,369,000

Implementing Fee: USD 711,000

Financing Requested: USD 9,080,000

Project/Programme Background and Context: The Cotonou channel commonly referred to as *Cotonou lagoon*, with a length of 4.5 km, an average width, of 300 m, and a depth of 5 to 10 m, is at the heart of an area of major human activities, including an international market, the Government welfare and administrative offices, the private companies in the sectors of Hotel industry and catering, home-made dyeing and fisheries, inland water transports of persons and goods.

As the consequence of this intense human activity along the shores and within the lagoon, it has been subject to major environmental issues, including pollution and physical erosion of the shores. These environmental problems are likely to worsen with the rise in sea water level and the extreme weather events (mainly the floods, the long-term drought and hurricanes).

The proposed project concept seeks to reduce the vulnerability of Cotonou's lagoon, along which key economic and socio-administrative infrastructures are established, to climate risks.

The project presents five components:

- a) Protection of the shores, rehabilitation and improvement of the socio-community infrastructures;
- b) Fight against the pollution of the lagoon and living environment;
- c) Fight against the seasonal floods of the shores and riparian areas and sensitization of economic operators;
- d) Mainstreaming the constraints of climate changes and the adaptation strategies in the legal texts regulating fishery and back-up the redeployment of affected fishermen;
- e) Sensitization and training of the local communities on climate changes, adaptation techniques and best practices.

The **overall goal** of the proposed project is to contribute to the execution of the Benin National Action Programme of Adaptation to climate changes through its coastal component (PANA - Benin) developed in 2007.

Component 1: Protection of the shores, rehabilitation and improvement of the socio-community infrastructures (USD 7,100,000)

Through this component, appropriate actions will be implemented to protect the banks and shores of the lagoon of Cotonou through a set of actions of anti-erosion fight, restoration and improvement of riparian social and community infrastructures threatened by the the rise of

the sea level and extreme climate phenomena (floods, violent winds, increased surface temperatures, prolonged droughts), but also the anthropogenic pressure on banks and shores not maintained due to a lack of economic interest for local authorities. The exploitation of community and adaptation infrastructures should enable local communities to generate financial resources usable for maintaining adaptation infrastructures.

Component 2: Fight against the pollution of the lagoon and living environment (USD 168,000)

This second component will implement appropriate actions to fight against the pollution of the lagoon environment and the du living environment of populations by solid and liquid wastes. The degradation and lack of maintenance of banks and shores have facilitated the invasion of such spaces by the household and industrial garbage and wastes and their colonization by illicit activities of all kinds, sources of nuisance to the public health, which must be overcome.

Component 3: Fight against the seasonal floods of the shores and riparian areas and sensitization of economic operators (USD 170,000)

This component will implement actions appropriate for fighting against seasonal floods of banks and riparian areas of the lagoon of Cotonou and sensitize businessmen for promoting floating bars and restaurants with a pedestrian access bridge, nautical sports, promenades in canoe and rowing boat, aquatic gardens. The Cotonou dam built to regulate exchanges between the sea and the lagoon has lost its function by lack of maintenance. This specific objective aims restoring the dam's initial function of and creating economic conditions likely to guarantee local resources that can be mobilized for the maintenance of the dam and all adaptation infrastructures.

Component 4: Mainstreaming the constraints of climate changes and the adaptation strategies in the legal texts regulating fishery and back-up the redeployment of affected fishermen (USD 357,000)

This component seeks to back up the revision of laws and provisions in force regulating fishing activities and their adaptation to the constraints linked to climate change and to the improvement of subsistence means of local communities, as well as the retraining of some fishermen in the new economic activities generated by the development of the banks of the lagoon of Cotonou. The official interdiction of fishing activities in the lagoon and their continuance tolerated for social and political reasons give the lagoon fishing of shrimps and fish a stealthy nature which does not abide by any technical or ecological standard. It is necessary to integrate here regulatory laws and provisions taking into account climate risks, sensitize populations of fishermen to that end and support some among them to shift to other economic fields.

Component 5: Sensitization and training of the local communities on climate changes, adaptation techniques and best practices (USD 90,000)

This component will help sensitize and train local communities on climate risks, adaptation techniques and good practices necessary for safeguarding the ecosystem, the human system and their own interests, and to limit the adverse impacts at a level compatible with their legitimate ambitions of economic and social development. The students, at the end of their training, may exploit the assets of this project in drafting writing their studies completion and thesis dissertation. Such assets will be subject to a reporting at the end of the project at the local, national and international level.



ADAPTATION FUND

## PROJECT/PROGRAMME PROPOSAL

### PART I: PROJECT INFORMATION

PROJECT CATEGORY:	REGULAR PROJECT
COUNTRY/IES:	BENIN
TITLE OF PROJECT/PROGRAMME:	ADAPTATION OF COTONOU LAGOON ECOSYSTEMS AND HUMAN COMMUNITIES TO SEA LEVEL RISE AND EXTREME WEATHER EVENTS IMPACTS
TYPE OF IMPLEMENTING ENTITY:	NATIONAL IMPLEMENTING ENTITY
IMPLEMENTING ENTITY:	FONDS NATIONAL POUR L'ENVIRONNEMENT (FNE)
EXECUTING ENTITY/IES:	DGE (DIRECTORATE OF ENVIRONMENT OF BENIN), MUNICIPALITY OF COTONOU, NGO, COMMUNITY ASSOCIATIONS.
AMOUNT OF FINANCING REQUESTED:	<b>US\$ 9,080,000</b> (in U.S Dollars Equivalent)

### PROJECT BACKGROUND AND CONTEXT:

Vulnerability studies and assessment carried out as part of the National Adaptation Programme of Action (NAPA) and the Second National Communication of Benin on Climate Change (SNC) have revealed that coastal zone, water resources, agriculture and forestry are the most vulnerable sectors to climate change. Based on some climatic and non climatic scenario established for the future evolution of the coastal area, and according to the indications provided by DIVA Software, the sea level could continuously rise up to about 0.81 m, over the period 2000 – 2100, confirming in so doing the Intergovernmental Panel on Climate Change (IPCC)' projections. Water resources will also be affected both quantitatively and qualitatively with a drastic impact on agriculture and populations' health. The vulnerability of water resources sector will also be translated by a falling tide in the pluviometry varying annually between 3% and 8% (scenario A1B) or between 4% and 5% (scenario B1), a

displacement of the quillwort 1000 by more than 350 km southwards between 2025 and 2050 along with all the consequences.

Specifically, the major climatic risks the area is exposed to are the sea level rise, flooding, intense winds, and increase in the sea surface temperature (TSM). The vulnerable living conditions in this area are those of the fishermen, farm operators, craftsmen, salt operators, traders, tourists and industrials. The most vulnerable among the means of livelihood are agriculture and truck-farming, fishery and aquaculture, handicraft and trade, salt making, tourism and industry.

The potential impacts concern the sea level rise, the losses or gains of land (in surface and in volume) through erosion or coast sand filling, the mangrove status.

The Cotonou channel commonly referred to as *Cotonou lagoon*, with a length of 4.5 km, an average width, of 300 m, and a depth of 5 to 10 m, appeared further to the September 1885 catastrophic flooding as a result of Ouémé river floods and overflowing of Nokoué lake. In order to channel the waters seawards and protect the nascent Cotonou town, the colonial administration, on September 21, 1885 dredged a 1.5 m width and 1 m depth cutting between the Nokoué lake and the sea, passing through the areas settled by the poorest populations (Bourgoinie, 1972; Pliya, 1980). According to Colleuil (1984), the resulting violent flow was sufficient to generate within a few days a 200 m wide channel which divided the town into two sectors maintained to date. (fig. 1.1 and 1.2).

From then, the social life has been reorganized around the water body, with the populations settling, in the most precarious conditions, along the unstabilized shore (more than 30% of the Cotonou Populations), making Cotonou the Benin town where poverty index is the highest: 38% against less than 30% in towns like Porto-Novo, Parakou, Abomey, Bohicon (PNUD, 1996, USAID-UNICEF-INSAE, 1996). As such, Cotonou town contributes about 64.7% of urban poverty in Benin (PNUD, 1997).

The major human activities poles in the surroundings of Cotonou lagoon are the Cotonou International Market covering 18 hectares on the West shore, the Government welfare and administrative offices, the private companies in the sectors of Hotel industry and catering, home-made dyeing and fisheries, inland water transports of persons and goods.

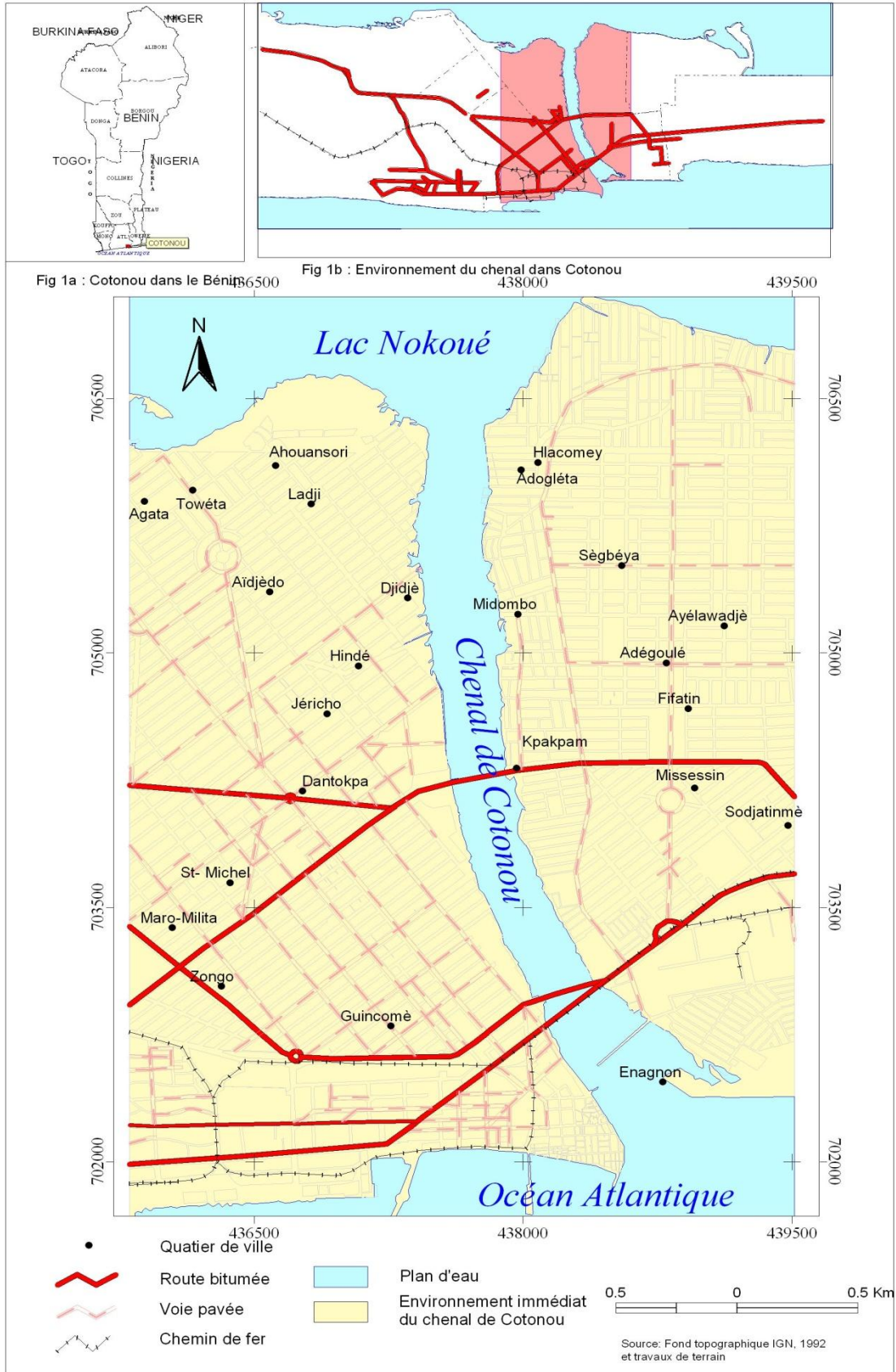
The Cotonou International Market (Dantokpa Market including the Gbogbanou segment), where more than 500,000 users rush every day to encounter the 100,000 marketers, occupies the West shore of the lagoon covering a surface of 18 hectares (fig. 1.3). As a result of the transfer of the market on this site in 1962, there is an increase in the man-made pressure on the lagoon system, mainly bringing about various new sources of pollution (Ayadokoun, 1992 ; Montcho, 2005 ; Lawani, 2007 ; Vissin *et al.*, 2010).

The physical and biological characteristics of the Cotonou channel evolve at the rate of the periodical alternation of obstruction and opening. When the channel is opened, some part of the overflowing from Ouémé river and Nokoué lake directly flow into the sea, entailing acceleration of the water level drops in the whole lower delta.

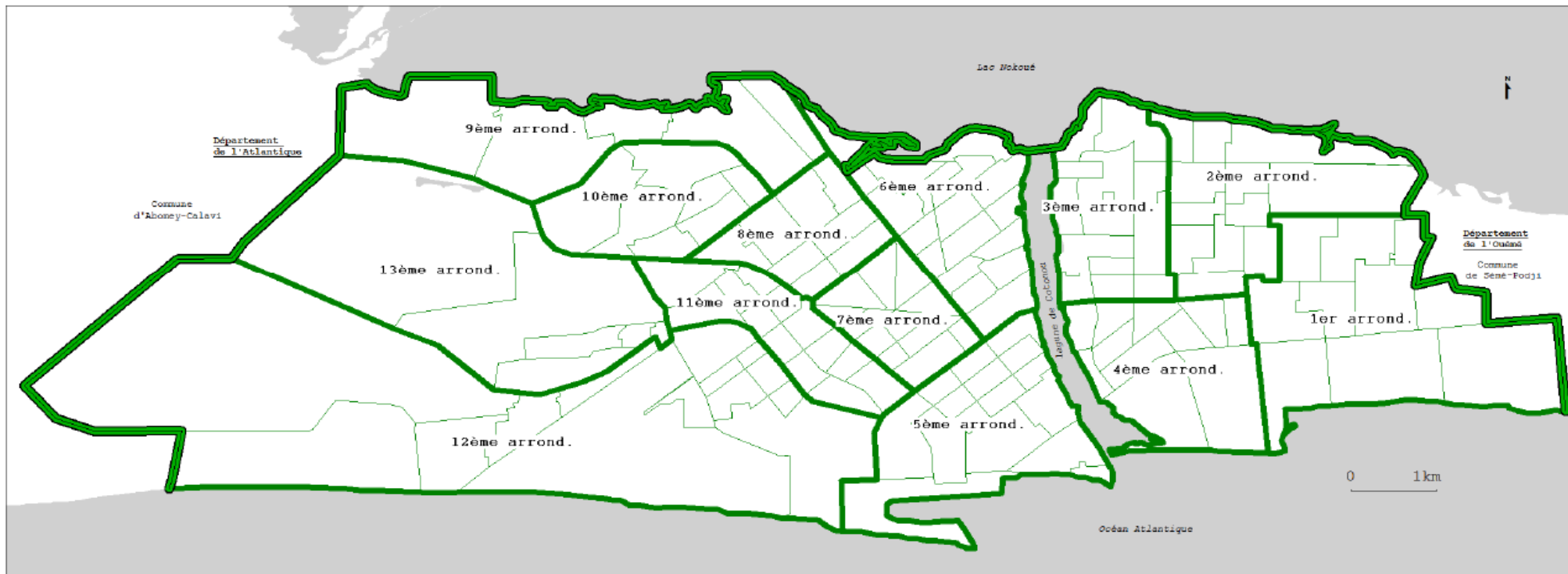
(Pélissier, 1963). From December to April every year, there is always a reverse of the water-stream prompting the salty water to sweep into Nokoué lake meanwhile the following floods reduce the water salinity. At the same time the daily swell movements maintain a regular flow and ebb regime of sea water. As a result there are some impacts on the environment and human systems, on the sedimentation and filling up speed, water salinity as well as on the flora and wildlife sometimes prosperous, sometimes limited both within the channel and the whole South west Benin lagoon complex.

The Cotonou lagoon's major environmental problems likely to worsen with the rise in sea water level and the extreme weather events (mainly the floods, the long-term drought and hurricanes) result from (i) the lagoon shores erosion and the degradation of socio-community and economic facilities, (ii) *pollution by household waste, waste waters, home-made dyeing waste, oil products and other economic activities waste*, (iii) *the occurrence of seasonal floods along the shores and riparian areas* (iv) *the disrespect of the regulation governing the lagoon fisheries by the fishing communities* and (v) *the low level of awareness of the local populations about the climatic risks and adaptation techniques*.





**Figure 1.1.** Cotonou Channel or lagoon



- limite de quartier
- limite d'arrondissement
- limite communale

Cellule du Registre Foncier Urbain (RFU) de Cotonou  
 Novembre 2007

**Figure 1.2 :** Map of Cotonou town (Cotonou Municipality, 2008)



Figure 1.3. Partial view of Dantokpa Market ([www.cotonou.org](http://www.cotonou.org))

*i) Lagoon shores erosion and socio-community and economic infrastructure degradation*

From the opening of the channel to the current situation, one observes the increase in the flows and ebbs rate between Atlantique Ocean and Nokoué Lake, throughout the Cotonou Lagoon (Dégbé, 2009). It ensues a process of physical erosion and degradation of the shores as well as socio community and economic infrastructure established along the lagoon. Generally, the erosion phenomenon is intensified with the hurricanes and floods. The ecosystem dynamics enables to project the future aggravation of the situation with the rise in sea water level and the extreme weather.

Yet, one observes the collapse of the platforms of socio-administrative buildings, terraces of hotels and restaurants and other economic infrastructure established along the lagoon. During the flood periods, the average water level is superior to the level where they were while those works were under construction 20 to 50 years ago. The hurricanes are the causes of the large waves that sweep into the lagoon, erode the unstabilized shores and hurl some solid waste and refuses of the wild dump at the shores. The waves' impacts added to those of household and industrial used waters poured out by the urban gutters and local small scale dyeing industries worsen more the unhealthy conditions of Cotonou lagoon water and shores.

*ii) Pollution by the household waste, used waters, refuses produced by the local small scale dyeing industries, the petroleum products and other waste generated by economic activities.*

The water quality in the channel and exchanges between the sea and lagoon system will be negatively affected by the rise in sea water level and extreme weather. Presently, it is during the low water that the sea water sweeps more into the Cotonou lagoon (November-March). This period might prolong with the rise in sea water level which changes the water regime and quality as well as the ichtyofauna composition.

More specifically, the waters drainage into the sea will be slowed down while the filling up of the lagoon will be accelerated, floods will be more catastrophic and the economic costs will be very expensive.

According to the findings published by Soclo (1999) and Roche International (2000), in the 1990s, Cotonou town used to produce annually 150,000 tons *solid waste* more specially from the households and Dantokpa market the major part of which is disposed on the lagoon shores. At the end of the years 2000, the production was estimated at 260,000 tons the collect of which is entrusted with 54 specialized NGOs. The refuse landfill strewing over the channel shores are composed of putrescible materials, biomedical waste, used apparatuses, batteries, heaps of iron and steel scrap, etc. (fig.2.2).

The **used waters** volume is evaluated to 4,750,000 m<sup>3</sup> per annum, 72% of which is generated by the households and Dantokpa market and 28% by the industries and public services. 397,000 m<sup>3</sup> if this is disposed of in the lagoon. The main used water sources are as follows:

- The waste generated by the local small-sized industries dyeing the so-called Senegalese or Malian clothes which are established along the channel since the 1990s;
- The urban waste generated by the storm-water drain of Akpakpa-centre;
- The urban waste generated by the storm-water drain of the new bridge;
- The urban waste generated by the storm-water drain of Midombo;
- The urban waste generated by the storm-water drain of Hlacomey;
- The urban waste generated by the storm-water drain of Jéricho;
- The urban waste generated by the storm-water drain of Dantokpa market;
- The urban waste generated by the storm-water drain of Dantokpa Secondary School;
- The used water waste generated by *Maternité Lagune* of Cotonou.

The construction of about fifty profit-making floating latrines on the channel at Agbato size for instance, worsens more the water pollution.

The Cotonou channel is navigable for the transport of goods and persons along the channel and from one shore to the other. Inland water transport of goods and persons has no direct impact on the aquatic environment, but the risk of ecosystem degradation is huge when it comes to chemical pollution of water with the pouring of **chemical products** smuggled from Nigeria, transported by water route and off-loaded in bulk on the undeveloped land wharf over night per hundred jerry cans. Those petroleum products are frequently poured into the water during the handling operations.

The situation of the pathogenic germs is much more alarming. As far as the total coliforms are concerned, for instance, their number varies between 4,000 and 6,000/100ml in June (rainy season) and between 2,000 and 14,000 /100ml in

September (end of the short dry season). As for the faecal coliforms, their number varies between 2,000 and 6,000/100ml in June with their quantities fluctuating between 1,000 and 11,200/100ml in September while the standard admitted for clean water is a maximum of 100 / 100ml.

The contamination by the coliforms is also observed in the wells in the riparian areas of Cotonou lagoon. (table 1.1)

Table 1.1: Bacteriological analysis of Towéta 1 wells (according to Dovonou, 2008).

Parameter Sites	Total germs (1 ml)	Escherichia coli (100 ml) (1)	Faecal streptococci (100 ml) (2)	(1)/(2)	Clostridium perfringens (100 ml)	Staphylococci (100 ml)	Salmonella and Shigella (100 ml)
Well 1	700	1100	120	9	1500	8000	450
Well 2	200	1600	280	6	1400	7000	400
Well 3	350	1500	250	6	1800	7500	250
Well 4	300	1900	200	9	1600	6000	300
Well 5	600	2200	300	7	2000	8000	500

Those bacteriological contaminations are favored by the changes undergone by the physic-chemical parameters of the channel water.

The temperatures collected in the channel are comprised between 28.5 and 30.8 °C (Bonou and Adisso 2002). These figures are superior to the temperature of the ambient air which is 27 °C. If temperature is a factor conditioning the abundance of living animals and plants, a variation of a few degrees in the temperature of water could, for instance, be a prejudice for the fish or other microorganisms that are important in food chain.

The pH values collected in Cotonou channel vary between 7.3 and 8.55 (Bonou and Adisso, 2002). These values which are superior to those of sea water and raw waters the pH of most of which is between 6.5 and 8.5 (Guilcher, 1959), are allegedly due to the used waters swept in the channel by the drain. If by definition, the pH of the water measures the acid-base equilibrium in most of the natural waters, it depends mostly of the carbon dioxide – carbon bicarbonate – carbonate equilibrium. pH reduces when the CO<sub>2</sub> content increases and inversely. The pH collected in the channel which is superior to the one of sea water and raw waters could therefore be harmful to the freshwater or anadromous species. As far as the water salinity is concerned, the values collected in the channel towards the river mouth (near to the sea) are higher (33.8 and 32.85‰), while those collected far away from the river mouth are in the range of 30.05 and 31.33‰ (Soclo, 1999). Salinity which indicates the quantity of salt in a given mass of solution is an important factor for biodiversity. It varies according to the depth, temperature, and sea water input and output (Marc, 1997). In

the Cotonou Nokoué Lake-Lagoon system, the highest average salinity is observed at the inlet of the Cotonou channel with a strong difference between the surface water (9‰) and the bottom water (17‰). The highest annual salinity is observed in December with 36‰ in surface and 25‰ at the bottom (Mama, 2010). The salinity influences the electrical conductivity which translates the overall ions content in the water. The conductivity varies according to the electrolytes content in the water and mostly with the temperature. (Le Barbe, 1993). The electrical conductivity in the channel varies between 41.5 and 51.6 mS/cm (Bonou and Adisso, 2002). The values of conductivity collected in the Cotonou channel that are superior to the threshold value ( $>500\mu\text{s}/\text{cm}$ ) reported by Belaud (1987), reveal that the channel water are highly polluted as a whole.

The polluting ions peaks, namely ammonium ( $\text{NH}_4^+$ ) and nitrates ( $\text{NO}_3^-$ ) in the Cotonou lagoon are observed from February to mid-May respectively, 0.9 mg/L and 5 mg/L (Mama, 2010)

Gases are of paramount importance for the welfare of the species in the water. Among those gases range oxygen for the fish,  $\text{CO}_2$  for the algae and the phytoplankton that are responsible for the photosynthesis. The major part of the oxygen dissolved in the water is generated by the air where it represents 20.95% of dry air (Martin, 1985). The collected values oxygen dissolved in the Cotonou channel water are comprised between 2 and 7.2 mg/l (Bonou and Adisso, 2002). Those values are low because the high salinity of the waters, as the more saline is a solution, the less dissolved oxygen it contains.

In view of the above-mentioned impacts, one can agree with Bonou and Adisso (2002) whose studies have confirmed that the Cotonou channel waters are subject to an organic pollution which reflects under various forms, namely:

- Less oxygenated and less airy environment;
- Disturbed nitrogen cycle (low rate of nitrate and high rate of nitrites);
- Oligotrophic and less productive environment (low rate of phosphates);
- Strong charge in faecal bacteria corresponding to high values of biological demand in oxygen (BDO5) and chemical demand in oxygen (CDO).

It is worth recalling that the water content of oxydizable materials responsible for its impoverishment in dissolved dioxide can be evaluated by measuring the quantity of dioxide needed for their degradation. For that purpose, two different parameters are used, the chemical demand in oxygen or CDO which gives the measurement of the total quantity of materials reduced in the water may they be biodegradable or not and the biological demand or BDO5 which gives a measurement of the biodegradable pollutant materials. The BDO5 is the mass of molecular oxygen (expressed in mg) used by the microorganisms to deteriorate within five days at 20°C and in the darkness, the oxydable materials contained in one liter of water.

In the Cotonou lagoon, the highest value in demand of biological oxygen (BDO5) is observed in February (35 mg/L). In the same way, the high average content of chlorophyll *a* in the surface water (60  $\mu\text{g}/\text{L}$ ) translates an important activity of

photosynthetic production. It is three times less deep (20 µg/L), and, the highest activity is performed in December (140 µg/L). However, the heavy metals (lead, cadmium, copper, zinc and iron) brought by the dyeing waste and other metallic residues have a negative impact on the oysters living in the channel (Dovonou, 2000).

By reference to the standard water quality (table 1.2) one realizes that the Cotonou channel pollution situation is alarming, and this can generate other negative impacts on the aquatic ecosystems. That pollution could lead to a drastic decrease of productivity of the channel as a whole, and of halielutic resources, in particular. One should fear the risk of disappearance of this water body through filling up as its environment becomes more and more anoxic. Faecal pollution could constitute another danger to human populations' health and more specifically the fishing populations, although that water is not drunk, but it could be source of contamination through swimming, mostly to the fishermen and sometimes to some riparians. The numerous wastes strewn over the channel shores or which are directly disposed of in the channel affect the physico-chemical parameters of the water body, and subsequently the water quality as well as the biocoenosis. As such, the organic and chemical pollution resulting from those wastes and the induced hydro-sedimentological modifications constitute the major factors deteriorating the quality of fish habitat.

Table 1.2: Multicriteria matrix of water quality assessment (Beaux, 1998)

Decreasing quality	Excellent	Good	Passable	mediocre	pollution
Quality class	1A	1B	2	3	4
Temperature (°C)	<20	20-22	22-25	25-30	>30
Conductivity (µs/cm)	<400	400-750	750-1500	1500-3000	-
pH	6.5-8.5	6.5-8.5	6.5-8.5	5.5-9.5	<5.5 ou >9.5
Dissolved Oxygen (mg/L)	>7	567	365	<3	-
Substance in suspension (mg/L)	0	<30	-	30-70	<70
BDO5 (mg/L)	<3	3-5	5-10	10-25	25
DCO (mg/L)	<20	20-25	25-40	40-80	>80
Nitrates (mg/L)	0	<44	-	44-100	>100
Ammonium (mg/L)	<0.1	0.1-0.5	0.5-2	2-8	>8

*iii) Seasonal floods of the shores and riparian areas*

Indeed, before the construction of Cotonou Port as well as its East breakwater, the Cotonou channel and Nokoué Lake were behaving like a lagoon close to the minimum flow and opened to the floods. During the minimum flow, the sea water level was averagely higher than the lake water level. The Lake water salinity was

average due to the inflow of fresh water, though in low flow, from Ouémé River and Sô stream; this salinity is however slightly higher in the channel due to the closeness to the sea. One observed in the Lake a salinity gradient in a West-est orientation. During the floods, the water level in the Lake and the channel remained superior to that of the sea until the disappearance of the shoestring sand making up the junction mouth. The water level in the Lake and channel depended upon the importance of the floods and the width of the mouth. The waters were essentially fresh. When the Cotonou channel managed to sweep the floods into the sea, the longshore drift quickly closed the sand mouth, limiting in so doing the salty water flow into the channel and Nokoué Lake (Roche International, 2000).

#### *iv) Regulation governing the lagoon fisheries*

Fishing activities in the Cotonou channel are conducted by the riparian and professional fishermen originating the lakeside villages established along the Nokoué Lake. Some of the fishing gears and techniques used are sources of potential bloody conflicts among the fishing communities. That is the case of the narrow-mesh gears used by about 3,295 fishermen registered in twenty-one (21) villages on Nokoué Lake, Porto-Novo lagoon and Cotonou channel (Alapini, 2001; Bonou and Adisso, 2002). Due to the devastating character of this gear, its utilization is prohibited on all the water bodies in the Republic of Benin, by Decree N°98-522 dated November 5, 1998.

Concerning precisely the South-est fluvial-lagoon network, the Ordinance N°068/MDR/DC/CC/CP/ dated March 12, 1997, stating Fishery Regulation on the Ouémé river-Porto Novo Lagoon Delta- Nokoué Lake Complex, in the provisions of its article 20, prohibits fishing on the Cotonou channel. The final aim is to enable this water body to play a role of physical and chemical exchange between the sea and Nokoué Lake, to facilitate the migration of hialieutic species in both directions, to ensure the spawning grounds protection on purpose of the natural restocking of Nokoué Lake and to reestablish the ecological equilibrium along the channel. Through that Ordinance, Public Authorities have proved their willingness to protect the ecosystem. But the fishing communities still are pungently opposed to its enforcement.

As a matter of fact, eleven (11) fishing campings are identified in the riparian areas of the channel (Badahoui *and al.*, 2009). Those are Dancodji campings (Akpakpa Dodomé), Placondji Jetée, Ancien Pont (between the Old Bridge and the third bridge and the Directorate of Fisheries), Abokicodji Lagune, Dédokpo (between Yatch Club and Martin Luther King Bridge), Kpankpan, Midombo, Adogléta, Agbato, Minontchou and Ladji Campings. In these campings, the fishermen do not have access to potable water, nor to a sustainable housing, nor to a sufficient habitable space. Sanitation and land security are compromised in the area. Those campings are established on the waste heaps and constitute unhealthy areas the occupation of which is formally prohibited by the public authorities. Along the channel, 270 canoes have been



registered at the same time (some are drawn alongside the fishing campings while others are operating on the channel water body), as well as 22 local fish-trap (acadja) parkings, 352 pilling for set nets, 28 cast nets and 14 prawn nets traps (in a sedentary fishery specifically designed for the prawns. During the night, the fishermen hang vigil light to the net traps to attract the prawns which are trapped into the gear pockets). Fishery is the activity permanently conducted by the professional fishermen along the Cotonou channel.

However, the unauthorized fishing activities not only harm the movements of migrant species between the sea and the lagoon system, but also affect the populations health due to the strong contaminations observed in the fishing products. It is important and urgent to drag the stakeholders, including the services in charge of regulation, to agree on a minimum of consensus, of course in the interest of each group of stakeholders.

*v) Level of the local populations awareness on the climatic risks and adaptation techniques*

The development of national documents relating to climate changes and commitments of Benin as part of the United Nations Framework Convention on the Climate Changes has regularly been a matter of participative approach associating all the stakeholders. That is mainly the case of the National Action Program on purpose of adaptation to the climate changes (PANA) the development of which ended in 2007. Cotonou Municipality belongs to the agro-ecological fishing area that is the most vulnerable to climate changes in the country: the most vulnerable communities have taken part in the works through their representatives and NGOs. But when time came to address specific thematic like the Cotonou lagoon Ecosystem and human systems vulnerability faced with the climate changes, very few stakeholders proved to really understand the issue. That translates the need for conducting a permanent information and sensitization campaign to the large public, beyond the national traditional campaigns.

That is why at local level, it would be relevant to ensure the sensitization / training of municipal, district and town sections' authorities. It would be their responsibility to respond to the needs of sensitization and training of the grassroots communities. Awareness campaign operations will also be organized in permanent settings during the execution of the project, and beyond, on the Cotonou lagoon shores.

As such, the special conditions of its origin, the regulatory role that it plays on the floods in Cotonou and on the wildlife and flora life within the South Benin lagoon complex, the poverty of the riparian populations and the strong pressure exercised on this ecosystem by them and the users of the Cotonou International market, constitute some circumstances worsening the vulnerability of Cotonou channel faced with the negative impacts of climatic variability, extreme weather and climate changes. That is why Benin Government envisages to accompany the most vulnerable livelihoods along the cotonou lagoon with a view to implementing the most adapted strategies of

adaptation through the resolution of the problems of shores erosion and infrastructure degradation, health, potable water supply and access and sanitation in a clean environment meeting the exigencies of modern life for the current and future generations.

This project comes under a large coastal protection program to combat the rise of sea water level identified by Benin Government in the National Action Program on purpose of Adaptation (PANA) to climate changes (MEHU, 2007).

Indeed, with a total population of 9,2 million Inhabitants in 2010, distributed on a surface of 115,762 km<sup>2</sup>, the monetary poverty affecting 40.3% of Benin population in 2006 / 2007 (INSAE, 2008), a human development index of 0.435 in 2010, and a Gross Domestic Product (GDP) below the minimum required rate of 7% for achieving the Millennium Development goals (MDG), Benin still has numerous challenges to take up as part of the various poverty reduction strategies.

The most significant progressions of poverty between 2007 and 2009 have been recorded in the sectors of agriculture-animal husbandry-fishery-forestry, trade, industry, transport and Public works and civil engineering (BTP) which nevertheless occupy the majority of the active population.

The economic growth initially projected for about 3% was estimated at 2.1% in 2010 against 2.7 % in 2009. This evolution is the result of the combined effects of cotton sector poor performances, foodstuffs production sluggishness, harvest losses due to floods and the low execution of public investment projects. This occurs in a context of moderated evolution of inflation of an annual average of 2.1 % (PNUD, 2011).

The Report on the Millennium Development Goals (MDG) "BENIN 2000+10" reveals that the major constraints hindering the achievement of the MDGs are as follows:

- The low growth and inadequacy of pro-poor growth strategies;
- The low capacities of primary education services in terms of projects cycle management and lack of a reliable information system (school card, number and state of the infrastructures...);
- The low capacity of the services in charge of gender mainstreaming promotion in matter of projects cycle management and lack of sex-disaggregated statistic data;
- Lack of local component of the National Health Development Plan;
- The environment protection services' capacity to implement the multilateral agreements activities in the field of environment;
- The lack of planning tools at the Water and Power supply sector level and the low capacity of Water supply services in projects cycle management;
- The lack of commercial policy;
- The low capacity in terms of mobilization, management and coordination of aid
- The lack of operational Monitoring-Evaluation mechanism in the sectors of agriculture, education, and in the ministry in charge of Gender promotion.

The distribution of foods consumption expenses by way of Integrated Module Survey on the households living conditions (EMICoV) in 2006 and 2007) revealed that 26.5% of the population suffered from hunger in 2007 against 23.1% in 2006. As such, the number of underfed persons increased by 3.4 points between 2006 and 2007. This upwards trend seems to be explained by the 2007 food crisis impacts. The results by residence area reveal that food poverty is more dominant in rural area (28.4%) than in urban area (23.2%).

In the field of gender promotion, the various laws and measures enforcement contributed to strengthening the legal and institutional framework in view of reducing gender imbalance and enhancing women participation in the development process, though that participation of Benin woman still is far away from the objective of gender equity. As far as women participation in decision-making spheres is concerned, there is a slight progress at the level of Parliament and local representation, mainly: (i) an increase of 3 points in the women representativeness at the National Assembly: 10% for the current legislative term (2007-2011) against 7.22% for the previous one (2003-2007); and an increase of 0.43 point in women representation during the last local elections organized in 2008: 4.18% (60 women elected out of 1,435 municipal councilors), against 3.75% (that is 46 women elected over a total of 1,199 municipal councilors) for the 2003 elections.

Though in progress as a whole, health indicators could not reach the set targets. Health services attendance rate increased from 45.6% in 2007 to 46.1% in 2009, while the pentavalent vaccination rate for the 0-11 month children increased from 96% in 2007 to 98% in 2009. The percentage of under 5 year-children sleeping under treated mosquito nets is steady between 2008 and 2009, that is 56.3% against a set target of 60% in 2009.

The industrial fabric still is embryonic (7.8% of GDP in 2009). In order to boost a processing-oriented economy with competitive enterprises, the following actions are planned: (i) promote the creation and development of new competitive industrial enterprises; (ii) continue the strengthening of the institutional, legal, judiciary and regulatory environment; (iii) proceed with reviewing the investments law to make it more incentive; (iv) promote the frameworks of exchanges and consultation between the stakeholders of the industrial sector; (v) build the capacities of the industrial enterprises as well as backup and coaching structures; (vi) implement appropriate institutional reforms in order to render Benin more attractive to direct foreign investments in the fields like mining, hydrocarbons and other potentially-attractive sectors; and (vii) create an Investment Promotion Agency.

Being in progress, the indicators relating to decentralization should be reinforced, mainly with the passing of the law on Inter-community cooperation and the adoption by Government in 2009, of the National Decentralization and Deconcentration Policy (PONADEC), As such, the indicator « number of development territories constituted and formalized » increased from four (04) in 2007 to ten (10) in 2009. The same applies for many other indicators, mainly:

- (i) the share of the Local Governments' expenses in the total General Budget of Government, which stabilized at 8.8% in 2009 against 4.1% in 2007;
- (ii) the increase of the transfers to the local governments between 2007 and 2009, thanks to the launching of FADeC (Local Government Development Support Funds), passing from 1.5% of the General Budget of the State in 2007 to 3.7% in 2009; and
- (iii) the share of investment expenses in the total expenses of the Local Governments which increased from 26% in 2007 to 45.6% in 2009.

In the sector of environment, one should observe the permanent effort of crosscutting mainstreaming of environment in the various strategic documents. On this purpose, the Government sees to ensure that the national development process is implemented in the strict respect of the global environmental standards contained in the conventions ratified by Benin. At this end, the national policy aims at: (i) strengthening through the implementation of the Strategic Environmental Evaluation (SEE); (ii) developing environment management tools such as the Millennium Ecosystems Evaluation approach (EEM), promoted by the United Nations System; and (iii) ensuring the enforcement of the regional and international conventions.

The sustainable management of environment, ecosystem and human systems of Cotonou lagoon, by and for the concerned populations, ie, the riparian populations, users of Dantokpa and Gbogbanou International Markets, the thousands of economic agents and craftsmen established along the shores and who undergo the ecosystem degradation impacts as well as the high pollution of those shores, are parts and parcel of this policy. Were this project not achieved, the Cotonou lagoon would fill up, bringing about the loss of its biodiversity and exposing half of Cotonou to quasi-permanent floods which would subsequently disorganize the economy of the town.

This is the general context substantiating this project aiming at enabling the Cotonou channel to fully play its regulatory role of hydrological regime of Beninese South-west fluvio-lagoon system and its role of facilitator of migrations of aquatic fauna in between the sea and the fluvio-lagoon system, irrespective of the negative impacts expected from the climate changes. The main beneficiaries are the fluvio-lagoon ecosystem components, Cotonou populations, in particular the riparian communities of the channel.

After all, due to the small dimensions of the stretch of water considering the extent of the major climatic phenomena, climate risks of the coastal zone (rise of the sea level, floods, violent winds, increased surface temperatures, prolonged droughts) are not differentiated in the space of first approximation, alongside the lagoon. Where they are realized, the climate risks quickly propagate over the stretch of water . However, thorough studies show minor variations in climate risks, the importance of which will be appreciated in microclimatology.

On the contrary, the environmental issues are well differentiated alongside the lagoon depending on the nature and intensity of the human activities (Figures .1.3 and 1.4).



**Figure 1.3 :** Distribution of dumps and storm drains in the environment of the lagoon of Cotonou



**Figure 1.4 :** Distribution of cottage-type dye works and sites of control of waters polluted by heavy metals in Cotonou.

The adaptation measures are not the response only to flooding risks though they these are the most obvious and further attract the attention of populations. The prolonged droughts which determines a long period of minimum flow favors the sea water flow responsible for the erosion of foot of slopes just like the provoked waves by the violent winds and boats and power driven canoes during the same period. The rockfill of the foot of slopes proposed in the component1.

The Emergency Project for Environment Management in Urban Area (PUGEMU) funded by the World Bank, after the floods of 2010, for the benefit of all the major cities of Benin shows the dominant place of floods among the preoccupying climate risks. Of course, adaptive actions taken into account as part of this project, such the treatment of urban waste from storm drains of the of Cotonou city before their pouring into the lagoon are not borne by this project. This action will enable to avoid the propagation of contaminants in the whole lagoon under the action of the lagoon of flows and back-flows of sea water.

The protection groynes of the Cotonou harbour, especially the sand stoppage groyne extended of 300 metres in 2010 are the cause of lack of sand at the mouth of the lagoon of Cotonou (Figure 1.5). The Sifato groyne and 6 other groynes underway of

construction at the east of the mouth of the lagoon have no obvious direct influence on the lagoon system.



**Figure 1.5 :** Sand stoppage groyne at the Port of Cotonou extended of 300 in 2010.

The specific threats associated to the adaptive measures proposed by component 1, are:

<b>Adaptive measures proposed</b>	<b>Associated specific measures</b>
<b>1</b> : Protect the sandy segments of the banks with the rocky coating	Erosion of the bank slope by currents of sea water flows and backflows and waves caused by the wind and canoes and power canoes. These threats are aggravated by the rise of the sea level, floods (top of slope), violent winds, long dry periods (foot of slope).
<b>2</b> : Develop pedestrian paths alongside banks	Erosion and caving of shores (flat parties extending the slope) by storm waters. Threat aggravated by violent rains and floods)
<b>3</b> : Develop on the two banks, on the appropriated sites, landing stages–passengers access and drop-off places for users and economic and tourist activities (fishing, transports, nautical sports, promenades in canoes and rowing boats, etc.)	Banks degradation by populations to access to income generating licit or illicit activities on the stretch of water. The gaps opened in the slope may be enlarged by violent rains and floods and lead to the collapse of any infrastructure.
<b>4</b> : build pilot sheds with concrete verandas, on some places alongside the banks, in the same style with those already set in face of Dantokpa market.	Degradation of banks by inappropriate infrastructures, erected by the populations for proximity economic activities. violent rains and floods may aggravate the degradation.

The bank or shore segments concerned by such measures are the ones on which a minimum agreement was reached in 2010 between municipal authorities and local leaders, i.e, the heads of Town Sections, the Heads of Areas, the development

Associations (Fig. 1.6). Those are also the segments whose development has been negotiated in 2011 (Fig. 1.7). The specific places of the works on the bank segments are underway of definition in consultation with local stakeholders.



**Figure 1.6 :** Segment de berge dont l'aménagement a été négocié en 2010





**Figure 1.7 :** Bank Segment whose development has been negotiated in 2011

The populations directly beneficiaries of the project are estimated at 370,000 inhabitants in 2012 (Commune of Cotonou, 2008). They are women and

men who live in the riparian Town sections of the lagoon of Cotonou. Equally, the population residing in other areas, and whose economic activities are conducted in the lagoon environment during the day are also concerned. Such people's numbers mainly increase on Dantokpa market official days, with users coming from all the regions of Benin and neighbouring countries (Nigeria, Togo, Burkina Faso, Niger).

The gender sensitivity of this project is mainly shown in the fishing sector where the roles are clearly distributed between women groups and men group in Benin. The fishing works themselves are executed by men and the fishmonger activities are conducted by women. In charge of the wholesale trade of fishing products, fishermen's wives assisted by a few men are organised within the national Association of fishmongers and assimilated of Benin, the umbrella organisation being the National Union of Fishermen, fishmongers and assimilated of Benin. Since, the securing and cleaning up of the lagoon environment must promote the revamping and improvement of halieutic products trading activities, substantial benefits for women can be expected. The project will also benefit to vulnerable women and populations working in other sectors, depending on the modalities that will be developed in the project document.

## ■ PROJECT OBJECTIVES:

### **General Objective**

The general objective of this project is to contributing to the execution of the Benin National Action Programme of Adaptation to climate changes through its coastal component (PANA - Benin) developed in 2007.

### **Specific Objectives (SO)**

SO1. Implement appropriate actions to protect the banks and shores of the lagoon of Cotonou through a set of actions of azntierosion fight, restoration and improvement of riparian social and community infrastructures threatened by the the rise of the sea level and extreme climate phenomena (floods, violent winds, increased surface temperatures, prolonged droughts), but also the anthropogenic pressure on banks and shores not maintained due to a lack of economic interest for local authorities. The exploitation of community and adaptation infrastructures should enable local communities to generate financial resources usable for maintaining adaptation infrastructures.

SO2. Implement appropriate actions to fight against the pollution of the lagoon environment and the du living environment of populations by solid and liquid wastes. The degradation and lack of maintenance of banks and shores have facilitated the invasion of such spaces by the household and industrial garbage and wastes and their colonization by illicit activities of all kinds, sources of nuisance to the public health, which must be overcome.

- SO3. Implement actions appropriate for fighting against seasonal floods of banks and riparian areas of the lagoon of Cotonou and sensitize businessmen for promoting floating bars and restaurants with a pedestrian access bridge, nautical sports, promenades in canoe and rowing boat, aquatic gardens. The Cotonou dam built to regulate exchanges between the sea and the lagoon has lost its function by lack of maintenance. This specific objective aims restoring the dam's initial function of and creating economic conditions likely to guarantee local resources that can be mobilized for the maintenance of the dam and all adaptation infrastructures.
- SO4. Back up the revision of laws and provisions in force regulating fishing activities and their adaptation to the constraints linked to climate change and to the improvement of subsistence means of local communities, as well as the retraining of some fishermen in the new economic activities generated by the development of the banks of the lagoon of Cotonou. The official interdiction of fishing activities in the lagoon and their continuance tolerated for social and political reasons give the lagoon fishing of shrimps and fish a stealthy nature which does not abide by any technical or ecological standard. It is necessary to integrate here regulatory laws and provisions taking into account climate risks, sensitize populations of fishermen to that end and support some among them to shift to other economic fields.
- SO5. Sensitize and train local communities on climate risks, adaptation techniques and good practices necessary for safeguarding the ecosystem, the human system and their own interests, and to limit the adverse impacts at a level compatible with their legitimate ambitions of economic and social development. The students, at the end of their training may exploit the assets of this project in drafting writing their studies completion dissertation and thesis defence. Such assets will be subject to a reporting at the end of the project at the local, national and international level.

### **Expected Results**

- Result 1:** The Cotonou lagoon shores are protected against the erosion resulting from the rise of sea water level and extreme weather and the socio-community infrastructures are rehabilitated and improved.
- Result 2 :** The lagoon environment and living environment of the populations are protected against solid and liquid wastes-induced pollution.
- Result 3 :** The shores and riparian areas of the Cotonou lagoon are protected against seasonal floods and the economic operators are sensitized to promote floating bars and restaurants fit with access foot bridge, the nautic sports, outing in canoes and aquatic gardens.
- Result 4:** The regulatory texts are reviewed and adapted to the constraints linked to the climate changes and adaptation strategies of the local communities and a support is brought for the redeployment of the affected fishermen.
- Result 5:** The local communities' awareness is raised on the climatic risks: they are sensitized and trained on the techniques of adaptation to climate changes and the best practices needed for protecting the ecosystem, human system as well

as their own interests, and to mellow down the negative impacts to a level that is compatible with their legitimate ambitions of economic and social development.

The following components are the five specific objectives assigned to the project:

- Protection of the shores, rehabilitation and improvement of the socio-community infrastructures;
- Fight against the pollution of the lagoon and living environment;
- Fight against the seasonal floods of the shores and riparian areas and sensitization of economic operators;
- Mainstreaming the constraints of climate changes and the adaptation strategies in the legal texts regulating fishery and back-up the redeployment of affected fishermen;
- Sensitization and training of the local communities on climate changes, adaptation techniques and best practices.

■ **PROJECT COMPONENTS AND FINANCING:**

**Table 1.3:** Project components and financing

<b>Component 1 : Banks protection, restoration and improvement of sociocommunity infrastructures</b>					
<b>ACTIVITIES</b>	<b>CONCRETE OUTCOMES EXPECTED</b>	<b>COMPONENTS OUTCOMES</b>	<b>INDICATORS</b>	<b>AMOUNT (X 1000 US\$)</b>	
<b>Activity 1.1</b> : Protect the sand segments of the banks with a rocky coating	<b>Outcome 1.1</b> : 4.5 kilometres of banks sand segments are protected by a rocky coating	<b>Outcome 1</b> : Eight (8) kilometres of Cotonou lagoon banks are stabilized with 4.5 kilometres of rocky coating, three (3) kilometres of pedestrian roads paved, with twenty (20) landing docks – landing stages and twenty (20) control sheds with terraces in concrete for awareness raising actions for populations on adaptation to climate change	Length of banks which rocky coating remains stable six (6) months after the works completion	2100	<b>7100</b> <b>Including transports and national and international missions charges</b>
<b>Activity 1.2</b> : Develop pedestrian roads along the banks	<b>Outcome 1.2</b> : Three (3) kilometres of pedestrian roads of about 15 m of roads limit are paved along the banks		Length of banks including the paved road remains stable six (6) months after the works completion	4200	
<b>Activity 1.3</b> : Develop on both banks, on appropriate sites, landing docks – landing stages of access for users and economic and tourism activities (fishing, transports, nautical ports, pirogues and small boat ride, etc.)	<b>Outcome 1.3</b> : Twenty (20) landing docks-landing stages – fixed wharfs established along the banks		Number of wrought works fully operational six (6) months after their establishment	400	
<b>Activity 1.4</b> : Build control sheds with terraces in concrete, in places along the banks, in the same style as those already established opposite Dantokpa market	<b>Outcome 1.4</b> : Twenty (20) control sheds are built along the banks to promote actions of awareness raising for populations on adaptation to climate change		Number of operational hangars six (6) months after their construction Number of new hangars built by private operators 12 months after	400	

<b>Component 2 : Fight against pollution of lagoon and life environment</b>					
<b>ACTIVITIES</b>	<b>CONCRETE OUTCOMES EXPECTED</b>	<b>COMPONENTS OUTCOMES</b>	<b>INDICATORS</b>	<b>AMOUNT (X 1000 US\$)</b>	
<b>Activity 2.1</b> : Build capacities of heads of area and SOGEMA to reduce the practice of discharging household wastes on the ground	<b>Outcomes 2.1</b> : 1000 mobile refuse containers are placed in riparian areas and in Dantokpa and Gbogbanou markets	<b>Outcome 2</b> : Two hundreds of mobile refuse containers are placed in riparian areas and in Dantokpa and Gbogbanou markets, two hundreds (200)aluminum basins and two hundreds (200) baskets are made available for women Association based on recycled materials of Dantokpa market , two hundreds (200) pieces of small composting materials are made available for the Association of market gardeners of Houéyiho , sixteen (16) improved latrines without any contact with channel water are built on the banks, capacities of night intervention of Naval Forces Units posted on entrance of Cotonou channel are reinforced, and campaigns for awareness raising for dyer craftsmen and oils dealers are organized	Number of mobile refuse containers still operational 18 months after their installation	40	<b>168</b> <b>Including transports and national and international missions charges</b>
<b>Activity 2.2</b> : Build capacities for collection and conversion of non biologically decomposable wastes by the Women Associations based on Recycled Materials of Dantokpa market (AFRMD)	<b>Outcome 2.2</b> : Two hundreds (200) aluminum basins and two hundreds (200) baskets are made available for AFRMD for collection and recycling non biologically decomposable wastes		Rate of increase of AFRMD volume of activity 12 months after material support	4	
<b>Activity 2.3</b> : Build capacities for conversion of non biologically decomposable wastes by the Association of Houéyiho market gardeners	<b>Outcome 2.3</b> : Two hundreds (200) pieces of small tools for biologically decomposable wastes composting are made available for the Association of market gardeners of Houéyiho		Rate of increase of volume of compost manufactured by AMH 12 months after material support	2	
<b>Activity 2.4</b> : Destroy the floating latrines and replace them by public improved public latrines without any contact with channel	<b>Outcome 2.4</b> : Sixteen (16) improved latrines without any communication with water from the channel are built on the banks		Number of operational latrines 12 months after their construction	32	
<b>Activity 2.5</b> : Treat urban discharges of the main sewers from rain waters of Cotonou city before their discharge in the channel	<b>Outcome 2.5</b> : urban discharges from the main sewers of Cotonou city rain water are treated before their discharge in the channel		This component is taken into account in the Emergency Project of Environmental Management in Urban Area (PUGEMU) financed by the World Bank	PM	
<b>Activity 2.6</b> : Raise populations awareness against petroleum products transportation by fluvialagoon route and support Naval Forces unit on the channel entrance to strengthen the fight	<b>Outcome 2.6.1</b> : Populations are aware of real and potential impacts of petroleum products on living resources of the lagoon and on the women and men living from these resources		Rate of reduction of illicit discharges of oils in riparian areas, 6 months and 12 months after the beginning of the awareness raising campaign	30	
	<b>Outcome 2.6.2</b> : New means of night interventions made available for Naval Forces Units posted at Ladji area.		Rate of increase of night missions of the Naval Forces Unit 6 months after the support	40	
<b>Activity 2.7</b> : Raise awareness on and train dyer craftsmen on the good practices of managing residual waters containing heavy leads	<b>Outcome 2.7</b> : dyer craftsmen are aware of and apply rational techniques of residual waters management		Percentage of dry cleaner's having adopted the new techniques of residual waters management 6 months after training	20	

<b>Component 3 : Fight against seasonal flooding of banks and riparian areas of Cotonou lagoon</b>					
ACTIVITIES	CONCRETE OUTCOMES EXPECTED	COMPONENTS OUTCOMES	INDICATORS	AMOUNT (X 1000 US\$)	
<b>Activity 3.1</b> : Rehabilitate Cotonou	Outcome 3.1 : The crest of the dam is leveled at the +0.635 metre hydro coast to limit the risks of obstruction of the lagoon mouth	<b>Outcome 3</b> : Le Cotonou dam is resized to limit the risks of obstruction of the lagoon mouth and five (5) businessmen get involved in the lagoon tourism valuation	Hydrological behaviour of the river mouth 12 months after the works	120	170 Including transports and national and international missions charges
<b>Activity 3.2</b> : Raise awareness of business men for the promotion of floating restaurants bars with pedestrian bridge of access , nautical sports, pirogues and small boat ride, water gardens	Outcome 3.2 : Ten (10) businessmen at least are involved in tourism valuation of Cotonou lagoon		Number of entrepreneurship files on the lagoon initiated 6 months after the beginning of the awareness raising campaign	50	
<b>Component 4 : Integration climate change in the laws regulating fishing in the channel</b>					
ACTIVITIES	CONCRETE OUTCOMES EXPECTED	COMPONENTS OUTCOMES	INDICATORS	AMOUNT (X 1000 US\$)	
<b>Activity 4.1</b> : Support the integration of constraints related to climate change and strategies of adaptation in the laws regulating fishing activities	Outcome 4.1 : An interministerial order regulating fishing on Cotonou channel is validated , signed by the ministers in charge of fishing and environment , and the riparian community is made aware of the standards of ecosystem sustainable management	<b>Outcome 4</b> :Constraints related to climate change and adaptation strategies are integrated in laws regulating fishing activities on Cotonou channel and thirty (30) former fishermen have retrained in the new economic sectors generated by the development of the channel.	Rate of decrease of breaches noticed by the agents of Naval Forces Units, the Environmental Police and the national Police , 6 months after awareness raising for fishermen on the basis of the new laws	40	357 Including transports and national and international missions charges
<b>Activity 4.2</b> : Support fishermen concerned by the regulation for their retraining in the new activities generated by the development of Cotonou channel	Outcome 4.2.1 : A workshop of awareness raising for fishermen is organized on the new economic activities in the channel		Number of fishermen having chosen the new economic activities , three (3) months after awareness raising	17	
	Outcome 4.2.2 : Thirty (30) fishermen receive material supports to get involved in the new economic activities		Number of fishermen maintained in the new activities six (6) months after the supports	300	

<b>Components 5 : Awareness raising and training for local communities on climate risks, adaptation techniques and good practices</b>					
ACTIVITIES	CONCRETE OUTCOMES EXPECTED	COMPONENTS OUTCOMES	INDICATORS	AMOUNT (X 1000 US\$)	
<b>Activity 5.1</b> : Raise awareness/train the local authorities , town councilors and heads of riparian areas on good practices and techniques of adaptation to climate change	Outcome 5.1 : 02 sessions of training are organized for local authorities, town councilors and heads of riparian areas on good practices and techniques of adaptation to climate change	<b>Outcome 5</b> : Managers of Cotonou Commune, town sections and riparian areas of the channel and target communities are aware of capacities of adaptation of ecosystems and human systems and develop	Percentage of local authorities having initiated a strategy of adaptation faced with major climate risks of the coastal area 01 year after the sessions	30	90 Including transports and national and international missions charges
<b>Activité 5.2</b> : Sensibiliser les communautés riveraines de la lagune de	Outcome 5.2 : local authorities have delivered to their target communities		Number of members from communities having	60	

Cotonou sur les bonnes pratiques et techniques d'adaptation aux changements climatiques	the training on good practices and techniques of adaptation to climate change	initiatives concerning adaptation measures	developed at least one adaptation measure to major climate risks of the coastal area , 01 year after the sessions		
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<b>Components of management and financing requested</b>			
6. Cost of execution of the project	Activity 6.1 : Ensure the technical coordination of the project activities	280	484
	Activity 6.2 : Ensure activities of management, follow up-evaluation and internal auditing	124	
	Activity 6.3 : Ensure the evaluation and external auditing of the project activities	80	
	7.Total cost of the project/programme	8369	
	8.Management charges for the project cycle requested by the institution in charge of the implementation (should the need arise)	711	
	<b>Amount of financing requested</b>	<b>9080</b>	

## ■ PROJECTED CALENDAR:

**Table 1.4 : Schedule**

<b>MILESTONES</b>	<b>EXPECTED DATES</b>
Start of Project Implementation	December 2012
Mid-term Review (if planned)	December 2014
Project/Programme Closing	December 2016
Terminal Evaluation	October 2016



## ■ PART II: PROJECT JUSTIFICATION

*A. Describe the project / programme components, particularly focusing on the concrete adaptation activities of the project, and how these activities contribute to climate resilience. For the case of a programme, show how the combination of individual projects will contribute to the overall increase in resilience.*

Based on the Cotonou channel referred to locally as “lagune de Cotonou”: Cotonou lagoon, this project comes in support to local authorities and riparian communities in order to implement options of adaptation identified by themselves. Most of options of adaptation are based on strategies some of which have already started being implemented. The projet integrates five components which are as follows:

*a) Protection of banks and restoration/improvement of lakeside sociocommunity infrastructures.*

The Benin littoral is naturally subject to coastal erosion. It is characterized by a barrier beach made up of soft sediments (coarse texture sands with fine), a high littoral transit of sand from the West to the East created by the obliquity of crests, and large seasonal variations of surge characteristics, which make the coastline unstable. With the construction of Cotonou port and its protection finger slips, the eastern area of the coast is deprived of the natural contribution in sand while it is still providing the areas further in the East with sand. The first consequences constitute the erosion of the coast sections directly located in the East of the port, the permanent opening of Cotonou channel’s mouth, the increase of the rate of rise and fall in the channel and banks erosion. The rise of the sea level and the extreme meteorological phenomena will contribute to the worsening of erosion phenomenon.

The state of degradation of Cotonou lagoon banks where the erosion has stripped the outlet of rain waters or waste waters’ main sewers and drink water carriage conduits, and where the insalubrity created by waste waters and municipal waste urge poor populations to abandon their slums, calls for urgent protection actions (fig.2.1). We must protect the integrity of the banks and the health of populations without being in the way of the migrating species movements, movement of water between Atlantic Ocean and Lac Nokoué, and the

Breeding grounds for fishes and shrimps. Options considered on the basis of bank segments specificities are :

- protection of banks sandy segments with a rocky coating;



**Figure 2.1** : outlet of rain waters or waste waters’ main sewer, drink water conduits *stripped by erosion in an unhealthy environment on the banks of Cotonou lagoon*

- development of paved pedestrian footpaths, along the banks;
- development on the two banks, in appropriate sites, of landing docks – landing stages and fixed embankments of access for users and economic and tourism activities (fishing, transports, nautical sports, pirogues and small boat ride, etc.).
- construction of control sheds with terraces in concrete, in places, along the banks, in the same style as those already built opposite Dantokpa market. The interest of the control sheds is to serve as a model for business men who would like to involve themselves in the tourism development of the lagoon environment and house awareness raising actions for the population on the issue of climatic risks, vulnerability and strategies of adaptation.

The robustness of the remedial works and the joys of spring to which they will contribute within riparian populations and those living in the whole Cotonou should make populations be aware of their capacities to stand up to natural environmental stress if they show spirit of anticipation through relevant strategies of adaptation.

*b) Fight against pollution of the lagoon and living environment*

The sources of pollution observed in Cotonou lagoon, on its banks and in the wells exploited in riparian areas are as numerous as varied : biologically decomposable and non biologically decomposable solid wastes (fig.2.2), various wastes and liquid products (releases of municipal rain water, household and industrial waste waters, oils, etc.). They are at the root of chemical contaminants which are essentially heavy metals (lead, cadmium, mercury, zinc, etc.) and persistent salts (phosphates, nitrates, nitrites, ammonium, etc.) and microbiological contaminants (fecal coliforms, total coliform count, streptococcus, etc.). These contaminants get in the lagoon water, in the wells water and in the sediments feeding fishes and shrimps. This results, in halibut products, in levels of concentration higher than the standards admitted by the World Health Organization (WHO 1995).



**Figure 2.2 :** *Rubbish dump on the banks of Cotonou channel*

The protection of waters quality requires bold measures of fight against all the sources and forms of pollution. Cotonou municipality, local authorities, all the populations involved and Non-Governmental Organizations (NGO) involved shall try to :

- Fight against the practice consisting in laying household wastes on the ground in riparian areas and in Cotonou international market.

The mobile refuse containers that the Market Management Company : “Société de Gestion des Marchés” (SOGEMA) has put on the western bank of the channel, opposite Dantokpa market, is an initiative the extension of which could be supported on the two banks. The same applies to the initiatives of Women

Associations based on Recycled Materials of Dantokpa Market and the Association of Houéyiho Market Gardeners which involve themselves actively in non biologically decomposable waste recycling and in organic waste conversion through composting the products of which are used to fertilize the grounds of market gardener areas of Cotonou city.

- Destroy floating latrines and replace them by improved range closets without any contact with the channel. The initiative of range closets built on the western bank of the lagoon by an NGO for Gbogbanou market users seems to be a base which will require to be reinforced ;
- Treat municipal waste from rain water main sewers of Cotonou city before their disposal in the channel. This constituent is greatly taken into account in the Emergency Project for Environmental Management in Urban Area (PUGEMU) the financing of which was approved by the Board of Directors of the World Bank on April 26, 2011.
- Fight against pollution of the channel by hydrocarbons by raising the awareness of populations especially the persons who carry these products through water route. The presence of Naval Forces Units posted at Ladji area is a deterrent action of fight against the illicit fluvial lagoon transport of hydrocarbons. It would be advisable to build the capacities of the night patrols of these units and raise the awareness of dealers for their guidance to other economic activities, including the new activities generated by the development of the lagoon.

In concrete terms, we shall have to:

- 1) build the capacities of heads of area and SOGEMA to reduce the practice consisting in laying household wastes on the ground ;
- 2) build capacities for collecting and conversing non biologically decomposable wastes by the Women Associations based on Recycled Materials of Dantokpa market (AFRMD) ;
- 3) build the capacities for conversing non biologically decomposable wastes by the Association of Houéyiho Market Gardeners (AMH);
- 4) destroy the floating latrines and replace them by improved range closets without any contact with the channel;
- 5) treat municipal waste from rain water main sewers of Cotonou city before their disposal in the channel;
- 6) raise the awareness of populations against the transport of oils by fluvial and lagoon route and support the Naval Forces unit posted at the entrance of the channel to increase the fight ;
- 7) raise the awareness of and train dyer craftsmen on the good practices of residual bulkwater management containing heavy metals.

c) *Fight against seasonal flood of banks and riparian areas and awareness raising for business men*

From the opening of the channel in 1885 until the 1950s, Cotonou lagoon has relatively efficiently carried out its mission of flood control in Cotonou City. Under the pressure of flood waters from “fleuve Ouémé” : Ouémé river and “lac Nokoué” : Nokoué lake, The shoestring sand of the river mouth was giving way, causing waters drainage towards the Ocean and the fall of level in the fluviolagoon system. On low-water level, the sea water used to enter the channel and the littoral current would cause a sand deposition which finally blocked the river mouth until the following floods. The development of port wrought works in 1960 has changed the lagoon hydrologic operation.

Indeed, built from December 1960 in deep water, Cotonou port is made up of a certain number of wrought works including a Western wharf in coarse rock, with 1 424 metre long, and an Eastern crossing in steel-sheet piles, with 770 metre long, which close the harbour area in the East while leaving a harbor channel with 180 metre wide (Leite, 2002). The role of the Western wharf in coarse rock is to protect the harbour area against the effects of Cotonou surge and current, especially sandbank and waves. Each year, it blocks about 1 500 000 m<sup>3</sup> of sand (Leite, 2002). There is then an almost total stopping of the contribution of sand in the East and an accumulation of sand in the Western part of the wharf. The consequences of this sand contribution stop constitute the phenomenon of catastrophic erosion observed on the socio economic wrought works on Cotonou Eastern coast (fig. 2.3) and the permanent opening of Cotonou channel which has resulted in important hydro biological and socio economic changes (Baglo, 1980).

In order to limit the consequences related to the permanent opening of Cotonou channel, a rockfill dam has been built in 1977 the objectives of which, according to Baglo (1980), was to:

- Reduce the speed of the subsidence in order to extend the period of reproduction and increase of freshwater species;
- protect the bridges on the lagoon in reducing the currents speed ;
- enable a certain intrusion of saline water in order to reduce the effects of waters pollution;
- avoid the flood of Cotonou City;

The dam was built out of a barrier of about 420 m and 6 straits of 4.5 m wide (Leite, 2002). The wrought includes a setting mechanism for sea-lagoon exchanges. But the dam built is 0.32 metre higher than the wrought provided for, the project owner having considered doing well in increasing the height. The exchanges were completely interrupted by a spit which has reconstituted itself in front of the dam, because of the significant reduction of the lagoon current, even before the end of the construction. This undesirable closing made the setting mechanism handling inefficient, changed the currents path at the river mouth, and caused the extension towards the western part of

the current sand spit until it completely closed the river mouth on May 6, 1978, with biological consequences more catastrophic and requiring fishermen to carry out its damping (Roche International, 2000).

The rehabilitation of Siafato finger slip and the construction of 7 new finger slips in the Eastern part of Siafato, the works of which were launched on July 06, 2009, should lead to stop immediately losses of sand in the Eastern part of Cotonou port when the works will be completed in 2012. However, the risks related to the rise in sea level and extreme meteorological phenomena and the good efficiency of the 7 new finger slips in process of construction may be the cause of a phenomenon of



**Figure 2.3 :** *Sluice dams at Cotonou channel mouth*

fattening at the level of the channel mouth. We should then have to:

- rehabilitate Cotonou dam in leveling the crest at the +0.635 metre hydro coast initially provided for and in re-activating the setting system for sea-lagoon exchanges, to avoid the obstruction of the lagoon mouth ;
- raise the awareness of business men for the promotion of floating restaurant bars with pedestrian bridges of access, nautical sports, pirogues and small boat ride, water gardens. These tourism and economic activities will generate on the lagoon a permanent life through the behaviour of Cotonou dam and that of the channel mouth would be a subject of a real time collective surveillance that would reinforce the alert systems the naval authorities would establish

*d) Integration of climate change and strategies of adaptation in the law governing fishing in the lagoon support to the conversion of affected fishermen*

The general framework of management and control of fishing in the maritime environment is defined by the Code of shipping (Order N° 68-38/PR/MTPTPT dated June 18, 1968, modified by Order N° 69-49/PR/MAE dated December 9, 1969) which enables, per ministerial order, to define the conditions of exercising maritime fishery. It enables to define non fishing areas and periods, prohibited machines, size limits of catch, the nature of baits used, the measures of control and follow up of fishing and prohibited activities. It also enables to determine the measures of hygiene and salubrity of the products. It finally provides for provisions on all related activities (ship construction, fish trade, ice manufacture, etc.), as well as fines for breach of fishing conditions and related activities.

This statutory basis is completed by orders, decrees and ministerial orders which specify some conditions of fishing exercise, in particular on industrial fishing licences. These are:

- ministerial order N°100/MTPTPT/MDRC dated July 31, 1968 defining the conditions of fishing exercise in territorial maritime waters;
- order N°73–40 dated May 5, 1973 related to the organization of industrial fishing;
- order N°76-92 dated April 2, 1976 related to the extension of territorial waters at 200 nautical miles (exclusive economic zone);
- decree N°78-18 dated February 9, 1978 related to the creation and power of the permanent technical Commission of the National Committee on fisheries;

The main laws regulating precisely fishing activities in Cotonou channel and on fluviolagoon water facilities are Decree N°98-522 dated November 5, 1998 and Order N°068/MDR/DC/CC/CP/ dated March 12, 1997 related to fishing regulation on Delta complex of 'Ouémé-lagune in Porto-Novo-lac Nokoué'. The Order has prohibited fishing on Cotonou lagoon in its article 20. The purpose is to enable this water facility to play a role of physical and biological exchange between the sea and 'lac Nokoué' : Nokoué lake, favour migration of halieutic species in both directions, ensure the protection of spawning grounds with a view to the after growth of "lac Nokoué" and restore the environmental balance of the channel. Through this article, the government has expressed its good intentions towards ecosystem conservation. But, fishermen fiercely oppose its implementation. In 2008, there has been in the channel, on banks and in riparian areas eleven (11) fishing stations, 270 fishing pirogues, 22 fish scrawls (acadja), 352 pilings for set nets, 28 cast nets, and 14 shrimp creels (Badahoui *et al.*, 2009).

Fishing remains an activity which is carried out permanently in Cotonou channel by professional fishermen. But the state of extensive insalubrity observed in the lagoon environment also affects halieutic products most of which are unfit for food.

Works by Youssao *et al.* (2011) show with some species of fishes very consumed such as *Sarotherodon melanotheron*, *Tilapia guineensis* and *Hemichromis fasciatus*, fished for in Cotonou lagoon in the period of low-water level, concentrations in lead of 1.25 to 1.50 mg/kg and exceeding 2 mg/kg at the level of the fishes liver. These values are very higher than the standards of 0.2 to 0.4 mg/kg defined by the World Health Organization (WHO, 1995).

Within the most prized shrimps species on the market (*Penaeus notialis* and *Macrobrachium sp.*), the content in lead is still higher during the period of low-water level. It was 3.5 mg/kg between August and September 2008 (Changotadé, 2010). This is one of the reasons which had made the European Union Food and Veterinary Office suspend shrimps import from Benin in 2004 and during more than one and half year.

Fishes and shrimps consume the lead from the sediment which content in lead has reached 535 mg/kg in period of low flow. In August-September (period of high water), the concentration of sediments in lead falls to 0.2-1.6 mg/kg.

The ecological effect of waters pollution is noticed at the level of organisms, population, biocoenosis and ecosystem. At the level of organisms, waters pollution, in particular food poisoning it causes is defined first and foremost on the basis of morphological and physiological criteria (Gaujous, 1995). So, in the case of a chronic poisoning, there is often the birth of abnormal forms, reduction of speed in growth with individuals and fertility decline. Under the effect of pollution, organisms change their behaviours and move to sites where physicochemical conditions are better. In an acute poisoning, aquatic organisms change their way of swimming and adopt another position in water. The number of juvenile individuals decrease because they are more sensitive to poisoning than adults. The change of sex- ratio is typical : there are more males which remain dwarf.

The non application of regulatory rules on lagoon fishery means that the ecological role of the channel and the health of halieutic products consumers cannot be really ensured without an effort of awareness raising for fishermen and without the institution of concerted measures in the interest of fishermen of course, riparian populations and government. This is the reason why it is important to make the arrangements to:

- support the integration of constraints related to climate changes and strategies of adaptation in the laws regulating fishing activities;
- support fishermen concerned by the regulation for their retraining in the new activities to be generated through the development of Cotonou channel.

In summary:

The current location of the lagoon, at the very heart of the town, was initially occupied by indigenous populations of Cotonou who are and remain fishermen. They have reorganised themselves to adapt their activities to the new situation and exploit the new opportunities offered (exploitation of migratory halieutic resources, utilisation of watersheds and banks as traffic lanes, etc.). Other populations of the inner country and foreign countries came to settle in riparian areas to develop parallel or additional activities or (processing and export of fishing products, trading, social services, etc.). The populations of riparian areas are the basis of the human system organised around the lagoon of Cotonou (figures 2.4 and 2.5).

The sandy nature of the mother rock favours the erosion and falling rocks of the shores and banks of the lagoon, under the effect of the energy of the flow and back-flow of the sea and lake waters and waves caused by the wind and rowing boats and power canoes. This phenomenon, the impact of which increases during the period of high waters (caving of the top of the slope and the shore) or the period of minimum flow (underwashing or collapsing of the bottom of slope), or following extreme weather events (major floods, violent winds and prolonged droughts), is a source of insecurity for circulation on the banks. This motivated the decrease of populations and entailed the

processing of important segments of the lagoon shores in dumping grounds for household and industrial garbage and wastes and platforms of activities for illegal oil traffickers. It was noticed since about fifteen years that after the major floods, oil products smugglers try to save space on the sailing water pouring trucks of household refuse on the eroded edges of the shores that they occupy. This behaviour contributes to further fragilise the lagoon banks, the decomposition of organic waste entailing new cavings, new erosions and the filling of the lagoon. On the basis of the climate and non climate scenarios set for the future evolution of the littoral zone and according to the les indications provided by the software DIVA, the level of the water on the coastal segment including the city of Cotonou may rise continuously, till they reach about 0.81 m, during the period 2000 – 2100. The expected consequences will be the aggravation of degradations observed currently on the banks of the lagoon of Cotonou.

The adaptive actions contemplated as part of the project will be of two types: material actions (installation or strengthening of infrastructures meant for fighting against the forms of degradation of banks and the lagoon environment, of a natural or anthropogenic origin and exacerbated by the variability and climatic changes) and social and educational and environmental actions (sensitization and training of populations and regulation of human activities likely to aggravate and degradation of the life framework).





**Figure 2.4 :** Density of the population in the environment of the lagoon of Cotonou



**Figure 2.5 :** Main infrastructures in the environment of the lagoon of Cotonou

That's why especially:

- 1) In the component 1, two joint adaptive measures are contemplated to stabilize the lagoon banks : the stabilisation of the slope or bank strictly speaking by a rocky coating (technical function) and the stabilisation of the top of slope or shore by a paved coating (technical and socio-economic function). The technique of protection of slopes and sites with a strong slope by rockfill proved efficient in the coastal area of Benin where segments of coast especially submitted to erosion, groynes and other harbor infrastructures are sustained by rocky blocks. On the lagoon banks, the rocky coating will be laid on the foot of slope up to the top of slope from where it shall be extended on the shore by a flat paved coating surrounded by gutters likely to exploit the plant engineering on the bank's side and the regular techniques on the side of external wall leading to urban civil engineering works. The paved surface will enable to avoid the rain erosion of the shores while favouring the access of users to social and economic infrastructures which will justify the maintenance work by businessmen, local development committees, and even the municipal road system services. Without this minimum economic function, and the resulting social animation, the developed banks would be subject to degradation by lack of maintenance.
  
- 2) In the component 4, two measures are contemplated to implement the regulation of fishing activities compliant with the requirements of the climatic change and to support the retraining of the outnumbered fishermen in new economic activities of which this project will enable the development. Actually, the regulation currently in force forbids the activities of fishing in the lagoon of Cotonou. This interdiction has never been respected because the concerned populations are populations of indigenous fishermen of Cotonou, the first to adapt to the situation resulting from the appearance of the lagoon on their lands. But during the periods of swelling of waters, minimum flow, floods, violent winds or prolonged droughts, conditions of use of some fishing engines aggravate the impact of natural events on the lagoon system. More than the repression measures socially and politically difficult to implement, it would be worth to build up accountability among the populations regarding the extent of their activities. A sensitization and education work should enable them to understand the need for making the fishing activities compliant with the technical standards conducive for the sustainability of the lagoon system to integrate into the new regulatory provisions. The overall volume of fishing activities will thus be reduced. Therefore, there is a need for guidance of some actors towards other economic activities.

***B. Describe how the project / programme provides economic, social and environmental benefits, with particular reference to the most vulnerable communities.***

The project suggested aims at protecting Cotonou downtown against the risks of degradation and insalubrity that have already occurred and against potential risks of flooding and worsening of effects from lagoon banks erosion. The beneficiaries are riparian poor populations of Cotonou channel and hundreds of users of Cotonou international market who hurry everyday to meet 100 000 traders.

At the economic level, daily business in Cotonou international market is estimated at F CFA one billion in the current conditions of insalubrity. The improvement of the secular and health environment and the working environment will, undoubtedly, positives benefits on microeconomics which will support the national economy. In the field of fishing for example, most of the shrimps fished for in the majority of in Cotonou lagoon and in "lac Nokoué": Nokoué lake, was exported to Europe (France, Spain Italy, Belgium) with turnovers of more than F CFA three billion a year for export companies which are: CRUSTAMER, FSG and SOBEP (Egounlety, 2005). Because of insalubrity and related problems, the production of shrimps has run under capacity, reducing to short-time working or total unemployment thousands of fishermen, wholesale fishmongers and workers, obliged to retrain in the illicit traffic of petroleum products on water facilities from neighbouring Nigeria. This traffic is particularly dangerous for health and life of populations practice it and for the quality of waters and living resources of the fluviolagoon complex : pirogues and dealers camps fires and losses of human life, as well as pouring-out of petroleum, diesel oil and petrol in the lagoon are regularly regretted. In improving the environmental conditions of production and treatment of shrimps on the Eastern bank of Cotonou channel, this project should favour the sustainable resumption of exports to European Union and relieve economically these men and women.

At the social and environmental plan, the implementation of the project will help, not only suppress household wastes dumps, anarchic discharge of residual bulkwater from dry cleaner's and other sources of waste water, but will also create conditions so that these sources of pollution do not re-form. The populations themselves, local authorities and NGOs shall have a major role in the establishment and maintenance of sustainable management mechanism of household and industrials wastes. Cleaning up lagoon banks benefit riparian communities who will have less health problems, on the one hand, and thousands of craftsmen and traders for whom this represents the work environment where they are obliged to spend their whole work days, on the other hand.

**C. Describe or provide an analysis of the cost-effectiveness of the proposed project / programme.**

The initiative consisting in digging a trench (currently known as Cotonou channel) between "Lac Nokoué" and Atlantic Ocean has been taken by the colonial administration, on September 21, 1885, to drain to the sea waters from the exceptional rise in the water level of "fleuve Ouémé" and "Lac Nokoué", observed since the beginning of the month, and thereby spare the city the

consequences of a catastrophic flooding. Almost 130 years later, this first function of Cotonou channel is typical at the moment. Currently, it is coupled with the function of facilitation for species migration between “Lac Nokoué” and Atlantic Ocean, their reproduction and ecologically rational management by riparian communities in a healthy environment. For the future, the erosion and degradation of the channel banks, worsened by the risks of sea-level rise and extreme meteorological phenomena, might be the cause of the city invasion by sea through the same channel.

Through the project suggested here, the Government of the Republic of Benin would like to support Cotonou Commune authorities, local authorities and areas communities involved in their effort to intervention for the sustainable expression of both basic ecological functions of Cotonou channel. The Government would in the same time like to support the taking of anticipation adaptation measures against the risks of flooding from the sea and the consequences of which shall be more terrible than those of floodings from “fleuve Ouémé”: Ouéme river.

Cotonou channel, “Lac Nokoué” and riparian areas have important sources of economic value, namely :

- Value of direct use of goods and services consumed (food resources, lagoon transports, etc.) ;
- Value of indirect use of functional standard benefit (ecological function, regulating function, etc.) ;
- Value of option on future uses (preservation of ecological functions, production of biodiversity, etc.) ;
- Value of legacy and value of living conditions that the present generations have to pass on future generations, either for their consumption, or to ensure the maintenance thereof (species in process of extinction, ecosystems threatened, life sustaining, etc.).

These are tangible and intangible properties, tradable and non tradable goods and services, exploited by the riparian populations of Cotonou lagoon and “Lac Nokoué”, and which have been threatened by climate changes. This project aims at limiting the impacts and turning the trend round, that is to say generating the goods in process of degradation and improving progressively populations living conditions.

The economic analysis should enable to compare the economic and social cost of the enjoyment and non enjoyment of these goods for the current and future generations in conditions of non intervention, and the economic and social cost of adaptation measures suggested by the project, together with the population concerned. The ratio of additional costs due to the implementation of adaptation measures and additional benefits at the level of ecosystems and human systems in terms of banks protection, channel and Lake replantation by species in process of extinction and in terms of poverty reduction, satisfaction of food and health requirements for example, should enable to appreciate the efficiency of adaptation measures. The tool for cost efficiency analysis imposes itself from then on as the best tool. But in this case, difficulties in evaluating the values of non tradable goods and services and intangible properties in

ecosystems and human systems do not enable to use this tool. It would be advisable that the cost efficiency analysis be the subject of a workshop during the proceedings of formulation or revision of this project document as part of the Program Cycle Management.

For the time being, it can be reminded that in the situation of poor communities living in precarious hygiene and health buildings along Cotonou channel banks, doing nothing faced with harmful effects of climate variability and extreme meteorological phenomena noticed today is always more costly for ecosystems and human systems than adaptation measures. The secretary of United Nations Framework Convention on Climate Change (CCNUCC) estimates between now and 2030, the costs of adaptation for developing countries at between USD 28 and 67 billion a year. Oxfam International (2009) thinks that in developing countries, the cost for adaptation shall amount to at least USD 50 billion a year, and even more if emission of greenhouse gas worldwide are not reduced quickly.

But the models of evaluation in force hardly enable to go from data drawn up worldwide to those of reduced spaces such as riparian areas of Cotonou lagoon. What is sure, is that more than 30% of Cotonou population are in most precarious conditions on non stabilized banks, thereby making Cotonou city contribute for 64.7% to urban poverty in Benin (UNDP, 1997; Cotonou Commune, 2010).

The variation in the income of actors involved in halieutic products export industry (especially shrimps) before and after the suspension of exports to European Union countries illustrates quite good the financial importance of this project one of the impacts of which, concerning development, will be to support the sustainable export rehabilitation. Indeed, the halieutic industry involves a community of about 90. 000 fishermen including 45 000 directly involved in shrimps sector. According to the professional Association (ATEP), national economic statistics establish that more than 350. 000 persons live on fishing.

The suspension of exports to European Union, in 2004, do not seem to have affected halieutic production (table 2.1). There has been the same trend on the rise of the annual production. But, the volume of export has lost its significance in 2009.

Supplies of the firms CRUSTAMER and FSG constitute direct income for fishermen and wholesale fishmongers who retail their catching to them. At the level of these firms, the income of fishermen and wholesale fishmongers, and the income paid in the form of wages have gone undergone a fall of 80 to 90% between the years 2001/2002 and years 2005/2006 (table 2.2).

The issue of profitability of adaptation projects is always very sensitive. In this case, especially for the component 1 is the most expensive, the options of protection of the banks and shores are technical options that seem to be the most adapted to the situation. Regarding the protection and stabilisation of banks the cheapest techniques

derive from the plants engineering; the most expensive techniques are those of the sheet piles ; the rock fill techniques have intermediary costs. Technically the plant engineering is not applicable here because the average draught exceeds 3 metres (the traction forces being exerted on the foot of slopes exceed 100 Newtons per square metre) : the plant engineering structures will not be able to resist.

On the shores opened to traffic, for social and economic reasons, the technology the most appropriate and requiring less maintenance is that the paved lanes. The plant engineering, cheaper, may also be envisaged if the lagoon water was not salty, and non unusable for watering the plants. The fresh water supply to the vegetal cover will be difficult in the lagoon environment and particularly expensive.

The costing standards used are the average costs of the linear kilometre of coating applied by civil engineering companies operating in Benin, for similar works (construction of groynes, urban lanes, roads). The dimensions of the infrastructures are those proposed in table 1.3 (4.5 kilometres of segments of bank slope; 3.0 kilometres of pedestrian lanes with about 15 m of right-of-way).

However, the modalities of setting up of rocky or paved coating may contribute to reducing the costs. We may also envisage to vegetalize partially the shores with the mixed system combining vegetalisation and paving: vegetalized top of slope and paved pedestrian path outside the shores (the cost of installation will be reduced of one third). In this last case, the relatively high maintenance cost (supply of fresh water) cannot be borne by the local populations.

**Table 2.1** : Evolution of the production, import and export of halieutic products, in tons/year (Department of Fisheries, 2010)

Years	2005	2006	2007	2008	2009
Productio	38696.88	39614	36396.42	37494.587	39691.587
Import	45227.99	46466	63479.723	77853.562	73471.195
Export	136.472	114.41	12.223	6.35	0.2617

**Source** : Department of Fisheries (2010)

**Table 2.2** : Variation in the income of actors involved in halieutic products export industry from 2001 through 2006

*In millions FCFA*

2001	2002	2003	2004	2005	2006

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<b>Income of fishermen and wholesale fishmongers</b>	1516	1605	836	439	443	159
CRUSTAMER	1034	957	494	336	405	159
FSG	481	648	343	103	38	

<b>Income paid in the form of wages</b>	74	113	84	33	55	26
CRUSTAMER	43	46	41	19	42	26
FSG	32	66	43	14	14	

<b>Tax revenues generated by the industry</b>	14	14	25	7	8	6
<b>result tax</b>	7	7	4	1	0	0
CRUSTAMER	7	7	4	1	0	0
FSG						
<b>Various taxes</b>	7	7	23	5	8	6
CRUSTAMER	5	5	21	4	4	6
FSG	2	2	2	1	4	

**Source :** Project to support the private sector (2007).

Table 2.2 shows that between 2001 and 2006 these agents have earned almost F CFA 5 billion.

Permanent or seasonal workers also earn income in the form of salaries and other social benefits. Salaries earned as it happens can be estimated between 2001 and 2006 at almost F CFA 390 million.

The Benin state has drawn from the taxation of these firms, tax revenues estimated, between 2001 and 2006, at about F CFA 77 million.

These financial benefits shall be found and improved thanks to the project implementation through the component of fight against pollution. Other financial benefits are expected, especially new tourism activities which promotion is provided for.

*D. Describe how the project / programme is consistent with national or sub-national sustainable development strategies, including, where appropriate, national or sub-national development plans, poverty reduction strategies, national communications, or national adaptation programs of action, or other relevant instruments, where they exist.*

The ratification by Benin of the United Nations Framework Convention on Climate Change on June 30, 1994, marked the starting point for the reorientation of documents of policy, strategy, plan and development programme towards sustainable development. The framework Law on



Environment dated February 12, 1999, the sector policy papers and national development planning tools are established in the vision of sustainable development with a particular opening on concerted protection of ecosystems and their resources.

So, Benin sustainable development strategies fall within a partnership between public and private actors, based on the logic of threatened ecosystems preservation, through the Declaration of Population Policy (DEPOLIPO) in 1996, Benin by 2025, the Document on Poverty Reduction Strategy (DSRP 2003-2005), the national Strategy of Growth for Poverty Reduction (SCRIP 2007-2011 and SCRIP 2011-2015).

In the field of environment and sustainable development, the main policies and strategies developed and implemented by Benin are:

- ✓ *the Environmental Action Plan (PAE)* adopted in June 1994 by the government and up dated in 2001, and which aims at the change of behaviour, especially through a rise of living standard and an awareness-raising for all Benin citizens, the control of the evolution of natural resources and the better management of biodiversity, and the improvement of life environment for all the Benin citizens ;
- ✓ *the National Agenda 21 adopted on January 22, 1997* and the objective of which is to define the orientations and the conditions to achieve sustainable development;
- ✓ *the Benin Long term Prospective Studies by 2025*, initiated since 1998, which integrate sustainable development concerns and thereby define the vision of Benin: « Benin will be in 2025, a pioneering country, a well governed country, a united and peaceful one, with a booming and competitive economy, cultural influence and social well-being ». This call for an economically rational management of natural resources and human systems;
- ✓ *the plan of National Orientation 1998 – 2002* which, after defining the first priority which is to fight against poverty to strengthen the economic growth, has identified in the field of environment, the deforestation, soil degradation, coastal erosion, and pollution in cities ;
- ✓ *the Declaration on National Land Planning Policy (DPONAT)* adopted in 2002 and within the framework of which are created the National Commission of Land Planning (CNAT), the Delegation for Land Planning (DAT) and the Fund for Intervention to Land Planning (FIAT), responsible for seeing to the development of Land Planning Policy and the follow up of its implementation;
- ✓ *the National Action Program of Fight Against desertification (PAN/LCD)*, developed in 1998 to identify the factors which contribute to the desertification and the concrete measures to be taken to fight against desertification and reduce the effects of dryness;
- ✓ *the National Strategy and the Action Plan for the preservation of biological biodiversity adopted in 2002* and aiming all in all at contributing to Benin sustainable development and reducing poverty through the preservation,

sustainable use of biological resources and fair and equitable sharing of profits from the exploitation of the said resources;

- ✓ *the National Sanitation Policy, developed in 1998 and the objective of which is to promote sanitation in order to improve the living environment of populations ;*
- ✓ *the National Strategy of Fight against Air Pollution in Urban Area adopted in 2001 and which is based on the development of legal, political and economic instruments likely to favour the fight against pollution and reduction of pollution sources and on the implementation of a strategy for households, the transports sector, industrial sector, management of wastes and hazardous substances, atmospheric control and international cooperation ;*
- ✓ *the National Strategy for Urban Mobility, adopted by the government in 2005 and aiming amongst others at ensuring conditions of movement within cities and preventing and limiting nuisances attributable to cities development ;*
- ✓ *the Declaration on Housing National Policy adopted in August 2005 and which aims at facilitating the access of the greater number of populations to a decent and cost effective housing and, consequently, contributing to poverty reduction;*
- ✓ *the Strategy for Attaining Objective N°7 on MDGs adopted in 2006 and which denounces the main challenges related to environment degradation : (i) the stopping of deforestation and destruction of protected areas ; (ii) fight against coastal erosion and soil degradation; (iii) air pollution reduction ; (iv) promotion of means of urban transportation; (v) taxi-moto transport improvement; (vi) free flow of traffic ; and (vii) appropriate treatment of household and industrial wastes;*
- ✓ *the strategic development Orientations for the period 2006-2011 which point out the backward movement of the national forest cover of 70.000 ha a year between 1990 and 2001 and recommend, to turn the trend round, amongst others, promotion of concerted and participating of natural resources, strengthening the legal and regulatory framework in this field and the implementation of conventions related to environment, ratified by Benin;*
- ✓ *the National Policy of Decentralization and Deconcentration (PONADEC) adopted in 2009 with three main objectives : (i) implement an harmonious and balanced land planning policy, integrating the whole national territory to attain a sustainable and equitable development, (ii) ensure the implementation of principles of good territorial governance by a modernized and efficient administration, (iii) reduce the level of poverty through the improvement of access to basic services and the economic development of communes economic potentialities.*

As part of Benin commitments in multilateral agreements on environment, especially the United Nations Framework Convention on Climate Change, we have to insist on :

- ✓ *the National Strategy for the implementation of United Nations Framework Convention on Climate Change, adopted in 2003, which has defined a framing and*

an explicit vision concerning, climate change, related United Nations Framework convention and their relation with national economy business plans, on the one hand, and national commitments and available opportunities as part of the Convention, on the other hand.

- ✓ *The Initial National Communication of Benin on climate change presented at the 8th Session of the Parties Conference (CoP8), on October 23, 2002, and setting out the plans, studies and national action programs for environment and sustainable development;*
- ✓ *the National Action Program for the purposes of Adaptation to climate change adopted by the Government in 2007 in which the "protection of the coastal area faced with the rise of water level" is identified among the first five national priorities for which a sheet of draft adaptation has been suggested for the financing by the international community.*
- ✓ *The Second National Communication of Benin on climate change adopted by the Government in November 2011, in which relations between the rise of sea level and coast flooding likely to affect human settlements, public infrastructures, fishing activities and other economic activities, as well as biodiversity of littoral ecosystems, are reaffirmed.*

This project fall within this national dynamics in aiming in particular at (i) taking up two of the seven major challenges identified as part of the Strategy to Attain the Objective N°7 of MDGs in Benin – fight against coastal erosion and soil degradation and the appropriate treatment of household and industrial wastes – (ii) making commune authorities, local authorities and civil societies organizations be aware of their responsibilities, for the implementation of measures to clean up and protect the lagoon banks against erosion, (iii) getting riparian communities involved in following up the implementation of measures towards the cleaning up and rational management of the ecosystem.

At the local level, the project has been identified under the name "Development project for the lagoon bank" and integrated to a programme of Cotonou City Hall entitled "Banks Development Programme". It was provided for to stabilize and clean up both banks of Cotonou lagoon between "Ancien Pont": former bridge and Hindé area (in the Northern part of Dantokpa market). It results from sessions of concertation organized with the managers of Land Affairs Department of the Town Hall and with the first authorities of the town hall that the project could not be worked out and executed owing to sufficient financial resources, but it has remained one of the major priorities of Cotonou Commune.

*E. Describe how the project / programme meets relevant national technical standards, where applicable.*

This project suggestion is developed in compliance with the structure and instructions of the Fund for Adaptation and guidelines of the Group of Least Developed Countries for the development of programmes of adaptation. The guidelines of the Group of Least Developed Countries for the development of adaptation programmes had been exploited for the development of the Benin National Action Program for the Adaptation to climate change in 2007 and the Adaptation Project for Benin agriculture and food sector to the climate change the implementation of which started in January 2011 on financing by the Fund for World Environment. The project also complies with the Benin national guidelines for the development of Adaptation projects resulting from the workshop organized by the national Fund for Environment, in Cotonou, on 04 and 05 October 2011.

As far as the evaluation of the cost of the works for development and cleaning up lagoon banks is concerned, the standards used concern essentially the definition of tasks, the reference price index for the use of the Public Administration (fourth version) published by the Ministry of Economy and Finance in January 2011, and prices on the market.

During the implementation of the project, the physical interventions on the ground shall comply with the national and sub regional standards in the field. In particular, the construction of infrastructures shall be submitted to environmental impact assessments recommended by Law n° 98-030 dated February 12, 1999 related to the Framework Law on environment in the Republic of Benin. Suppliers and operators in charge of any work shall apply the norm-creating and technical specification provisions validated by the Benin Centre for standardization and Quality Management (CEBENOR) established by decree N°97-520 dated October 17, 1997.

*F. Describe if there is duplication of project / programme with other funding sources, if any.*

The City Council of Cotonou and the Ministry of Environment, Housing and Urban Planning have been seeking funding for this project for more than five years.

The Emergency Project for Environmental Management in Urban Areas (PUGEMU) whose funding was approved by the Board of Directors of the World Bank on 26 April 2011 included the treatment of waste waters of Cotonou before they are discharged into the lagoon through urban drains. That is why costs relating to those actions are not borne by this project. PUGEMU was initiated by the government of Benin subsequent to the catastrophic floods which affected more than 680,000 people and caused 46 casualties in the country in 2010. The more affected regions included the coastal districts where more than 50,000 houses were destroyed, and 150,000 people were made homeless and 278 schools were flooded.

Likewise, the problem of loss of sand at the mouth of the lagoon of Cotonou should also be solved through the project to rehabilitate the rock groin of Sifato and to construct 7 new rock groins east of Sifato; the works were launched on July 6, 2009 and are expected to complete in 2012. Those works are not included in the activities of this project. It is rather envisaged the rehabilitation of the sluice dam of Cotonou to better manage the consequences of the new configuration of the river mouth.

Lastly, the project for the “Protection of the Urban Community of Grand Cotonou from Climate Change” (PCUG3C) was set up through a partnership agreement between the City Council of Cotonou and the Non-Governmental Organization “Research and Expertise Centre for Local Development” (CREDEL). This project, funded by the Research Centre for International Development (CRDI) and the Department for International Development (DFID) of the United Kingdom through the ACCA (Adaptation to Climate Change in Africa) program, is implemented in the 1<sup>st</sup>, 3<sup>rd</sup>, 6<sup>th</sup>, 9<sup>th</sup>, 12<sup>th</sup>, and 13<sup>th</sup> arrondissements of Cotonou. Relevant activities of this project will be implemented until 2012 in the 3<sup>rd</sup> and the 13<sup>th</sup> arrondissements located on the bank of the lagoon of Cotonou and will include:

- to identify and evaluate endogenous strategies to adapt and fight against floods and climate change and to share them within the platform;
- to identify and evaluate institutional measures to fight against floods and to make proposals for their integration;
- to develop and/or consolidate local strategies through endogenous experiences and research achievements;
- to disseminate lessons and achievements related to the implementation of strategies through various channels to populations of various arrondissements and local and national decision-makers.

The PCUG3C project was launched by the Mayor of Cotonou on 1<sup>st</sup> March 2010. The consultations held with stakeholders as part of the preparation of this project document helped to harness the partial social results obtained by the PCUG3C project to identify the technical interventions proposed.

*G. If applicable, describe the learning and knowledge management component to capture and disseminate lessons learned.*

The project includes a learning and knowledge management component.

After launching the project, training and sensitization activities for local communities, local authorities and the public will be organized in order to set stakeholders for the establishment of a promoting environment and the implementation of all the components.

Local authorities, city councilors and heads of riparian districts of the channel will be trained on the themes of climate change, the adaptation techniques to climate change and best practices. That training will be attended by local chiefs, community intellectuals of districts, NGOs and media houses (printed media and broadcasting industry). The training will be led by national or international experts and consultants. Local authorities and community intellectuals of districts will be tasked with reporting the lessons learnt to the grassroots communities they come from, with the assistance of national or international experts. The personalities attending the training will also oversee sensitization sessions for the general public through relevant channels (local radio stations, conferences, etc.), under the patronage of local authorities.

During project implementation, students and researchers from technical and vocational training schools, national universities, research centers and private universities will have the opportunity to prepare their end-of-study dissertations or theses in the areas of urban and lagoon environment, sustainable management of natural resources, adaptation of livelihoods to the current variability of climates and to extreme weather phenomena and climate change. Experiences acquired, lessons learnt and the best practices developed will be stored on hard copies and on films (photos, movies, radio and TV broadcast, etc.) and made available to the public through site visits, exchange of visits, conferences for schools, universities and the general public, and through scientific presentations during colloquia and conferences at the national or global level. All the items relating to costs, expenses and income will be capitalized and aggregated based on adaptation components and options; extreme weather phenomena, their impacts and the costs of responses will be recognized.

At the end of the project, an end-of-project conference will be held to share results with professionals and the international scientific community both on organizational and environmental results and on the issue of adaptation costs on which little information is available globally. The results will be made available to universities, research centers and institutions involved in the management of marine and lagoon ecosystems and in the issue of sustainable development for their re-use.

During the execution of this project, apart from the activities of sensitization and training of direct recipients, the acquired knowledge will be capitalized through students studies completion dissertations and thesis defences works. At the end of the project, the acquired knowledge will be subject to a reporting at the local, national and international level under the appropriated forms (radio and television broadcasting programs, field visits, workshops and conferences).

The component 5 devoted to the training will be completed by the issue of capitalisation, with mentioning of the seminar of end of project planned in table 3.3. (Monitoring and Evaluation Plan (S&E))

*H. Describe the consultative process, including the list of stakeholders consulted, undertaken during project preparation.*

The General Directorate of Environment under the supervision of the Ministry of Environment, Housing and Urban Planning, and the Department for Land Affairs of the City Hall of Cotonou are jointly responsible for the technical implementation of the project in partnership with non-governmental organizations, local bodies of districts located on the bank of the lagoon, and fisheries exploitation and exportation enterprises based in those districts. All the stakeholders are involved in the development of the project, from the grassroots to the summit:

- ✓ heads of districts located on the bank of the lagoon of Cotonou;
- ✓ managers of development associations in riparian districts;
- ✓ managers of fisheries exploitation and exportation enterprises based in the districts;
- ✓ NGOs dealing in environment protection and the sustainable management of natural resources (Research and Expertise Centre for Local Development (CREDEL), Association of Female Scrap Dealers of Dantokpa Market (AFRMD), Association of Truck Farmers of Houéyiho (AMH), Coordination of Waste Management and Sanitation NGOs (COGEDA) which gathers 54 NGOs, etc.);
- ✓ heads of riparian arrondissements: 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup>, and 6<sup>th</sup> arrondissements;
- ✓ authorities of Cotonou City Hall;
- ✓ managers of national technical institutions involved in the issue of sustainable development (General Directorate of Environment, General Directorate of Forests and Natural Resources, Beninese Agency for Environment, University of Abomey-Calavi, University of Parakou, private university centers, Fish and Ocean Research Center of Benin, etc.);
- ✓ the Ministry of Environment, Housing and Urban Planning, the Ministry of Agriculture, Animal Husbandry and Fisheries, and the Ministry of Energy, Oil and Mining Research, Water and the Development of Renewable Energies, the Ministry of the Youth, Sports and Leisure, the Ministry in charge of Maritime Economy and Port Facilities, the Ministry of Communication and Information and Communication Technologies, the Ministry of Culture, Literacy, Handicraft and Tourism;
- ✓ the National Assembly;

The consultation approach used is different depending on each stakeholder.

For economic stakeholders (hoteliers, restaurant owners, fisheries exploitation and exportation enterprises, etc.), and communities suffering directly the harmful effects of

climate variability and extreme weather phenomena, the consultation approach is based on the concerted evaluation of vulnerability; such evaluation is held on the workplace or the meeting room of heads of riparian districts. Those sessions helped to reach consensus on the ultimate purpose and the operational approaches of the project.

Stakeholders providing support or institutional stakeholders are required to play important roles in the implementation of the project in terms of control, monitoring, evaluation, enhancement and reuse of results. The consultation approach used with them is that of free discussions on the national interest and the objectives of the project, the intervention mode of stakeholders and the specific role of each group of stakeholders. Representatives of government and parliament authorities are sensitized on the conducive conditions to establish through laws and/or regulations in order to preserve the sustainability and ecological functions of lagoon ecosystems threatened both by man-made actions and the increase of sea level and extreme weather phenomena.

**I. Provide justification for funding requested, focusing on the full cost of adaptation reasoning.**

Benin is one of the 48 least developed countries (LDCs) in the world. Its development index of 0.427 ranks it 167 out of 187 countries evaluated (UNDP, 2011). Considering that rank, the country's own resources do not enable it to cope with the climatic events suffered by the populations and to provide them with the physical and biological resources they depend on. That is the case of 30% of the population of Cotonou stacked all along the 4.50 line kilometers of a 300-meter wide lagoon. That is also the case, in a lesser extent, of 100,000 traders and craftsmen who spend their days in the international market of Cotonou, on the unhealthy banks of the lagoon where they receive 500,000 clients coming from the other districts of Cotonou, all the regions of Benin and neighboring countries. The continued deterioration of lagoon environment compromises not only the business and health of part of the population with no alternative solutions, but also the sustainability of the lagoon ecosystem exposed to the unceasing rise and fall of the sea and the river, which is incompatible with the physical equilibrium of water body and harmful to the biology of migratory species and the profitability of human business; this situation is worsened by the rise of sea level and extreme weather phenomena.

The Fund for Adaptation is an opportunity to rescue those natural and human systems from the harmful effects of climate change against which the concerned populations cannot develop in an autonomous way adaptation strategies up to the needs.



## PART III: IMPLEMENTATION ARRANGEMENTS

### A. Describe the arrangements for project / programme implementation.

Four districts (Arrondissements) of the city of Cotonou are located on the banks of the lagoon of Cotonou; they include the 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> arrondissements. An Arrondissement is a subdivision of the Commune of Cotonou administered by a council of arrondissement chaired by a deputy mayor who bears the title of Head of Arrondissement. The Head of Arrondissement is appointed by the Municipal Council among municipal councilors elected on the list of the concerned arrondissement. The council of arrondissement is made up of all the heads of area, each head of area having been chosen by their area council and appointed by the Mayor of Cotonou. Thus, the 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> arrondissements are the democratic territorial and social entities which are the most directly affected by the problems of the lagoon of Cotonou. The councils of arrondissement in charge of administering the arrondissements under the responsibility of the mayor are the authentic representatives of grassroots communities faced with problems related to the deterioration of the lagoon and its environment.

This project will be implemented on the ground by four horizontal entities: they include the arrondissement councils of the 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> arrondissements, which encompass for each arrondissement one representative of the Area Development Committee, one representative of the association of women of the arrondissement, one representative of the association of the youth of the arrondissement, one representative of NGOs dealing in environment on the territory of the arrondissement, one representative of fisheries exploitation and/or exportation enterprises running their business in the arrondissement, one representative of the Land and Environmental Affairs Unit of the City Hall of Cotonou, one representative of the Regional Directorate of Environment, Housing and Urban Planning of Atlantique/Littoral region, one representative of the General Directorate of Environment. The Councils of Arrondissement with such make-up will be tasked with the implementation and the monitoring of the development works on their respective sections of lagoon bank. A permanent consultation framework between the chairpersons of Councils of Arrondissement will help to harmonize views and find out relevant solutions to common problems.

The national implementation body (National Environment Fund) will enter into a management agreement with the General Directorate for Environment (DGE). DGE will have a coordination team composed of a Coordinator appointed by the Director General of Environment, a Deputy Coordinator appointed by the Mayor of Cotonou, a monitoring and evaluation officer and an administrative assistant. The Coordinator will be accountable to the Director General of Environment who is his direct line supervisor.

At the national level, it will be set up a Steering Committee whose chairperson will be the representative of the Minister of Environment and whose vice-chair will be the representative of the Mayor of Cotonou. The Steering Committee will include such members as the General Directorate of Environment, the National Environment Fund, the Directorates in charge of Lands and Environment and technical units of the City Hall of Cotonou, the Beninese Agency for Environment, the Directorate for Fisheries, the General Directorate of Water, the Directorates in charge of Housing and/or Urban Planning, the Directorate in charge of Public Works, a representative of the universities of Benin, a representative of the Beninese Center for Scientific and Technical Research and the Chairpersons of Councils of Arrondissements from the 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> arrondissements, the Focal Point for Climate Change, the Coordinator and the Deputy Coordinator of the project.

A Technical Committee will be tasked with developing the terms of reference of the different activities of the project, and evaluating and ensuring the quality of technical proposals from service providing enterprises and NGOs, and preparing the meetings of the Steering Committee. The Technical Committee will be made up of the Chairpersons of Councils of Arrondissements from the 3<sup>rd</sup>, 4<sup>th</sup>, 5<sup>th</sup> and 5<sup>th</sup> arrondissements, the Directorates in charge of Lands and Environment and technical units of the City Hall of Cotonou, the General Directorate of Environment, the Directorates in charge of Housing and Urban Planning, the Directorate in charge of Public Works, a representative of the universities of Benin, the Directorate for Fisheries, the Fish and Ocean Research Center of Benin, the Directorate in charge of port facilities, a representative of the Benin Navy, a representative of the Directorate in charge of Public Security, a representative of the Chamber of Commerce and Industry of Benin (CCIB), the Directorate for Sanitation, the Directorate for Pollution Prevention and Environmental Risk Management (DPPGRE), the Directorate in charge of Legislation, the Focal Point for Climate Change, the Directorates in charge of Handicraft and Tourism, the Monitoring and Evaluation Officer, the Coordinator and the Deputy Coordinator of the project.

All the implementation contracts will be signed by the Director General of Environment.

The coordination team of the project will be hired through call for applications based on the competences required for each technical, administrative or accounting position (Coordinator, Deputy Coordinator, Monitoring and Evaluation Officer, Administrative Assistant and Accountant).

All the administrative or accounting operations will comply with the provisions of the manual of procedure which will be developed and validated by the Steering Committee upon a proposal by the national implementation body. The compliance with technical, administrative and accounting standards must be absolute during the implementation of the project.

The duties of the main stakeholders are shown in Table 3.1.

**B. Describe the measures for financial and project / programme risk management.**

The National Environment Fund (FNE) could open a special bank account in which advance payments received from the Fund for Adaptation will be deposited. This measure will ensure the transparency of the accounting management system at the level of the national implementation body. Similarly, each implementation body will be required to open a bank account in order to safeguard payments and make the accounting system reliable. Periodic financial reports submitted to the Board of the Fund for Adaptation will testify to the strength of the management system.

Project risks could stem from unexpected events, situations or abnormalities which may arise during the implementation period of the project. Directions will be given to all the stakeholders for the immediate conveyance of the information to the coordination team, the Director General of Environment (DGE) and the National Environment Fund (FNE). If satisfactory responses can be identified and applied to settle the risk, it is proper nevertheless to notify it to project managers. When the risks are important, they should be handled by FNE and the Steering Committee (CP).

The Board of the Fund for Adaptation will be referred to for all the risks and solutions applied.

Anyway, a list of risks experienced (financial risks and project risks) and solutions provided will be drawn up and maintained by the coordination team. This list will included in the results of the project and will be capitalized and used in the same way as the regularly expected results.

**Table 3.1 Duties of the main stakeholders of the project**

Components	Activities	Responsible Organizations	Contractors
	<b>Activity 1.1:</b> To protect sandy areas on river banks with rock apron	DGE	Public Works Enterprises
	<b>Activity 1.2:</b> To build pedestrian walkways along river banks	City Hall of Cotonou	Public Works Enterprises and NGOs
	<b>Activity 1.3:</b> To build on the two river banks, on appropriate sites, landing stages for users and economic and tourist activities (fishing, transport, nautical sports, promenades in canoe and small boat, etc.)		Public Works

1. Protection of river banks, rehabilitation and improvement of socio-community infrastructures	<b>Activity 1.4:</b> To build control sheds with terraces in concrete on various areas along the river bank, with the same style as those built opposite Dantokpa market	City Hall of Cotonou Councils of Arrondissements	Enterprises
2. Fighting pollution on the lagoon and the living environment	<b>Activity 2.1:</b> To build capacities for heads of areas and SOGEMA for them to be able to reduce the dumping of household refuse on the floor	DGE City Hall of Cotonou	NGOs
	<b>Activity 2.2:</b> To build capacities for non-biodegradable waste collection and reclamation by the Association of Female Scrap Dealers of Dantokpa Market (AFRMD)		NGOs
	<b>Activity 2.3:</b> To build capacities for biodegradable waste reclamation by the Association of Truck Farmers of Houéyiho		NGOs
	<b>Activity 2.4:</b> To destroy floating latrines and replace them with improved public latrines with no contact with the channel		NGOs Directorate of Sanitation
	<b>Activity 2.5:</b> To treat waste from the rainwater drains of the city of Cotonou before their discharge into the channel		PM
	<b>Activity 2.6:</b> To sensitize populations against the transport of fuel by rivers and lagoons, and to support the Navy Unit stationed at the entrance of the channel to scale-up the fight		NGOs Directorate of Sanitation
	<b>Activity 2.7:</b> To sensitize and train dyers on the best practices for the management of wastewaters containing heavy metals		NGOs
3. Fighting seasonal floods on the river banks and in districts located on the banks of the lagoon of Cotonou	<b>Activity 3.1:</b> To rehabilitate the dam of Cotonou	Directorate of Port Facilities	Public Works Enterprises
	<b>Activity 3.2:</b> To sensitize businessmen on the promotion of floating pubs and restaurants with pedestrian bridges for access, nautical sports, promenades in canoes and small boats, and water gardens	Tourism Directorate CCIB	NGOs
4. Integration of climate change in legal provisions governing fishing in the channel	<b>Activity 4.1:</b> To support the integration of constraints related to climate change and adaptation strategies into legal provisions governing fishing	DGE Directorate of Fisheries	Directorate of Legislation NGOs
	<b>Activity 4.2:</b> To support fishermen targeted by the regulations for their reconversion in new business set up thanks to the development of the channel of Cotonou	City Hall of Cotonou	NGOs
5. Sensitization and training of local communities on climate risks, adaptation techniques and the best	<b>Activity 5.1:</b> To sensitize/to train local authorities, councilors and riparian heads of areas on best practices and climate change adaptation techniques	DGE	NGOs
	<b>Activity 5.2:</b> To sensitize communities residing on the banks of the lagoon of Cotonou on best practices and		

practices	climate change adaptation techniques	DGE	NGOs
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**Table 3.2 Potential project risks and risk reduction strategies**

Risks	Level of impact	Probability of occurrence	Reduction strategies
Change of the national strategy relating to climate change subsequent to Beninese cabinet reshuffle which removed responsible stakeholders	Low	Low	The components of sensitization of the project could be activated for new government officials on the basis of international commitments and the relevant documents already adopted by the Beninese government and parliament
Low effectiveness of the alleviation of the non-climatic factors of the deterioration of ecosystems: wastewater-caused pollution, solid waste, oil products, etc.	Average	Low	The increased accountability of nuisance offenders and local monitoring committees through sensitization, training pedagogy and the mobilization of umbrella organizations (associations, development committee, etc.) should contribute to limit that risk.
Lack of synergy between the implementation bodies on the ground	Average	Low	The strengthening of the consultation framework between heads of arrondissements and chairpersons of extended councils of arrondissements will help to boost the synergy.
High reliance of the project on subcontracting	Low	Low	The project will use quality control to check services provided and providers should accept this. Intermediate evaluations will be organized for that purpose.
Poorly designed budget estimates, under-evaluation or over-evaluation of allowances for some budget lines	Average	Average	Transfers of credits between budget lines and the exploitation of "miscellaneous" items up to 5% integrated in the budget of components <sup>1</sup> will induce the flexibility needed for the smooth performance of the project.

*C. Describe the monitoring and evaluation arrangements and provide a budgeted M&E plan.*

Monitoring and evaluation for the implementation of the project will be carried out in two ways: through classical evaluations appropriate for all projects and whose results are destined in priority to technical and financial partners and decision-makers, and through participatory methods involving the beneficiary populations of the project.

<sup>1</sup> The sub-items of the budget which include "miscellaneous" items will be developed during the drafting of the project document.

The project coordination team will prepare annual technical and financial reports to be submitted to the Steering Committee and the Board of the Fund for Adaptation, based on the expected results and indicators. The sensitization of populations on adequate behaviors and best practices in the area of the non-consumptive utilization of ecosystems and the human livelihoods of the lagoon environment should be based on the results of diagnosis and evaluation acquired on the ground, in order to establish the motivation of stakeholders over a time step inferior to the year. That is why the monitoring and evaluation plan can be defined as follows:

- The project team will ensure daily monitoring by referring to the provisions of the annual work plan and specific indicators;
- The extended councils of arrondissements will gather every month to evaluate the progress of works on the ground, to visit sites and to identify the community supports necessary to the progress of works;
- The permanent consultation framework of heads of arrondissements will ensure the daily watch and monitoring of works on the ground and will report discrepancies and problems identified to the General Directorate of Environment and the City Hall of Cotonou;
- The Technical Committee will meet every quarter to appreciate the progress of schedules works and to identify intermediate achievements that can be harnessed for sensitization of local populations, with site visits;
- The Steering Committee will gather once in a year to approve progress reports and financial reports and to endorse work plans and draft budgets;
- Two external independent evaluations will be organized:
  - Mid-course evaluation;
  - Final evaluation three months prior to the end of the project, targeting particularly sustainability and the impact of results.

**Table 3.3 Monitoring and Evaluation (M&E) Plan**

M&E Activities	Persons in charge	Costs (US\$) <sup>2</sup>	Periods
Startup workshop	Coordinator FNE	4,000	Within the first three months after the signing of the management agreement
Workshop to define methodology and to examine indicators with beneficiaries	Coordinator Monitoring officer	5,000	Within two months after the startup workshop
Session of the Steering Committee	Project team	10,000	Within three months after the startup workshop, then

<sup>2</sup> Not included the project personnel time and coordination needs

			once in a year
Meeting of the Technical Committee	Coordinator	20,000	Quarterly
Meeting of extended councils of arrondissements	Coordinator	40,000	Monthly
Consultation of heads of arrondissements	Coordinator	5,000	Permanent
Development of annual work plans and budgets and technical and financial reports	Project team	0	Annual
Development of quarterly evaluation reports	Project team	0	Quarterly
Mid-course evaluation	FNE Project team Consultants	35,000	Mid-course
Audit	FNE Consultant	20,000	Annual
End-of-project seminar	FNE Project team	20,000	Before final evaluation
Final evaluation	FNE Project team Consultants	45,000	Three months before the end of the project
TOTAL		204,000	

Project coordination expenses (wages of the personnel, trips, office equipment and supplies, training, etc) are estimated at US Dollars 280,000. They will be itemized during the drafting of the project document, together with specific budget codes of the Fund for Adaptation.

Therefore, total coordination expenses and monitoring and evaluation expenses would amount to US Dollars 484,000, i.e. 6.14% of the costs of operational activities.

*D. Include a results framework for the project proposal, including milestones, targets and indicators.*

**Table 3.4 Logical Framework of the Project**

Results	Indicators	Baseline situations	Targeted objectives	Sources of verification	Risks and assumptions
<p><b>Result 1:</b> Eight (8) kilometers of the banks of the lagoon of Cotonou are stabilized with 4.5 kilometers of rock apron, 3 kilometers of paved pedestrian walkways, with twenty (20) landing stages and twenty (20) control sheds with terraces in concrete for the promotion of the sensitization of populations on the adaptation to climate change</p>	<p><b>Indicator 1.1:</b> The length of lagoon banks whose rock apron has remained stable six (6) months after the works</p>	<p>Sandy areas of lagoon banks are eroded by the rise and fall of sea and salty water</p>	<p>Protect sandy areas of lagoon banks with rock apron</p>	<p>Quarterly evaluation reports  Implementation and delivery reports</p>	<p>The laying of the rock apron may disturb the interests of some riparian dwellers who use the lagoon sand.</p>
	<p><b>Indicator 1.2:</b> The length of lagoon banks whose paved road has remained stable six (6) months after the end of works</p>	<p>Riparian dwellers dump garbage on the lagoon banks to get stable terrain over the water body.</p>	<p>Build pedestrian walkways along the lagoon banks</p>	<p>Quarterly evaluation reports  Implementation and delivery reports</p>	<p>The physical configuration of the lagoon banks may constrain the regularity or the continuity of the paved road.</p>
	<p><b>Indicator 1.3:</b> Number of fully operational landing stages six (6) months after their construction</p>	<p>A few landing stages are available but their number does not meet the needs</p>	<p>Build landing stages on the banks for users and economic and tourist activities (fishing, transport, nautical sports, etc.)</p>	<p>Quarterly evaluation reports  Implementation and delivery reports</p>	<p>The consultation framework of heads of arrondissements should facilitate the harmony of works on the two lagoon banks.</p>
	<p><b>Indicator 1.4:</b> Number of operational sheds six (6) months after their construction  Number of new sheds built by private entrepreneurs 12 months later</p>	<p>The sheds with terraces in concrete built in front of Dantokpa market are models which suit the lagoon banks.</p>	<p>Build control sheds with terraces in concrete along the lagoon banks using the same style as those already built in front of Dantokpa market</p>	<p>Quarterly evaluation reports  Implementation and delivery reports</p>	<p>Steps should be taken to avoid the occupancy of terraces by oil products traffickers.</p>
<p><b>Result 2:</b> Two hundreds (200) mobile garbage cans are installed in the riparian districts and in the markets of Dantokpa and Gbogbanou, two hundreds (200) aluminum</p>	<p><b>Indicator 2.1:</b> Number of mobile garbage cans still operational 18 months after their installation</p>	<p>A few mobile garbage cans are already in use in Dantokpa market.</p>	<p>Build the capacities of heads of areas and SOGEMA to reduce the dumping of household refuse on the floor</p>	<p>Delivery reports  Quarterly evaluation reports  Field trips</p>	<p>The use of mobile garbage cans should not raise any particular problems.</p>
	<p><b>Indicator 2.2:</b> Increase rate of the business of the Association of Female Scrap Dealers of Dantokpa market</p>	<p>The Association of Female Scrap Dealers of Dantokpa market (AFRMD) used to get material support from OXFAN QUEBEC as part of a project already completed.</p>	<p>Build capacities for the collection and reclamation of non-biodegradable waste by the Association of Female Scrap Dealers of Dantokpa market</p>	<p>Delivery reports  Quarterly evaluation reports  Field trips</p>	<p>The absorption capacity of the commercial partners of AFRMD may limit the rate of increase of the volume of women's business.</p>
	<p><b>Indicator 2.3:</b> Increase rate of the volume of compost</p>	<p>The truck farmers of Houéyiho are good at making</p>	<p>Build capacities for the reclamation of biodegradable</p>	<p>Delivery reports  Quarterly</p>	<p>The distribution mode of composting tasks</p>



containers and two hundreds (200) baskets are provided to the Association of Female Scrap Dealers of Dantokpa market, two hundreds pieces of small equipment for the composting of biodegradable waste are provided to the Association of Truck Farmers of Houéyiho, sixteen (16) improved latrines with no contact with the channel water are built on the lagoon banks, the nighttime intervention capacities of the Navy Units stationed at the entrance of the channel of Cotonou are built, and sensitization campaigns for dyers and oil products traffickers are organized	made the Association of Truck farmers of Houéyiho (AMH) 12 months after the material support	compost for their own needs and those of the market but they are limited by material means.	waste by the Association of Truck farmers of Houéyiho	evaluation reports  Field trips	involving actors in turn should not hinder market garden production.
	<b>Indicator 2.4:</b> Number of operational latrines 12 months after their construction	Populations badly need latrines in Dantokpa market and in districts located on the banks of the lagoon of Cotonou.	Destroy floating latrines and replace them with improved public latrines with no contact with the channel	Implementation and delivery reports  Quarterly evaluation reports  Field trips	Local authorities and Dantokpa market managers should use qualified personnel to manage the latrines.
	<b>Indicator 2.5:</b> This aspect is included in the Emergency Project for Environmental Management in Urban Areas funded by the World Bank	The wastes of the city of Cotonou are discharged into the lagoon of Cotonou without any anti-pollution treatment.	Treat urban wastes of rainwater drains of the city of Cotonou before they are discharged into the channel	Field trips	The City Hall of Cotonou should ensure the effective implementation of this item by the Emergency Project for Environmental Management in Urban Areas.
	<b>Indicator 2.6.1:</b> Rate of decrease of the illegal deposit of oil products in riparian districts, 6 months and 12 months after the beginning of the sensitization campaign	Oil products transported by night on the lagoon with thousands of 50-liter jerry cans are often discharged accidentally into the lagoon.	Sensitize populations against the transport of oil products by river and lagoon and provide support to the Navy units stationed at the entrance of the channel to scale-up the fight	Quarterly evaluation reports  Field trips	The orientation of traffickers to the new business opportunities yielded by the development of the lagoon banks could help decrease the number of illegal deposits.
	<b>Indicator 2.6.2:</b> Increase rate of nighttime missions of Navy units 6 months after the support is provided	Navy Units are stationed at the entrance of the lagoon of Cotonou and monitor traffic between Nokoué lake and the lagoon.		Delivery reports  Quarterly evaluation reports  Field trips	Preliminary population sensitization activities will increase the effectiveness of the deterrence role of the Navy Units.
	<b>Indicator 2.7:</b> Percentage of dyers who have adopted the best practices for the management of wastewaters 6 months after the training	Wastewaters from dye-works contain ions of heavy metals.	Sensitize and train dyers on the best practices for the management of wastewaters	Training reports;  Quarterly evaluation reports  Field trips	The unhealthy environment in which dyers work can be a source of discouragement.
	<b>Indicator 3.1:</b> Hydrologic behavior of the lagoon mouth 12 months after the works	The height and the control system of the dam of Cotonou are not in compliance with the initial specifications.	Rehabilitate the dam of Cotonou	Works reports  Quarterly evaluation reports	The results of the rehabilitation project of the rock groin of Siafato and the construction of 7 new groins might not meet expectations.
<b>Result 3:</b> The dam					

of Cotonou is resized to limit the risks of obstruction of the lagoon mouth and five (5) businessmen engage into the tourist promotion of the lagoon.	<b>Indicator 3.2:</b> Number of entrepreneurship on the lagoon initiated 6 months after the beginning of the sensitization campaign	The current unhealthiness of the banks of the lagoon of Cotonou hinders tourist activities.	Sensitize entrepreneurs for the promotion of floating pubs and restaurants with pedestrian bridge for access, nautical sports, promenades in canoes, etc.	Workshop reports  Quarterly evaluation reports  Field trips	The interest of economic and tourist operators in the developed lagoon will depend on the quality of the stabilization and sanitation works on the lagoon banks.
<b>Result 4:</b> Constraints related to climate change and adaptation strategies are enshrined in regulations governing fishing activities on the channel of Cotonou and thirty (30) former fishermen have given up fishing and engaged into new business yielded by the development of the channel.	<b>Indicator 4.1:</b> Reduction rate of offences recorded by Navy Units, the Environmental Police and the National Police 6 months after the sensitization of fishermen on the basis of new laws	The laws in force forbid fishing activities in the lagoon. Fishermen are opposed to such legal provisions which are not complied with.	Support the integration of constraints related to climate change and adaptation strategies in regulations governing fishing	Workshop reports  Quarterly evaluation reports  Field trips	Professional associations of fishermen should participate in analyses and discussions leading to the passing of regulations to support compliance by members of such associations.
	<b>Indicator 4.2:</b> Number of fishermen who turn to the new business opportunities three months after sensitization activities	Tourist and recreational activities are almost absent on the lagoon of Cotonou.	Support fishermen affected by the regulations for their reconversion in the new business opportunities generated by the development of the channel of Cotonou	Workshop reports  Quarterly evaluation reports	The progress and quality of development works the lagoon banks will be critical in the choice by fishermen.
	<b>Indicator 4.3:</b> Number of fishermen who have kept carrying out the new businesses six (6) months after they got the support	Genuine alternatives are not proposed to fishermen.		Workshop reports  Quarterly evaluation reports  Field trips	The working conditions and the level of income will determine the behavior of these stakeholders.
<b>Result 5:</b> The authorities of the Commune of Cotonou, arrondissements and areas located on the banks of the channel and grassroots communities become aware of the adaptation capacities of ecosystems and human livelihoods, and develop initiatives as regards adaptation measures	<b>Indicator 5.1:</b> Percentage of local authorities who have initiated an adaptation strategy to handle the major climate risks of the coastal area one year after the sessions	Local authorities have some idea of climate change and its harmful impacts	Sensitize/to train local authorities, councilors and riparian heads of areas on best practices and climate change adaptation techniques	Workshop reports  Quarterly evaluation reports  Field trips	Local authorities show a great interest for climate change as an important theme for the mobilization of populations.
	<b>Indicator 5.2:</b> Number of community members who have developed at least one measure of adaptation to major climate risks, one year after the sessions	Daily life problems do not allow members of the grassroots to develop prospects on climate change.	Sensitize communities residing on the banks of the lagoon of Cotonou on best practices and climate change adaptation techniques	Workshop reports  Quarterly evaluation reports  Field trips	The impact of the sensitization of populations by local authorities will depend on the progress and quality of lagoon banks development works and the hope of a better life.

**Table 3.5 Schedule of Activities**

Activities	Schedule											
	Year 1			Year 2			Year 3			Year 4		
<b>Activity 1.1:</b> To protect sandy areas on river banks with rock apron												
<b>Activity 1.2:</b> To build pedestrian walkways along river banks												
<b>Activity 1.3:</b> To build on the two river banks, on appropriate sites, landing stages for users and economic and tourist activities (fishing, transport, nautical sports, promenades in canoe and small boat, etc.)												
<b>Activity 1.4:</b> To build control sheds with terraces in concrete on various areas along the river bank, with the same style as those built opposite Dantokpa market												
<b>Activity 2.1:</b> To build capacities for heads of areas and SOGEMA for them to be able to reduce the dumping of household refuse on the floor												
<b>Activity 2.2:</b> To build capacities for non-biodegradable waste collection and reclamation by the Association of Female Scrap Dealers of Dantokpa Market (AFRMD)												
<b>Activity 2.3:</b> To build capacities for biodegradable waste reclamation by the Association of Truck Farmers of Houéyiho												
<b>Activity 2.4:</b> To destroy floating latrines and replace them with improved public latrines with no contact with the channel												
<b>Activity 2.5:</b> To treat waste from the rainwater drains of the city of Cotonou before their discharge into the channel	Activities of the Emergency Project for Environmental Management in Urban Areas (PUGEMU) funded by the World Bank											
<b>Activity 2.6:</b> To sensitize populations against the transport of fuel by rivers and lagoons, and to support the Navy Unit stationed at the entrance of the channel to scale-up the fight												
<b>Activity 2.7:</b> To sensitize and train dyers on the best practices for the management of wastewaters containing heavy metals												
<b>Activity 3.1:</b> To rehabilitate the dam of Cotonou												
<b>Activity 3.2:</b> To sensitize businessmen on the promotion of floating pubs and restaurants with pedestrian bridges for access, nautical sports, promenades in canoes and small boats, and water gardens												
<b>Activity 4.1:</b> To support the integration of constraints related to climate change and adaptation strategies into legal provisions governing fishing												
<b>Activity 4.2:</b> To support fishermen targeted by the regulations for their reconversion in new business set up thanks to the development of the												



**■ PART IV: ENDORSEMENT BY GOVERNMENT AND CERTIFICATION BY THE IMPLEMENTING ENTITY**

**A. RECORD OF ENDORSEMENT ON BEHALF OF THE GOVERNMENT<sup>3</sup>** *Provide the name and position of the government official and indicate date of endorsement. If this is a regional project/programme, list the endorsing officials all the participating countries. The endorsement letter(s) should be attached as an annex to the project/programme proposal. Please attach the endorsement letter(s) with this template; add as many participating governments if a regional project/programme:*

<i>(Enter Name, Position, Ministry)</i>	<i>Date: (Month, day, year)</i>
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**B. IMPLEMENTING ENTITY CERTIFICATION** *Provide the name and signature of the Implementing Entity Coordinator and the date of signature. Provide also the project/programme contact person’s name, telephone number and email address*

<p>I certify that this proposal has been prepared in accordance with guidelines provided by the Adaptation Fund Board, and prevailing National Development and Adaptation Plans (.....list here.....) and subject to the approval by the Adaptation Fund Board, understands that the Implementing Entity will be fully (legally and financially) responsible for the implementation of this project/programme.</p>	
<p><i>Name &amp; Signature</i> Implementing Entity Coordinator</p>	
<i>Date: (Month, Day, Year)</i>	<i>Tel. and email:</i>

<sup>6</sup>. Each Party shall designate and communicate to the Secretariat the authority that will endorse on behalf of the national government the projects and programmes proposed by the implementing entities.

Project Contact Person:
Tel. And Email:

## BIBLIOGRAPHY

- Ayadokoun A. (1992). Impacts de l'utilisation des pesticides organochlorés et du trafic de produits pétroliers sur l'environnement côtier au Bénin : exemple de la lagune de Cotonou. Mémoire de Maîtrise. 52 p.
- Azokpota E. (2005) Impacts de l'utilisation des colorants sur la qualité des milieux aquatiques à Cotonou : Cas de la teinture artisanale des textiles. Mémoire de DESS/MEQUE/FAST/UNB. 82p
- Badahoui A., Fiogbé E.D. et Boko M. (2009). Les causes de la dégradation du chenal de Cotonou. *Int. J. Biol. Chem. Sci.* 3(5): 979-997.
- Baglo, A. M. (1980). Les conséquences géographiques de la construction du barrage de Cotonou sur la zone lagunaire du sud-est béninois. Mémoire de maîtrise en géographie, Université Nationale du Bénin.
- Bonou C, Adisso P. (2002). Evaluation de la pollution organique et bactériologique due aux excréta, aux eaux usées et aux déchets solides dans la lagune de Cotonou. CPU/UAC 2002, 66 p.
- Bourgoignie G. 1972. *Les Hommes de l'Eau, Ethno-écologie du Dahomey Lacustre*. Editions Universitaires ; 391 p.
- Colleuil B. (1984) Un modèle d'environnement lagunaire soumis aux conditions de climat équatorial tempéré : le lac Nokoué (République Populaire du Bénin). Thèse, Université de Bordeaux I. 135 p.
- Dégbé C.G.E. (2009). Géomorphologie et érosion côtière dans le golfe de Guinée. Mémoire de Master of Sciences en Océanographie Physique, Chaire Internationale en Physique Mathématique et Applications, Faculté des Sciences et Techniques, Université d'Abomey-Calavi. 98 p.
- Dovonou E.F. (2008). La pollution des plans d'eau au Bénin. Mémoire de DEA en Environnement, Santé et Développement. Université d'Abomey-calavi ( Bénin). 70 p.
- Hubert H. (1908) Etudes scientifiques du Dahomey. Larose Paris 500 p.
- Lawani L. B. (2007). Etude de la pollution des eaux, des sédiments et des crevettes du lac Nokoué par les métaux (Pb, Cd, Cu, Zn, Fe) au Bénin. Mémoire de DESS. 70 p.
- Leite E.C. 2002. Incidences de la dynamique des interventions humaines sur les écosystèmes naturels : le cas du complexe lac Nokoué - lagune de Porto-Novo au Bénin. *Dire (La Revue des Cycles Supérieurs de l'Université de Montréal)*, 11(2).
- Leite, E.C. (2002). Incidences de la dynamique des interventions humaines sur les écosystèmes naturels : le cas du complexe lac Nokoué-lagune de Porto-Novo au Bénin. *Dire. La revue des cycles supérieurs de l'Université de Montréal*. Volume 11, numéro 2, 2002, pp. 26-27.
- Mama D. (2010). Méthodologie et résultats du diagnostic de l'eutrophisation du Lac Nokoué (Bénin). Thèse de doctorat, Université de Limoges. 177 p.
- Médédji D (1996). Dynamique de la pauvreté urbaine au Bénin : une analyse en terme d'entrées sorties.
- Montcho. A., (2005). Suivi de la pollution azotée et phosphatée dans les écosystèmes du lac Nokoué et du chenal de Cotonou. Mémoire pour l'obtention du diplôme d'Ingénieur des Travaux, EPAC/UAC, Bénin. 72 p + annexes
- PASP (2007). Business plan de relance des exportations de crevettes et produits de pêche du Bénin vers l'Union Européenne. Rapport final. Projet d'appui au secteur privé (Composante Relance de la Filière Halieutique). Cotonou. 67 p.
- Pliya J. 1980. La pêche dans le Sud - Ouest du Bénin. Etude de géographie appliquée sur la pêche maritime et continentale, AGE COP, Paris ACCT, 296 p.
- PNUD (1996). Perception des dimensions du bien-être, de la pauvreté et de la richesse dans les quartiers pauvres en milieu urbain (EPPU). Cotonou, PNUD, 1996.
- PNUD (1997). Rapport sur le développement humain au Bénin. PNUD. Cotonou. 131 p.
- PNUD, 2011. Bénin Rapport Annuel 2010. PNUD Bénin, Cotonou, mai 2011. 40 p.
- Roche International. 2000. Etude du Projet d'aménagement des plans d'eau du Sud- Bénin : l'Environnement, les eaux et les forêts, Volume 2- Tome 4 janvier.

- Roche International. 2000. Etude du Projet d'aménagement des plans d'eau du Sud- Bénin : Le secteur des pêches, Volume 2- Tome 2, janvier.
- Soclo H. (1998). Etat de l'environnement côtier et marin au Bénin. *In*: Chidi A.and S.G Zabi (eds). State of the Coastal and Marine Environment of the Gulf of Guinea (Etat de l'environnement côtier et marin du Golfe de Guinée) Large Marine Ecosystem Project for Gulf of Guinea (LME) UNIDO et IOC pp 11 - 16
- Tossou E. S. 2000 : *Impact du trafic des produits pétroliers sur les écosystèmes lacustres : Cas du lac Nokoué et de la lagune de Cotonou (Bénin)* Mémoire de DEA en Gestion de l'environnement FLASH / Université d'Abomey-Calavi, 132 P.
- USAID-UNICEF-INSAE (1996). Enquête démographique et santé (EDSB-1. Cotonou, 1996.
- Vissin E.W., Sintondji L. O. et Houssou S. C. (2010). Etude de la pollution des eaux et de la contamination du *Tilapia guineensis* du canal de Cotonou par le plomb. RGLL, N°08 déc. 2010. pp. 215-227.
- Youssao A., Soclo H.H., Bonou C., Vianou K., Gbaguidi M. et Dovonou L. (2011). Evaluation de la contamination de la faune ichthyenne dans le complexe lagunaire Nokoué – chenal de Cotonou par le plomb : cas des espèces *Sarotherodon melanotheron*, *Tilapia guineensis* et *Hemichromis fasciatus* (Bénin). *Int. J. Biol. Chem. Sci.* 5(2): 595-602,